THE

JOURNAL OF THE SOCIETY OF ARTS,

AND OF THE

INSTITUTIONS IN UNION.

VOLUME XVIII.

FROM NOVEMBER 19, 1869, TO NOVEMBER 11, 1870.

LONDON:

PUBLISHED FOR THE SOCIETY BY BELL AND DALDY, YORK-STREET, COVENT-GARDEN.

1870.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

116th Session.] FRIDAY, NOVEMBER 19, 1869. [No. 887. Vol. XVIII.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at eight o'clock :—

November 24.—" On Silk Supply." By Thomas Dickins, Esq., Chairman of the Silk Supply Association. On this evening Francis Bennoch, Esq., will preside.

December 1.—" On an Improved Means for Laying a Tunnel for the Transit of Passengers across the Channel." By Zerah Colburn, Esq., C.E. On this evening Captain Tyler, R.E., will preside.

December 8.—" On Prints and their Production." Being a sequel to a former paper, entitled " Engraving and other Reproductive Art Processes." By S. T. Davenport, Esq.

December 15.—" On India-rubber, its History, Commerce, and Supply." By J. Collins, Esq.

December 22.—" On the Recent Improvements in Small Arms, British and Foreign." By Capt. O'Hea.

Cantor Lectures.

The first course of Cantor Lectures for the present Session will be " On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., and will consist of three Lectures, to be delivered on Monday Evenings, the 6th, 13th, and 20th December, at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing two Friends to each Lecture. Tickets for this purpose have been forwarded to each Member.

India Committee.

At a meeting of the Committee, held on Thursday, Nov. 11th, it was resolved that the Council be recommended to memorialise the Secretary of State for India to take measures that the visit to this country of Niaz Mahomed, a native of Yarkand, may be made useful for the promotion of our commercial interests in High Asia.

The Conferences on subjects relating to India will be resumed on Friday evening, the 26th instant, when a paper on " Irrigation," by T. Login, Esq., C.E., will be read and discussed. The chair will be taken at 8 o'clock.

The Council, on the recommendation of the Committee, offers the silver medal of the Society for the best treatise on the profitable production of tea. Competing treatises must be sent in to the Secretary of the Society of Arts, on or before June 1st, 1870. Each treatise must bear a distinguishing motto, and be accompanied by a sealed envelope, containing the name and address of the writer, with a corresponding motto on the outside.

The following suggestions have been drawn up by the Committee, for the guidance of intending competitors :—

1. The medal is offered in consequence of the conflicting opinions expressed on the subject by practical men in England, as shown by the reports of the two conferences on tea cultivation, held by the Society.

2. The treatise to be on—" The profitable Production of Tea in India, from the First Purchasing or Renting of the Land to the Arrival of the Tea in the London Market," with especial reference to the following points :—

The cost, *i.e.*, the price or rent, of land, and its judicious selection as to soil and climate.

The best method of raising and planting out tea plants, and the effect of the use of manure.

The relative advantages of planting in the " shade " or the " open."

The use of mechanical inventions and contrivances, as tending to reduce the cost of production and manufacture, more especially in leaf-rolling ; the application of steam or hot air to the roasting or drying processes with a view to economy in fuel ; and machinery to simplify and cheapen the manufacture of tea-boxes.

The manufacture of brick tea, such as will find a profitable sale in Central Asia, and successfully compete with that from China.

The utilisation of tea seed in the arts and manufactures, or in feeding cattle.

The rolling and sifting of tea.

The condition of the supply of labour.

The size of tea packages.

The cost of cultivation in full detail.

The cost of manufacture in full detail.

The nature and cost of transit in full detail ; first to sea-port ; second to London.

The chemistry of tea manufacture.

The causes of " sour" tea, and how they may be avoided.

The causes of past failures.

3. The attention of writers is especially called to the treatises of Ball, Fortune, Bruce, and Morice.

Mechanical Committee.

The Council have appointed a Committee to consider and discuss questions, relating to mechanical inventions, which may appear to be of too technical a character to be brought before the Society at the Wednesday evening meetings.

Designs for Channel Steamers.

In response to the offer of premiums, seventeen models and one drawing have been received. These have been referred to a Committee, on which the following gentlemen have been invited to serve :—

Lord Henry G. Lennox, M.P., Chairman of the Council.	C. W. Merrifield, F.R.S.
Lieut.-Colonel Boxer, R.A.	Admiral Ommaney, C.B.
Henry Cole, C.B.	E. J. Reed, C.B., Chief Constructor of the Navy.
Sir J. F. W. Herschel, Bart.	Seymour Teulon.

Telegraph Committee.

The Council, looking at the fact that the Government have now taken under their control the whole of the telegraphs of the United Kingdom, have appointed a standing Committee of the Society of Arts to watch the interests of telegraphy generally, as well as to promote the progress of the science and the efficiency of the system. The following gentlemen have been invited to serve on this Committee :—

Lord Sackville Cecil.	Professor W. A. Miller, F.R.S.
Earl of Caithness, F.R.S.	C. W. Siemens, F.R.S.
Sir W. Fothergill Cooke.	Professor Tyndall, F.R.S.
Latimer Clark.	Sir William Thomson, F.R.S.
Hyde Clarke, D.C.L.	Cromwell F. Varley.
Colonel Glover.	Sir Charles Wheatstone, F.R.S.
Professor Guthrie.	
Sir J. F. W. Herschel, Bart., F.R.S.	

Husking and Cleaning Rice.

The following communication from the India Office was laid before the Council, and the Secretary was instructed to take the opportunity of his recent visit to Manchester to proceed to Liverpool, with the view of obtaining the required information :—

India Office, S.W., 24th September, 1869.

Sir,—The Secretary of State for India has been requested by the Government of India to obtain information for them, on the processes pursued in England, France, and other parts of the Continent of Europe, and, if possible, in the United States, for husking and cleaning rice.

The Government of India have also suggested that such information might be obtained through the Society Arts, and I am therefore directed by the Duke of Argyll to request that the wishes of the Government of India may be placed before the Council of the Society.

I am, Sir, your obedient servant,
Herman Merivale.

P. Le Neve Foster, Esq.

The Secretary visited Liverpool with this object, and obtained materials for a report, which will shortly be laid before the Council, and transmitted to the Secretary of State for India. It will also be published in the *Journal.*

Preservation of Meat.

The following communication, received from the Colonial Office, has been laid before the Council, and by them referred to the Food Committee :—

Downing-street, November 1st, 1869.

Sir,—I am directed by Earl Granville to transmit to you, to be laid before the Committee on Food, sitting at the office of the Society of Arts, a copy of a despatch from the Governor of Victoria, on the subject of two meat-preserving companies established in that colony. Some of the samples of meat sent by the Melbourne Company, which is referred to in the memorandum of the Chief Secretary of 17th June, also accompany this letter.

I am, Sir, your most obedient servant,
F. R. Sandford.

The Secretary to the Society of Arts.

Governor Sir J. M. Sutton to Earl Granville.

(Copy.)

Government Offices, Melbourne, June 18th, 1869.

My Lord,—I have the honour to bring under your lordship's notice the enclosed copies of letters, which have been addressed to the Chief Secretary by two meat-preserving companies established here, together with a copy of the memorandum of the Chief Secretary on the subject referred to in those letters. It is, I am sure, unnecessary for me to disclaim any preference for these companies, or for either of them, as compared with others, whether companies or individuals, engaged in similar enterprises; but it would, I believe, be difficult to over-estimate the important benefits which these colonies (I do not refer to Victoria alone) would derive from the development of a trade in preserved meats, the produce of the colonies. And as it is not desired to obtain these benefits at the expense of either the imperial or the colonial governments, or at that of the consumers (for if they should not likewise derive benefit from the trade, it would, as it ought to, fail), your lordship will, I hope, pardon me for requesting such assistance as you may properly afford, for enabling the military and naval departments, and the public at large, to examine and to form their own opinion on the character and prospects, as regards purchasers, of a trade in the establishment of which these colonies have so deep an interest.

I have, &c.,
(Signed) J. H. T. Manners Sutton.

The Right Hon. Earl Granville, K.G.

(Copy.)

With reference to my late interview with his Excellency the Governor, when his Excellency was pleased to say he would bring under the notice of the Right Honourable the Secretary of State the preserved meats of the Victoria and the Melbourne Meat Preserving Companies, I beg to hand to his Excellency copies of letters addressed to me by the two companies, also, for transmission to Earl Granville, a bill of lading for one case of meat shipped by the Melbourne Company per *Avoca.*

It is unnecessary for me to observe that, while this government does not desire to favour one company more than the other, the assistance which is sought from her Majesty's government is of great importance to the producing interests of the colony.

(Signed) James McCulloch.

17th June, 1869.

Mr. Randall to the Honourable J. McCulloch.

(Copy.)

The Melbourne Meat Preserving Company, Limited,
56, Queen-street, Melbourne, 5th May, 1869.

Sir,—At the suggestion of one of the shareholders of this company, I am instructed by the board to forward you a case containing 12 tins of our preserved meats, and to request the favour of your kind intervention in bringing them under the notice of her Majesty's govern-

ment at home, through his Excellency the Governor of the colony.

It is needless for me to mention the many channels that are open for the introduction of our meats at home. Besides the navy, and for military purposes, they might advantageously be used in prisons, poor-houses, &c.

I have advised our London agents, Messrs. John McCall and Co., of 137, Houndsditch, that this case has been forwarded to you, and they will be prepared to supply the home government with any additional samples they may require, and will also quote prices, and give all requisite information.

I append a note of the contents of the above-mentioned case.

I have, &c.,
(Signed) R. R. Randall, Secretary.

To the Honourable James McCulloch,
Chief Secretary of Victoria.

Contents of Case.

6	tins	boiled mutton	6 lbs. each
4	,,	boiled beef	6 lbs. each
1	,,	corned beef	6 lbs.
1	,,	spiced beef	6 lbs.

Mr. Caldwell to the Honourable J. McCulloch.

(Copy.)

Melbourne, 16th June, 1869.

Sir,—I have the honour to refer, with many thanks, to your government, to the exertions which the agent general has made to introduce Australian preserved meat, for the use of H.M. Navy, and I would take the liberty to remind you of the sample cask forwarded, per your favour, to the Hon. George Verdon, on the 5th of March, per *Somersetshire*, the bill of lading of which was forwarded to you, for the purpose of submitting the meat to the examination of the proper naval authorities at home. So all important is this question to the success of our company, and, I may say, to the prosperity of these colonies, that I hope you will excuse me if I request your kind intervention with the governor to procure a special application, not only for our company, but for any other company as well, having such products to introduce, more especially to draw attention to the sample cask above referred to, and to get a trial order for both beef and mutton to be put on board the ships, and submitted to the test of their approval.

I have, &c.,
(Signed) Robert Caldwell,
Victoria Meat Preserving Company.

To the Hon. James McCulloch.

Subscriptions.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

First Ordinary Meeting.

Wednesday, 17th November, 1869; Lord Henry Gordon Lennox, M.P., Chairman of the Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Ainsley, S. James, 13, St. Mark's-crescent, Regent's-park, N.W.
Anderson, William Mortimer, 1, Buckingham-gate, S.W.
Ashford, John Richard, 9, Cambridge-terrace, Clayton-road, Peckham, S.E.
Balfour, Major-General George, C.B., 6, Cleveland-gardens, W.
Banyard, William Barnard, 1 and 2, Great Winchester-street-buildings, E.C.
Barrett, John Woodward, 9, Ramford-place, Plough-road, Rotherhithe, S.E.
Bartholomew, Charles Eugene, 1, Chepstow-villas, York-road, Dartmouth-park, N.
Baxter, R. Dudley, 6, Victoria-street, Westminster Abbey, S.W.
Benas, Alfred, 62, Cornhill, E.C., and 148, Queen's-road, Bayswater, W.
Bishop, William H., jun., 7, Sumner-terrace, S.W.
Brightman, Richard, Sheerness.
Browne, William Lewis Clifton, Clifton-villa, Belsize-road, N.W.
Bulmer, Edward Sewell, Conservative Club, S.W.
Burnett, Rev. C. Compton, The Manse, Newmarket.
Buttery, Horace, 173, Piccadilly, W.
Carlill, John Burford, M.D., 42, Weymouth-street, Portland-place, W.
Chance, R. L., Glass Works, near Birmingham.
Cheverton, George, Tunbridge Wells.
Clark, William Chignell, M.A., Ph.D., Ongar, Essex.
Cowper, John Curtis, 27, Victoria-road, Kensington, W.
Crowley, Frederick, Alton.
Dalziel, Davison Octavian, 47, Wood-street, Cheapside, E.C.
Dashwood, Thomas, Ryde.
De Stern, Baron, 4, Hyde-park-gate, Kensington, W.
Digby, George Digby Wingfield, Sherborne Castle, Dorsetshire.
Drummond, Rev. William Richard, All Saints Church, New Amsterdam, Berbice.
Eames, T. R., Bridge-house, Barnes, S.W., and St. Michael's-house, Cornhill, E.C.
Eaton, Richard, Basford, Nottingham.
Ellis, Arthur William, Messrs. Simpsons, Payne and Co., Millwall, E.
Evans, Henry J., Cardiff.
Eyre, Charles, Welford-park, Newbury.
Fennell, John Greville, Barnes, S.W.
Fielden, Joseph, Witton-park, Blackburn.
Franklin, J. A., 58, Gower-street, W.C.
Franks, C. W., 2, Victoria-street, S.W.
Garford, John, 31, Russell-square, W.C.
Gaskell, Daniel, Lupset-hall, Wakefield.
Goodford, Rev. Charles O., D.D., Provost of Eton.
Gordon, Hugh M., Abergeldie.
Hickisson, James, 75, Southgate-road, N.
Higley, William S., London and Westminster Bank, 41, Lothbury, E.C.
Irvine, John R., Firhill, Springbank, Glasgow.
Isborn, George R., Oriel-chambers, Water-street, Liverpool.
Jahn, Adolf, 32, Alwyne-road, Canonbury, N.
Johnson, William, Bank-house, St. Helen's, Lancashire.
Kehde, H. A., 96, Denmark-road, Kilburn, N.W.
Lowe, William Drury, Locke-park, Derby.
Lyon, John George, Messrs. Burt, Boulton, and Heywood, Millwall, E.
Lyon, Joseph, Chapel-house, Ormskirk.
Mackinnon, William Alexander, Acrise-park, Canterbury.
Maitland, William, Addlestone, and 2, Royal Exchange-buildings, E.C.
Mayer, Joseph, Liverpool.
McCorquodale, George, the Willows, Newton-le-Willows.
Mechi, J. J., Regent-street, W.
Napper, H. F., Lakers-lodge, Loxwood, Horsham.
Oakden, Ralph, Exeter-house, Bournemouth.
Palmer, John Dalton, Brunswick-house, Barnsbury-park, N.
Pattinson, W. W., Felling-house, Gateshead.
Phillips, Josias, Literary Institution, Bodmin.

Powell, Thomas Harcourt, Drinkstone-park, Bury St. Edmunds.
Raphael, Alfred, 19, Princes-square, Bayswater, W.
Reeves, Thomas James, Woodhays, Wimbledon, S.W.
Roberts, Thomas, Hamilton-house, Milford.
Rosser, William, Llanelly.
Rothery, Charles William, Littlethorpe-villa, near Ripon.
Ryde, John, 155, Fenchurch-street, E.C.,
Samuda, Joseph, 3, Dartmouth-park-road, Highgate-road, N.W.
Sanders, Gilbert, 53, Claverton-street, Pimlico, S.W.
Steel, John, Southerfield, Abby-town, Carlisle.
Stephens, C., Woodley-hill, Earley, Reading.
Storer, Richard Milward, 16, Cranbourn-street, W.C.
Sturman, Edward Albert, LL.D., Packington-college, Packington-street, N.
Thudichum, T. L. W., M.D., 3, Pembroke-road, Kensington, W.
Turnbull, Maxwell Gartshore, 30, Upper Berkeley-street, Portman-square, W.
Varley, Samuel Alfred, 66, Roman-road, Holloway, N.
Waite, Charles, LL.D., St. John's College, Weighton-road, South Penge-park, S.E.
Ware, Charles W. Cumberlege, 21, Princes-gate, W.
Wilkinson, Frederick Eachus, M.D., Battle-cottage, Sydenham, S.E.
Williamson, G. J., 124, Lower Thames-street, E.C.
Yarrow, A. F., 42, Grosvenor-road, Highbury New-park. N.
Zanni, Geminiano, 29, Sidmouth-street, Gray's-inn-road, W.C.

The Chairman delivered the following

ADDRESS.

Ladies and Gentlemen,—Before entering on the business of the evening, it is only right that I should express to you the great diffidence with which I appear before you as Chairman of the Council of the Society of Arts. Certainly, on the last occasion when I had the honour of addressing you from this place, I had no idea that I should, at so short an interval, be again trespassing on your kind attention and forbearance. I am so sensible of my own shortcomings on that occasion, that it was only upon its being clearly explained to me that my re-acceptance of the office would at this time be advantageous to the interests of the Society, that I consented to undertake such an onerous position. I may add that the diffidence which I felt was somewhat removed by the knowledge that the bye-laws of the Society have clearly laid down what are the duties of the chairman, upon the opening night of the session, the rule being to the effect that "the chairman of the Council shall deliver an address to the Society at its first ordinary meeting after his election, declaratory of the policy which the Council proposes to follow during its year of office." It will, therefore, my duty this evening to try and shadow forth be such a programme as shall induce the members to feel an increased interest in the Society, and to give their hearty co-operation to the Council in its endeavours to promote the objects for which the Society was founded.

Since our last meeting, the Society has lost by death three very distinguished members. Dr. Roget and Professor Graham (Master of the Mint) died sincerely and deservedly regretted by the scientific world, and leaving behind them a great reputation for the success of their labours in the cause of science. The news of the sudden death, at St. Petersburgh, of Sir Wentworth Dilke, was, I am certain, received by every one of our members with unfeigned regret. Since 1845, Sir Wentworth had shown the most indefatigable zeal and energy in promoting the various objects of the Society of Arts; he was emphatically a Society's man. He was a member of the Society's Committee for promoting the Great Exhibition of 1851, and was named in the Royal Commission as one of the five members of the Executive Committee. At the close of that brilliant success, honours were showered upon him, and pecuniary reward was offered and declined. In 1853, he was appointed by the Crown as Commissioner at the American Industrial Exhibition in New York. His special report on that exhibition was, the following year, printed and laid on the table of the House of Commons. From 1857 to 1859, he held the office of Chairman of the Council of this Society. For the International Exhibition of 1862 he was again Executive Commissioner, and, on the death of the Prince Consort, he received a baronetcy, in recognition not only of his public services, but also of the regard and esteem in which he was held by the Prince, who looked upon him as his most valued adviser in the various undertakings which his Royal Highness promoted for the public good. I feel that, in this room and in this Society, no more flattering epitaph can be pronounced upon him than this, that Sir Wentworth Dilke earned the esteem and confidence of that great Prince who is so deeply regretted by us all.

It is well known that, in all large societies, a great deal of the most valuable work is done by committees, and, amongst ourselves, so successful have been the operations of several of these Committees, that they have been requested by the Council to continue their labours during the ensuing session. Foremost amongst these, not only from the mass of information collected, but also from the practical value of their labours, stands the Committee on Food.

The Food Committee, originally appointed three years ago, upon the suggestion of my lamented friend, our Vice-President and active member of Council, Mr. Harry Chester, has, as the pages of the *Journal* have informed the members, been busily engaged in collecting and publishing information connected with the supply of food to the people. Valuable information has been given on a variety of topics relating to that subject. The supply of meat, fish, poultry, milk, and grain, together with the distribution of them,

whether by markets or otherwise, have all occupied in turn the attention of the Committee. The information thus collected has been widely circulated, and has drawn attention to the solution of several problems. At the present time, the great question for which solution is urgently wanted is some means by which meat can be brought to this country, where it is dear, from our colonies and other countries, where it is abundant and cheap, in a raw state, unsalted and uncured. Surely our chemists ought to be able to devise some means by which decay and decomposition can be arrested a sufficient length of time to allow the meat to be brought from abroad and sold in our markets. The Committee has had before them many processes for this purpose, and has put them to the test; hitherto, however, the results have not been such as to warrant the Committee in pronouncing any one as completely successful, although, in some instances, a sufficient amount of promise has appeared to justify the parties in further prosecuting their labours.

I may mention, as an instance of how much the labours of the Society in this department are appreciated in high quarters, that, only a day or two ago, Lord Granville, the Secretary of State for the Colonies, forwarded here certain packages of preserved meats which had been received from the colonies, and the fitness of which for the supply of our army and navy the Government were desirous of having tested. This shows the esteem in which our labours are held, his lordship evidently considering the Food Committee of this Society the most competent authority to give an opinion upon such an important question.

Up to this point, I believe it is true that the plan which appears to hold out most prospect of success is that which, at the same time, presents the least novelty of conception, viz., the preservation of meat by means of ice. It is evident, however, that unless ice can be produced much cheaper than at present, no appreciable results can be expected from this system, and I am, therefore, obliged to repeat what I said last year, that, as yet, an increased supply of meat to the people of this country appears to depend upon the success which may attend the labours of our scientific chemists in producing artificial ice at an economical rate. Suggestions have indeed been made at different times as to the feasibility of importing live cattle from the countries above referred to, and some few have been already so brought from Rio de Janeiro; but the remembrance of the fearful havoc made by that plague which was first introduced into this country by foreign cattle, is still too recent for public opinion to look with much favour upon projects of this kind. Those who reflect how many thousands of the poor in this metropolis and throughout the country go many weeks, and even months, almost without animal food, cannot but follow with anxiety the efforts which are still being made for the attainment of this great end; and I earnestly trust that the information collected and published by the Food Committee, during the ensuing session, will so stimulate the scientific world, as to enable my successor next year to announce to the Society a satisfactory solution of the great problem to which I have alluded.

For many years the Society of Arts has had under its consideration the best means for bringing about an improvement in the condition of British India, by developing the vast agricultural resources of that Empire.

With this view, a Committee was appointed last session to inquire into the whole subject of the hidden wealth of India. It proceeded principally by means of Conferences, at each of which a paper was read and a discussion followed.

This Committee proved a great success, and the information collected by it has been published, and will probably lead to very important results. Papers were read on the following subjects:—On the Cultivation of Tea, of Silk, and of Cotton, on Indian Fibres, on Waste Lands in India, on Hill Settlements and Sanitaria, and generally upon the state of trade with Central Asia and Thibet.

The discussion on tea culture elicited some very interesting facts, vouched for by unimpeachable testimony; among the most important, that the quality of the tea grown in India is fully equal to that grown in China, and that the quantity was only limited by comparative ignorance of the proper means of its cultivation, and, further, by the limited amount of labour that can be procured in order to produce it at a remunerative price.

The area of land taken up by tea cultivation is not easily estimated, as the tea companies, although possessed of large estates, have only a portion under cultivation, and there is no means of ascertaining the extent of the private tea gardens. About 550,000 acres have been taken up, of which about 60,000 have been brought under cultivation, and there is a large amount of land at the disposal of the government, suitable for tea cultivation, still unappropriated.

Bearing these facts in mind, it is sad to read the figures as to the yearly growth and exportation of tea from the two empires, India and China. Last year, the exportation of tea to this country was 154 millions of pounds, of which 106 million lbs. were retained for consumption in this country, which gives our consumption at about 3½lbs. per person. England, Russia, and America are the chief tea-consuming countries; the two latter, it may be assumed, consumed one million pounds. Then there are the Chinese people, three millions in number, and great tea consumers. Taking

our own consumption as the standard for Russia, America, and China, it would appear that, in China alone, there is an annual production of 80 or 100 millions of pounds, and only seven millions of pounds in India, and this after nearly a quarter of a century of cultivation.

The Society has co-operated this year with the Manchester Cotton Supply Association, in awaking the attention of the government of India to the improvement of the culture of cotton and other agricultural products of that country.

The attention of the Committee was also directed to the production of silk. The extensive spread of disease among the silkworms of various producing countries, has, for many years, been attended by a failure of this important material of manufacture. The effect has been to inflict great distress on several towns in England which were engaged in the various branches of this industry. It has, therefore, been a matter of great satisfaction to the Council, to have co-operated in the movement for the establishment of a Silk Supply Association, such as has recently been formed. This association, which has now been organised, receives the support of most of the leading manufacturers, and it is proposed to start a journal especially to ventilate the subject. Mr. Dickins, president of this association, has kindly undertaken to read a paper on silk supply to our members next Wednesday evening, and no doubt an interesting discussion will ensue upon it.

The importance of extending the influence of Englishmen in India, as a means of promoting civilization and the advancement of the population, long since engaged the attention of the Society, and it was partly through the part taken in the matter by our members, that the Government of India seriously took up the promotion of Hill settlements and sanitaria in India. These establishments, which had been formed by the zeal of individual statesmen and administrators, have of late years been made productive of great benefit, not only to our European army, but in developing the resources of the temperate regions of India. Although there is a division of opinion among the Indian press, it is evident there is a more active interest excited in the departments of the Government and among the local public. The hill-stations have been visited this year by the several Governors, and there is every appearance of a more vigorous public feeling. By placing the English residents in more healthful climates, it is hoped they will be better able to exert their physical and mental powers. Observations made here, with regard to the sanitary arrangements of the hill stations, have also not been without a salutary effect in strengthening the hands of those locally interested.

The conservation of forests in India will, in the present session, engage the attention of the Society. The indiscriminate destruction of timber not only diminishes rainfall and promotes drought, but, by depriving the inhabitants of wood fuel, it leads to the burning of animal manure for that purpose; thus the crops are deprived of a fertilising material, and evils flow from the abuse of natural resources. It is to this waste of manure that some attribute the inferior crops of cotton in many parts of India, where the yield is only 70 lbs per acre, as compared with 400 lbs. in the United States.

Sir Digby Wyatt has proposed to the Indian Committee that one of the conferences should be devoted to following up Mr. James Fergusson's admirable paper on the Monuments of India. The South Kensington Museum has done and is doing much to illustrate this interesting subject, and the Committee expect to bring together on that occasion such a collection of drawings and photographs as will afford the members and visitors a practical opportunity of appreciating the value and interest of the several styles of Indian Art.

During the Indian Conferences, the state of trade with Central Asia was the subject of discussion within this room, and in the public press. Much interesting information was given, but as the matter is very comprehensive, and by no means exhausted, it will be again taken into consideration this session. The Council has thought it desirable that the visit of Niaz Mahomed, a native of Yarkand, should be taken advantage of to obtain better information as to the nature of our increasing trade with High Asia, and the Council has recently memorialised the Secretary of State for India to take measures for that purpose.

One result of these conferences was, that a deputation waited on the Duke of Argyll, and pressed on his Grace the importance of developing the agricultural resources of India, by the appointment of a Minister of Agriculture, and by extending the system of assisted exhibitions of agricultural produce in India. The Duke of Argyll received the deputation with great cordiality; and although he could not, of course, promise the former, he agreed to write to Lord Mayo in favour of the latter course.

The Society of Arts has offered a silver medal for the best treatise on the profitable production of Tea. It may be interesting (as a proof of the excellent relations between our Society and the India-office) to know that the Duke of Argyll has recently asked us specially to report on the cultivation of rice in India. Nothing more need be said to justify the re-appointment of this Committee.

The next object upon which the Council intend, this year, to appoint a Committee is one on which I believe will be elicited information

of a very useful and interesting character. It will be composed of professional men and amateurs interested in the various mechanical questions of the day. In this Committee will be discussed such subjects relating to progress in mechanical inventions as are not of sufficient general interest to be brought before our ordinary meetings. This action of the Council may appear to some to be of a more sectional character than any which they have hitherto undertaken, but the Society will readily perceive that there are many details of mechanical science which are well worthy the careful attention of professional members, whilst at the same time they are hardly suitable for general discussion; and it has been long a well-known principle of economy that division of labour often produces the greatest and most valuable results.

Intimately connected with mechanical inventions is the subject of the Patent Laws. The Society having had a great hand in the enacting of the present laws, this most difficult question will continue to receive the anxious attention of the Council, and convenient opportunities for discussion will be afforded to all those who are interested in it, whatever may be their opinions,—whether they be the advocates of the maintenance of the present system, or whether they incline to a reform of that system, as well as those who take a bolder line, and propose an entire abolition of the monopolies conferred by the patent laws, or, as they are sometimes called, the taxes on invention. Far be it from me, as the mouthpiece of the Council, to give any decided opinion upon so vexed a question; a greater authority than I am will shortly speak on this subject. Sir Joseph Whitworth has promised to read a paper on it before the Society. I understand that it is about to be discussed in the French Legislative Chamber, and it will no doubt be brought under the notice of our own Parliament. I can, however, hardly be blamed for saying this much, that our present patent laws very often act unfairly, and that, in many instances, they operate as a serious impediment to trade. *Prima facie*, it cannot be denied that a man who has spent his lifetime or his fortune in experiments has a right to recoup himself when he has made a valuable discovery; but, on the other hand, it sometimes happens that the original inventor breaks down, or becomes bankrupt, before his invention can be perfected, and he is then obliged to sell his discovery to another, who, having none of the merits of an inventor, takes out the patent to the making of his own fortune, and the serious cost of the public. Again, it has been alleged, and indeed few can deny, that a great abuse has crept in, in the almost indiscriminate granting of patents for so-called inventions, the originality of which often could not be supported for five minutes before a jury or a judge in equity, although they have received the sanction of the law officers of the Crown. This not only does harm in encouraging foolish persons to waste their money in taking out useless patents, but also encumbers the records of the office with an immense mass of rubbish, through which every intending patentee must search, in order to see whether he has been anticipated, or must run the risk of expensive litigation. This, indeed, is the almost universal accompaniment of a successful patent, so much so that the patent law, as now administered, would appear to be instituted for those who have merely patience and money, and not for those who have inventive power. Some persons are even bold enough to assert that the class of persons who derive most benefit from our patent laws are those gentlemen of the long robe who devote their special attention to this department of practice. As an instance of the great difficulty which often exists in deciding questions of this kind, I may mention that, on a recent occasion, the Master of the Rolls, being unable to decide between two opposing litigants, ordered the erection in the yard adjoining his Court of two elaborate models of the machines which formed the subject of dispute.

It is scarcely necessary to mention that the Society still directs its attention to the encouragement of art-workmanship, by offering premiums for the production of various articles.

For the present Session, the Society offers a large number of prizes for productions in most branches of art-workmanship, and additional prizes are offered for specimens of the application to industry of prescribed art-processes. The works sent in by competitors are exhibited in the Society's Rooms, for the inspection of members and their friends, and are usually afterwards, through the courtesy of the Lord President of the Council on Education, sent to the South Kensington Museum, where they excite considerable interest.

I need hardly remind you that, in 1852, the Society founded its Union of Institutions, and it now has about three hundred Literary and Scientific Societies and Mechanics' Institutions, in different parts of the kingdom, in union with it. A few years afterwards the Society's system of Examinations was established, the marked success of which is known to most of those present. When this system was first instituted, no other Examination existed which persons of the classes to which members of Institutions usually belong could take advantage of. But the example thus set by the Society was soon followed by the two Universities, in their Middle Class Examinations, and by the Government in the Examinations

held by the Science and Art Department. The former are, in many respects, unsuited for, and, indeed, cannot be taken advantage of by members of Mechanics' Institutions generally; but the latter are open to the class for which the Society's Examinations were established, and the subjects include a large number of those in the Society's list. These Government Examinations are certainly working well, and are attended by very large numbers of candidates, and the Council felt that, under these circumstances, it would be wise to omit from its list of subjects all those which are embraced by the Science and Art Department. The Council decided that, for the Society to continue doing on a small scale that which the Government is now doing on a much larger scale, and with equal efficiency, would be a waste of its power and funds, and they, therefore, removed sixteen subjects from the programme. It is hoped that, in adopting this course, the best interests of the Institutions have been consulted, while the Local Boards, which in nearly every case are connected with the management of the Science and Art Examinations, as well as those of the Society of Arts, will be relieved from their double labour, and the candidates themselves will not in any way suffer by the arrangement. I may add that the number of certificates awarded this year was 2,075, all of which received my signature.

I shall have the pleasure this evening of presenting to the most distinguished candidate of the year, Mr. William John Wilson, of the classes held at the Polytechnic Institution, an engineer's clerk, a prize that, as most of you are aware, was first given by the Prince Consort, whose valuable services to the Society will never be forgotten. This prize, which consists of twenty-five guineas, has, since his lamented death, been continued by Her Majesty, a constant proof of the warm interest taken by our Sovereign in the welfare of this Society.

Upon the subject of National Education, the Society of Arts has always taken up a position both impartial and neutral. Indeed, the position and composition of our Council renders such a course imperative. In all probability there are amongst our members gentlemen holding each a distinctive faith as to the principle on which a system of national education should be carried out. There are probably many who believe that education should be compulsory; there are others who think that it should be denominational as well; some may agree with me in viewing with satisfaction the arrangements in Faversham School Union, in which religious differences are set aside, and education placed on the basis of a common Christianity; and there are again many who believe the teaching of any distinctive form of religious belief should not be insisted on by the State, but should be left out of school training, and should rest entirely in the hands of the parents, and of the ministers of religion selected by them.

The Council has, therefore, adopted one rule of conduct, and has continued the even tenour of its way, endeavouring to assist every institution which appears to further the great object which the Society has at heart, namely, that every child in the kingdom should have an opportunity of being properly educated in the primary and secondary, as well as technical, subjects of instruction. It was with this view that the Society subscribed recently twenty guineas to the Education League which met at Birmingham, and the like sum to the Education Union which met at Manchester. By those who left out of sight the principles which have always guided us, such a proceeding might be misunderstood, and, indeed, it was so by one of my friends who has held high offices in the State, and who has given great attention to, and earned much praise for, his views on national education. He argued that, by subscribing to the Education League, we stamped with our approval the principles or system approved by them, viz., a system of compulsory education supported by universal rates; but I am happy to say that he has readily admitted the soundness of the explanation given him by our Secretary, that it was not the means proposed, but the object sought, viz., an extension of sound and practical education, to which the Society gave its assistance.

I suppose I may take it for granted that there is at least one position upon which all are agreed, and that is, that the pressing necessity of the times is to establish an improved and extended system of technical education.

I may also take for granted that, excepting in a few large schools, an education of this character is not given at all; and even that teaching which is given is far from what it should and might be made. Of the small schools for elementary instruction which are scattered throughout the country, we are told by the Rev. Mr. Fraser, the school inspector, that one-third may be considered as good, one-third moderate, and the remaining one-third as positively bad. But, even in the best of these, technical instruction is, from want of time, impossible. What a melancholy picture we have here given us! There are at least one million of children born every year in this country for whose welfare, in after life, a sound technical instruction is positively necessary. Yet, we know from the reports published by the Science and Art Department, that there are at present only about one-tenth of this number by whom even elementary drawing is acquired. The object of the wage-earning classes in sending their children to school is to have them returned to them, prepared not for elegant scholars, but for superior

artizans. These classes are so situated that even the most thrifty amongst them cannot, in justice to themselves, spare the services of their children beyond the age of eleven, and even if they are left until they attain that age, what do they, under the present system of primary education, learn? I am assured on the best authority that, in the common parochial schools, it takes nearly seven years to impart, even fairly, reading, writing, and arithmetic, and this by the daily attendance of five or six hours' school, up to the thirteenth or fourteenth year. This, at thirteen or fourteen years, is little to have learned; and it is clear that those who are taken away at eleven years old can know this little but imperfectly. What is wanted now, therefore, is an improved system of education which shall, by shortening the time now given for primary, enable secondary and technical instruction to be given at the same time.

The great distress which has been, and is being felt by those engaged in some of our manufactures, is alleged by many to be solely due to the provisions of the French Treaty. It is not for me to enlarge upon so vexed a question as this; but I cannot forbear asking those of our manufacturers who are unable to compete successfully with the French manufacturers, and especially in those branches of production where beauty of design and harmony of colour are main ingredients of success, whether the deficiency may not, in some measure, be due to the lamentable want of technical instruction to be found among the industrial classes in this country, as compared with that possessed by the same classes in France—a contrast insisted upon by every one of those intelligent reports drawn up by artisans who were sent over by the Society of Arts to visit the Exhibition of Paris, in 1867.

It is certain that the present system of primary education is deficient, and, equally so, that it is possible so to improve the method of imparting it as to shorten the period for the perfection of elementary instruction, and at the same time combine technical instruction with it. The large schools now in existence show practically how much can be done in this direction, and they show further that this can be given at a cheaper rate than the deficient education which is now given in smaller schools. The same time which is now required for teaching a child but little, and that little imperfectly, may be made sufficient to teach him more, and that perfectly. The experience of large schools now demonstrates that this is perfectly feasible, where the teaching power is, owing to the number of children, so great as to admit of the classification of the pupils, not according to age, but to their capabilities and intelligence.

There are several great Institutions in which this attempt has already been made with most unexampled success, and two of these labour under the great disadvantage of being compelled to teach two languages; the Dowlais School, for the mining population in Wales, where Welsh is taught as well as English, and the great Jewish Free School, where Hebrew and English are taught together. Although the particulars of this great Institution have been published, yet, as I have recently visited it myself, perhaps I may say a few words as to the impression it produced on my mind. One of the most remarkable features in all these schools is the immense teaching power which is to be be met with. The Jewish Free School is situated in Bell-lane, in the very midst of the poorest and most ignorant class of our densely-populated metropolis. The daily attendance in the boys' school is over 1,500, with the exception of Fridays, Saturdays, and Sundays. On Saturday, being the Jewish Sabbath, the school is closed entirely, and on Friday and Sunday the attendance falls off very greatly—on the former, as being the preparation for the Sabbath, and on the Sunday, as being our own holiday; so that I am informed that, were the school closed on those days, the omission would scarcely have any appreciable effect on the progress of the pupils. For this daily attendance of 1,500 boys there is a staff of thirty teachers, including the manager, and these have, almost without exception, received their education in the same establishment over which they are now called upon to preside. Many of them have taken their B.A. degree, whilst at least one is now studying for an M.A. degree at the London University, and these gentlemen, both in their acquirements and intelligence, would contrast favourably with those occupying the same position in any similar institution throughout the country. One of the most striking features of the school is the lowest class, composed of what may be called gutter children. It is impossible to run one's eye over the benches filled with these little outcasts without being struck with the completely vacant expression which is generally to be seen amongst them. A considerable proportion (seven to twelve) are of foreign parentage, Holland and Poland contributing their quota to the number. The majority, 90 per cent., on admission, are not able to give their own names, and appear to have no language in which to express their wants. Yet even in this, the very first stage, two languages, English and Hebrew, are taught. Compare this description of the lowest class with the least advanced in parochial schools, where most of those who enter have already been in attendance at an infant school. The school is divided into many classes, according to the knowledge of the boys, progressing onward to

the highest class. This generally numbers about 70, and although I myself saw some children of eleven years old, who had so far profited by the training they had received in the lower classes as to have earned their place in the highest at the age of eight, still the average should be set down at thirteen. It is most remarkable, in visiting this class, to observe the alteration in the *physique* of these lads since they left the lowest class. Of course, they are not all there, for many of the poorer and more stupid boys have left the school without reaching this class, either from the extreme poverty of their parents, or from their losing all hopes of their children having sufficient intelligence to go so far in the path of learning; but, as a general rule, they enter the class at ten, and leave at about thirteen. They are taught, in mathematics, the First Book of Euclid, algebra up to simple equations; in arithmetic, vulgar and decimal fractions, practice, and simple proportion; general grammar; the geography of Europe and the British Isles; general history; social science from Ellis's "Outlines," and physiology, from Dr. Lankester's "School Manual of Health." I myself assisted at a most interesting examination, showing the highest proficiency on the part of the boys, on the history of the Stuarts, and then, desiring them to give some incident in Bible history analagous to the events of more recent times, their answers were wonderfully accurate. The school hours are from nine o'clock to one, and from two to four; but, and this is, perhaps, one of the most remarkable features of the whole, two hours daily are devoted to instruction in the Hebrew language. Far be it from me to question the propriety of this arrangement, respecting, as I do most sincerely, the religious convictions of every man, and knowing as I do that the interesting traditions of Jewish history require that prayers should be raised and the Scriptures read in the Hebrew language. I quite understand why such a rule should exist; but the point which I would urge upon the consideration of all managers and directors of Christian schools is this, that if it is possible to bring about such great results in a week from which Saturday and Sunday are altogether eliminated, and Friday partially excluded, whilst, from each of the four days which remain, two hours are taken for the study of a dead language, what might not be accomplished in a Christian school, where there would be but one holiday, and where the two hours saved daily might be devoted to secondary or technical education. It is generally admitted that the children of the wage-class leave school at about eleven, and it may be urged that the scheme of education which I have here described as being followed in the highest class of the Jews' Free School is only obtainable by those whose parents allow them to remain until they are thirteen; but, with this system of tuition, boys of eleven would, at any rate, have spent some time in the second class, and, if removed at that age, it would be with the following results:—They would have learned to read and write well, and would know enough of arithmetic for ordinary business, whilst they would have also learned grammar, European and British geography, history, and a fair knowledge of the Pentateuch both in Hebrew and English, with a tolerable amount of general Biblical knowledge. These magnificent schools have received very rich endowments from time to time, and they are now largely supported by the beneficence of the house of Rothschild. The children pay one penny per week, and the average cost per head for teaching power is about £1 12s. I should add that there is a girls' school of 1,000 girls conducted on the same principle.

Had time permitted, I should much like to have dwelt for a few minutes upon the magnificent educational establishment which, in company with Mr. Edwin Chadwick, I this day visited; I refer to that known as the Rev. Wm. Rogers's middle-class school. I can only say that I came away completely enamoured of that school, and of the principles upon which it is conducted. So much was I struck with what I there saw, that I could not but say to the head-master, that if ever I could be of any service in promoting the prosperity of that school, or of similar schools, a belt of which ought to encircle the metropolis, he had only to refer to me, and I should be found in my place in Parliament advocating those principles, the soundness of which had been so conclusively established by the results which I there witnessed.

In connection with the subject of education, the Council propose to appoint committees to act in different localities, for the purpose of promoting the establishment of scientific and technical colleges, such as Owens College, Manchester. It is hoped that arrangements may be made for holding meetings in furtherance of this desirable object, in Manchester and in other large hives of industry. The duties of the members of the committees resident in those neighbourhoods will be to try and enlist the sympathies of their neighbours, and induce them to exert themselves in furtherance of our object. The Council rejoice to learn that the subject of scientific instruction is under the favourable consideration of the Convocation of the Province of York.

The Committee which has been formed for the encouragement of the establishment of free libraries and museums throughout the kingdom will continue its labours, by collecting such information as may stimulate and aid the formation of these useful adjuncts to educa-

tion, as generally as possible. It is well known that the necessity for such institutions has been admitted, by the fact that legislative authority has been given for the levying of rates for this purpose. From the returns which have been collected, it appears that in only thirty-one places in England and Wales, three in Scotland, and three in Ireland, have such institutions been established by means of rates.

Marvellous to relate, at the present time, neither London, Glasgow, Edinburgh, Belfast, nor Macclesfield has established a free library of its own by means of rates. The Corporation of the City of London having, doubtless, felt how great such an omission would be in their case, have voted the sum of £25,000, and a site at the east-end of the Guildhall. There they purpose to erect a library, and to provide suitable accommodation for readers, to supersede that at present afforded, which is very meagre. The library consists of 25,000 volumes of books, and there is an average attendance of 1,200 a-month. I am happy to say, that a special Committee of the Corporation has been appointed to stimulate and superintend action in this work.

Another point which has been under the consideration of this Committee is one which I myself had the honour to submit to them, and it is whether the Council cannot, by vigorous action, bring a pressure to bear on the government, and induce them to compel the irresponsible trustees who manage our great art collections to part with their superfluities on loan, and permit the circulation of this mass of duplicate specimens of art-treasures among the local institutions of the Empire. So important an element in the technical education of the country have I always considered this to be that, even before I assumed the post of Chairman of our Council, I had in Parliament, on several public occasions, moved in the matter. During the last session, I questioned the Prime Minister, but the answer I received, while admitting the justice of the request, gave but little hope of carrying out our wishes. I repeated my question again, and got no answer at all.

On a subsequent occasion, the Prime Minister replied to a letter from the Secretary of this Society, asking him to receive a deputation, that he was unable to give any personal attention to the matter. Discouraged, but not defeated, we shall, during the ensuing Session, leave no means untried to bring about what we desire to see, namely, that all local institutions should, by a system of loan, participate in the use of those duplicate specimens of art and science, many of which have been purchased by funds raised by general taxation. So long as the present system of managing our public collections by irresponsible boards exists, I fear that little amelioration can be hoped for in this respect.

I may, however, add that, although it has been one of the principal objects which in my public career I have kept steadily before me, to abolish, if possible, this system of irresponsible managers, and to place our national collections under the care of a responsible Minister of the Crown, who would be liable to be called upon in his place in Parliament to give an account of his stewardship, I must say that, during the last week or so, my opinion has been slightly modified, and for the moment at least, I have felt somewhat doubtful even of the advisability of placing our art-treasures under the care of one responsible minister.

Amongst all the subjects of discussion in Parliament last year, there was scarcely one which had a greater bearing on Arts, Manufactures, and Commerce, than that which was brought under its notice with so much ability by my friend Mr. Graves, the member for Liverpool, when he asked that the government would take into their consideration the propriety of allowing printed matter and parcels to be conveyed through the post at a cheap rate. No attempt was then made to contravene the soundness of the arguments alleged in favour of such a measure, but certainly no promise was given of any determination to accede to the request. It will, therefore, be the duty of the Society of Arts, during the coming Session, to collect all the information they can from those countries—Prussia, Belgium, and Switzerland—where this system has been successfully carried out, with a view of pressing it upon the attention of the government. In Switzerland the Council have good reason to believe that the attempt to combine a cheap parcel-post with a cheap letter-post and cheap telegraphy has been successful, in enabling retail dealers to conduct their business more cheaply, and with considerably reduced stocks, by enabling them to send by letter, or, if need be, by telegraph, their orders to the wholesale depôt. This of course is the case in an especial degree in the matter of perishable goods, and, we have every reason to believe, it enables Swiss traders to compete more equally with England. In Switzerland, and some parts of Germany, it is stated, and I believe accurately, that the substitution of a halfpenny rate for the transmission of printed matter as well as newspapers has produced receipts equal to the old penny rates which they have replaced. I may add that, although as Chairman of the Council of the Society of Arts, I shall do all in my power to bring about what would be so much to the advantage of Arts, Manufactures, and Commerce, I beg to assure those of our members who belong to the manufacturing and commercial world, that my action in this matter will be purely unselfish; and I venture to think that if they had, as I have, the honour of

occupying a seat in Parliament, or had held an official position under government, they would be inclined to petition for a diminution rather than for an increase of facilities for the transmission of printed matter.

In close connection with this subject is that of the management of the telegraphs, which has been undertaken by the government. It is, therefore, now more than ever necessary that there should be some watchful action over this monopoly. There is no doubt that the science of telegraphy may be considered still in its infancy, and it is the instinctive nature of the managers of all monopolies to rest satisfied with what they have, and to reject all improvements. Such is well known to have been the case on the formation of the first electric telegraph company, who, in the first instance, having purchased Cooke and Wheatstone's patents, naturally set their faces against the introduction of newer instruments to supersede them. We cannot, therefore, with this experience, expect that the same spirit will be less manifest now that the telegraphs are to be under the control of a government department. It is with a view to watching scientific improvements, and, if possible, promoting cheapness in the transmission of messages, that the Society will direct its attention to this matter. Such a result will of course be advantageous both to the revenue and to the public, by increasing the number of messages dispatched, and cheapening the rates at which they are sent. Mr. Scudamore, in a Post-office report, states that telegraphic communication in England is only used habitually for the purposes of wholesale trade, or in cases of emergency. In Switzerland, on the contrary, as I have said, there is reason to believe that the transmission of telegraphic despatches at half a franc has been found most successful. It carries information to the very villages, and is made available by the working classes, and thus the labour market is quickened. The Society will see that the experience of the telegraph in other countries is at least made known in this country.

Our members will probably be aware that a Committee has been for some time sitting with the object of marking the houses in which the great and good of former days were born, lived, or died. For this purpose, tablets were required, which, while they should not disfigure the buildings on which they were placed, should be easily affixed, and should be rendered, as far as possible, not only imperishable, but easily cleaned when grimed by the smoke and dirt of our great towns. With such an object, our leading makers of encaustic tiles were applied to. Some refused even to attempt so difficult a task, but after very many failures the Council have the satisfaction to announce that Messrs. Minton, Hollins, and Co. have at length overcome all difficulties, and I would now draw attention to the specimens on the wall, which are the result of their skill and ingenuity. These tablets are, I think, highly creditable to Messrs. Minton, and completely meet the wishes of the Society of Arts, for, like the incised clay slabs of the ancient Persians, they alter not, neither do they change.

Tablets have been already affixed to commemorate Lord Byron and the Emperor of the French; and leave has been obtained from the owners of the houses to commemorate in a similar manner Sir Joshua Reynolds and Benjamin Franklin. Tablets are also proposed to Flaxman, Barry R.A., Handel, Garrick, Dryden, Goldsmith, Sir W. Blackstone, Sir Humphrey Davy, and Dr. Jenner, and other names will doubtless follow.

The object with which the Society of Arts has undertaken this duty can hardly be better expressed than in the well-known lines of Longfellow:—

> Lives of great men all remind us
> We may make our lives sublime,
> And departing, leave behind us
> Footprints on the sands of time;
>
> Footprints, that perhaps another
> Sailing o'er life's solemn main,
> A forlorn and shipwrecked brother
> Seeing may take heart again.
>
> Let us then be up and doing,
> With a heart for any fate;
> Still achieving, still pursuing,
> Learn to labour and to wait.

I believe there is only one other Committee to be re-appointed, and that is the one on musical education. The results of their previous labours have tended to show, conclusively, that music ought to take a much higher place than it at present holds in our system of education.

The valuable information obtained by this Committee on the subject of musical pitch in foreign countries, will have been read in the *Journal* with much interest. It seems clear from this that there is nothing like a uniformity of pitch at present, and it is at least useful to have this fact established.

Our proceedings with reference to the cab question, one in which most of you, as inhabitants of the metropolis, cannot fail to be interested, will, it is believed, be attended with beneficial results. I had the pleasure last Session of heading a deputation to the Home Secretary on the subject, and he soon afterwards brought forward a Bill for placing the regulation of this department under the Home Office.

The premiums offered by the Society for improved forms of vehicles, will, it is hoped, elicit some marked improvement in our cab accommodation.

Prizes have also been offered for the best

models of steamers adapted to the carriage of passengers between England and France, and the result will no doubt be looked for with much interest. The Channel passage is certainly one of the questions of the day, and the Society of Arts, in this as in other matters, being anxious to promote public convenience, has taken action in the matter, and I cannot but say that I think the increasing amount of communication which now takes place between the two countries, and which has of course led to this action on our part, is one of the most hopeful signs of the times.

The result of the frequent intercommunion of the two peoples has already sensibly weakened the prejudices which existed on one side and the other, and which were a necessary consequence of the protracted hostilities which had been waged between the two countries. I feel that it is of the greatest importance that what is done should be done quickly, so that there may be no check to the growth of friendly feelings between the two nations. The multitude of schemes that have been propounded testifies to the universality of the interest felt; and it was with the view of applying a prompt remedy that the Society of Arts offered the prizes which I have just referred to, and seventeen models have been sent in, and will be carefully examined by a special Committee; but, by the terms of our announcement, it is more the laying out of the accommodation, rather than the speed of the vessels, which these models are designed to show. I was somewhat relieved to find that this was so, because from the little technical knowledge of such subjects which I acquired whilst Secretary of the Admiralty, I was convinced that, with the small draft of water, and with the given length, no great increase could be expected over the speed of the fast boats now performing the service. I look, therefore, upon such boats as merely a makeshift, tending to preserve the happy feelings of friendship now existing between the two countries, until something permanent, at a moderate cost, can be arranged. In my opinion, all that could be desired would be a line of fast and powerful steamers, such as the new Holyhead and Dublin boats, with comparatively steady qualities and ample cabin accommodation, and doing the passage in about one hour. While discussing this question, let us not forget that the key-note of the whole position is this, that at Dover there is a pier which has cost £750,000, with 36 feet of water at its base, alongside which vessels of any size and draught of water may generally embark or disembark, and, with but very slight additions, this would be the case every day of the year. I have this on the highest professional authority. It is on the French coast, therefore, that the money should be spent, and it could be successfully spent either at Boulogne or Calais, by running out a pier to join the harbour with the shore. Of the two harbours, as they now stand, Calais is far preferable—I mean for such steamers as we have, or those proposed in the conditions of the premiums offered by the Society, which draw only seven feet of water. It is very seldom that a vessel cannot get into Calais at any time of the tide, while at Boulogne, except for two hours before and after high water, no vessel can enter, and even then it is very difficult when a strong wind is blowing from the westward, which, in the Channel, is the prevalent wind. Were the piers to be thrown out as I have suggested, this difference would be reduced. I may add that I have seen and studied a most excellent scheme for doing this, the work of a distinguished professional friend of mine. It is now before the municipality of Boulogne, and has been submitted to the Emperor of the French. A point of no small importance is, that it could be completed in 18 months from the time it was begun.

There are several projects for a tunnel under the sea, and, as one of these schemes is to be unfolded in this room in a fortnight's time, I will say nothing about it to-night. Then, there are the schemes for a bridge across the Channel. One especially has attracted great attention in Paris, and is reported to be favourably looked upon by the Emperor of the French. The designs for this Channel bridge are the work of Monsieur Boutet, and have, I believe, been already discussed by the Society of Engineers; and my impression is, that this is the best scheme for a bridge over the Channel that has been proposed. There is in Paris a model, on a large scale, which bore ten times the weight which would require to be borne by the Channel bridge, constructed with less than one ton of metal, and resting on two abutments of rough timber, which were incapable of sustaining a very great strain. M. Boutet was kind enough to describe his drawings to me at length; and even if the Channel bridge were not attempted, his plan of building bridges is capable of such astonishing results as to make it well worthy the study of our own engineers. My objection to such schemes, however, is not only the vast cost at which they are estimated, but also the great length of time that would elapse before their completion.

Before I conclude, I may inform our members that our library has been re-arranged, a new catalogue made, and a librarian appointed, and that a reading-room is attached to it, in which may be seen the various newspapers, and most of the scientific periodicals, not only of England, but of France and Germany; and it may be

useful to members coming up from the country to know that they will find in the reading-room every convenience for conducting their correspondence. Our library is very rich in the transactions of learned societies, and, indeed, constitutes a valuable library of reference for Arts, Manufactures, and Commerce.

Only one duty now remains for me, and that is to thank you most cordially for the kind and patient attention with which you have listened to my long address. If I had had little to say, and if that little had been unsatisfactory, I could have stated it in a few words, but our Society is now so large, and the objects of its operations are of such national importance that brevity on such an occasion is impossible. Had time permitted, I could have said much more. I should like to have congratulated the art-world on the new galleries at the Royal Academy, and on those proposed for the National Gallery; and I should like to have told you somewhat of the doings of that important Committee on the Thames Embankment which sat here, presided over on many occasions by one who has perhaps done more than any one else for the embellishment of London, the present Marquis of Westminster. However, time warns me to refrain, and I will only add that although the power possibly, and very probably, will be wanting in me to do full justice to your Society during the coming year, I can most positively assure you that the will is there, and that, as far as I can, I will in every way do my best to promote the interests of this great Society, which has now, for considerably more than a century, been endeavouring to further the progress and improvement of Arts, Manufactures, and Commerce in this country.

At the conclusion of the address, Mr. William John Wilson was called up to receive the Queen's Prize of twenty-five guineas. The Secretary having read a list of the certificates upon which the prize was awarded, the noble Chairman presented it to him, with a few congratulatory remarks.

Mr. Cole, C.B., said it was not the practice for any discussion to follow the opening address; but, having a Chairman who had thrown himself so heartily into his work, as it was evident the noble lord had done, it would be most ungracious to separate without awarding him a most cordial vote of thanks. He was happy to say, as an old member of the Society, that when gentlemen ceased to be Ministers of the Crown, it sometimes happened that office was found for them in this Society. Doubtless, by the ability which their Chairman had displayed whilst Secretary of the Admiralty, he had qualified himself for a still higher position in the public service, whenever there was a change in the political position of affairs. He could not help saying that they had never had a Chairman who had made himself more thoroughly master of the various subjects upon which he had to touch, and it was evident to all that his duty on that occasion had been performed in no perfunctory manner. He, therefore, had much pleasure in proposing a cordial vote of thanks to his lordship.

Mr. Seymour Teulon seconded the motion, which was carried by acclamation.

Lord Henry G. Lennox briefly acknowledged the compliment, and the meeting then separated.

ANNUAL INTERNATIONAL EXHIBITIONS.

The plans and designs for the buildings wherein the forthcoming international exhibitions are to be held, have been approved by her Majesty's Commissioners for 1851; and a competition having been invited, the following builders sent in tenders:—

For the Main Building.

Cubitt and Company	£72,200
Holland and Hannen	71,800
Mansfield, Price, and Company	70,900
Smith and Company	68,407
Lucas, Bros.	68,335

For the Conservatories.

Holland and Hannen	£5,940
Smith and Company	5,896
Mansfield, Price, and Company	5,850
Cubitt and Company	5,780
Lucas, Bros.	5,696

Those of Messrs. Lucas, being the lowest in both cases, were accepted, and, on Monday, the 15th inst., a party of navvies proceeded with pickaxes and spades to the site of the Exhibition, and commenced the excavations for the foundations. It is a matter of congratulation for the Commissioners that they have the services of builders already experienced in the construction of exhibition buildings, besides being already engaged upon works in which the Commissioners have an immediate interest, viz., the Royal Albert Hall.

Many alterations will be necessary in the portions of the Horticultural Gardens upon which the exhibition buildings will abut. The unnatural and geometric slopes existing at present will probably give way to a spacious and level grass plot—an arrangement certainly conducive to a good effect for the buildings, which are on a far smaller scale than their similar predecessors. Two large structures will be erected at the back of the straight portions of the arcades running east and west of the Horticultural Gardens. They will each contain two stories, of 500 feet run, by a breadth of about 30 feet. The upper storey will be the space allotted to pictures and fine arts, and the under portion will be for the particular branch of manufacture or industry chosen for representation at the exhibition. The space will be divided amongst the foreign countries who signify their intention of contributing; but, in the arrangement of articles, all similar objects will be brought together, and no regard in the arrangements given to the country by whom they are sent. This is manifestly an improvement upon the old system of spacing out exhibitions according to countries, inasmuch as greater facilities for comparison are thus obtained.

Although to foreign countries will be allotted certain spaces, still, independent exhibitors of any nationality can select for themselves to send, either through their own commission or direct to the head organisation, the objects they desire to exhibit. On this point, however, as the time for the reception of goods approaches, more detailed regulations will be issued. The first announcement, sent out already, can be accepted only as a mere sketch of the scheme proposed by her Majesty's Commissioners.

As far as can be learned, the catalogue is to be a feature in the undertaking. In addition to the ordinary bare descriptions of the exhibits, the date of the birth, the honours and the works of the artist, art-worker, and producer of new manufactures will be given.

The exhibition of fine art, pictures, sculpture, and art applied to industry, will take place each year. The various industries and manufactures will be represented in turn. The first year, 1871, is devoted to pottery of all kinds; woollen and worsted fabrics, including the machinery employed in their production; and educational objects, &c.

In the section for fine arts, there can be little doubt that each year will prove capable of bringing forward a diversity of artistic productions. The Union Centrale of Paris, this year, has held an exhibition of objects, in which the application of art in their manufacture is an essential feature; and, certainly, if this exhibition is a criterion of the progress annually made in art productions in France, it augurs well for the fine art section in the forthcoming Annual International Exhibitions.

In a future notice a description of the architectural features of the buildings, as well as of the semicircular arcades at the north of the Horticultural Gardens, whereby the Albert Hall will become connected with the exhibitions, will be given.

ARCHITECTURE OF LONDON.

In view of the proceedings of the Thames Embankment Committee of this Society last session, the following extract from the *Times* of the 17th inst., will interest the members :—

"The House of Commons Select Committee on Thames Embankment Approaches, was instructed to inquire what controlling power over public works in the metropolis is vested in any government department. The testimony given before the committee shows the unsatisfactory way in which these matters are managed. The construction of the Thames Embankment was intrusted by Parliament to the Metropolitan Board of Works, without any directions as to the character of the work. The Board might have constructed it of brick instead of granite, and might have made it no ornament to the metropolis. In fact, it is a very fine work as an engineering work, but Mr. Layard points out that the architectural details might have been improved if the designs had been submitted to a competent authority. The landings, he says, are, in many places, far from handsome, and the coping of the parapet is not worthy of the Embankment. At this moment, it seems, there is no control over the elevation of the railway stations, and the railway company might raise stations entirely disfiguring the Embankment. So, also, Parliament gave power to the City Corporation to erect the new Meat and Poultry Market, in Smithfield, in any way they pleased. The design of the Holborn Viaduct was laid before Parliament to show what the Corporation intended doing, but the Act passed did not bind them to adhere to that design. It was represented to the committee that, in the City, some works are under the control of the Commissioners of Sewers, and some are under one standing committee of the Corporation, and some under another. The design of the railway bridge across the river at Blackfriars went before the Bridge Committee; the continuation of that line of rail across Ludgate-hill went before the Sewers Commission. The new market in Smithfield went before the Markets' Improvement Committee, but the streets and approaches were submitted to the General Improvement Committee. The Bridge Committee seem to have settled the erection of London-bridge, but the approaches were made by a different committee. With the slightest alteration, the Monument might have been brought in at the end of King William-street, making a fine vista. A remarkable drinking-fountain has been put up in King-street, close under the beautiful front of St. Lawrence, Jewry; that is described as under the control of the parish. It is stated that the Metropolitan Board of Works have power to alter and abolish the name of any historic street. The powers of the First Commissioner of Works are very limited; he could not prevent the erection of the ugliest of statues in a public square in London. In the instance of great Government works, such as the Foreign-office, a plan is exhibited in the library of the House of Commons before the Bill is passed, but the Bill gives uncontrolled power to the Government. Some public buildings are under the care of one functionary, and some of another; the committee learnt that they were sitting in their committee-room by the pleasure of the Lord Chamberlain, and that he has the control of the internal arrangements of the Palace of Westminster, the assignment of the apartments, and the occupation of them. In those semi-public works which are executed under powers obtained from Parliament, there is no control after the Act is passed; and railways have been admitted into London without due stipulations as to the architectural character of the works. The result has been unfortunate. London-bridge is a very fine entrance to the City; but there is an iron girder crossing the road at no possible angle with the street, and one part is a semicircle joined on to a straight girder in the ugliest way possible. The fine old church of St. Saviour is blocked out by this vile girder crossing the street. Entering the new street—Southwark-street—you find another nasty girder crossing at a very bad angle. That street, the finest in the Borough, was built by the Metropolitan Board of Works, at a great cost, and immediately afterwards a railway company obtained power to go over it, and has really made the Blackfriars end a tunnel by a series of bridges, one following another. This has caused a serious loss to the Board by depreciation in value of the land on either side of the street; that is a source from which a gain should be obtained, towards defraying the expense of the improvement, so that the actual net cost of new streets in London is but about 60 per cent. of the gross outlay. There are several very objectionable railway bridges or viaducts on the south side of London. Crossing the Thames, the river frontages of the railway-stations at Charing-cross and Cannon-street are seen to be hideous. The two bridges at Blackfriars spoil one another. Mr. Henry Cole produced to the committee a photograph of the railway bridge across Ludgate-hill, showing wall advertisements, Alderman Waithman's monument, the bridge stopping the view of St. Paul's, altogether (said the witness) a sort of thing for a pantomime. Mr. R. Redgrave observed that in France, before that bridge was built, a canvas model would have been put up, which would have enabled the public to see beforehand the ugliness of the work. He supposes that if the public had thoroughly appreciated beforehand what they were about to erect, the Nelson Column would never have been raised; and he asked what can be more disgraceful than the Duke of Wellington pressing down an enormous arch at Hyde-park. The committee took much evidence as to the course to be adopted in future. With regard to private houses, we are improving in taste year by year, and the City authorities, in making new streets, require plans of the elevations of the houses to be submitted to them before they grant building leases. It was agreed that there ought to be some control over semi-public works in the metropolis, such works as cannot be executed without Parliamentary powers—some power to say, 'This is so ugly that it shall not be done.' A scheme for a department of architecture and arts, represented in both Houses of Parliament, and aided by a council of advice, had its advocate; so also had the claim of the Metropolitan Board of Works, as representing the ratepayers. Mr. Layard, then First Commissioner of Works, stated that he should be content, as a first step, with a deposit of plans, elevations, and designs in his office whenever any public company or corporate body applies for Parliamentary powers, to enable it to execute any works in the metropolis, and that the First Commissioner of Works should report to Parliament upon the subject with a view to

the committee on the Bill checking the execution of anything which would disfigure the metropolis. This is what was finally recommended by the committee. Mr. Layard noticed that valuable aid is obtained from the learned bodies of the metropolis. He has proposed that historical and Royal sepulchral monuments should be placed under the care of the First Commissioner of Works, and he wrote officially to the President of the Society of Antiquaries for a list of such statues and monuments; the society appointed a committee to compile such a list for him."

INSTRUCTION IN SCIENCE AND ART FOR WOMEN.

The second and third lectures of Professor Huxley's course on "Physiography," were delivered on the 13th and 16th inst., at the South Kensington Museum. The points discoursed upon were as follows:—

Lecture II.

1. The right bank of a river is that which lies on the right hand, when the back is turned to the source of the river.

2. When the face is turned towards the north, the east lies to the right hand, the west on the left hand, the south behind. The position of the sun, at mid-day, indicates the south; that of the pole-star the north. The magnetic needle indicates the north and the south.

3. By general consent, the top of an ordinary map is assumed to be the north. The size of a map bears a certain proportion to that of the countries it represents. This proportion is the scale of the map.

4. The course of the Thames and of its affluents is determined by the shape of the ground which forms the surface of the Thames basin. The Thames basin is bounded by relatively high lands, which separate it from other river basins, and are called "water-sheds" or "water-partings." Portions of these high lands rise into hills, such as the Chiltern hills on the north; the Cotswolds, on the west; the North Downs, on the south.

5. The whole surface of Great Britain is divided by water-sheds into a series of river basins; and these are separated into three groups by a three-rayed water-shed, which has nothing to do with the highest hills or mountains.

6. A vertical section of the ground, which forms the middle of the basin of the Thames, shows it to be composed of layers of gravel, sand, and clay, several hundred feet thick, and, beneath this, of chalk, which, in many places, contains flints. Towards the edge of the basin, on all sides, the layers of gravel, sand, and clay, disappear, and the chalk lies at the surface.

7. Gravel and sand are easily permeated by water; clay is not; chalk, when solid, is not. These circumstances, and the arrangement of the beds, determine the existence of springs and wells.

8. The gravel and sand are such as may be found in the bed of a rapid stream, or at the foot of a cliff on the sea-shore.

9. The clay is mud, such as may be found at the bottoms of slow moving rivers or sheltered places in the sea, dried and hardened.

10. The chalk is mud, such as exists at the bottom of the Atlantic ocean.

Lecture III.

1. The Thames and its basin have not existed for ever as they now exist. Every year the rain-fall washes, or dissolves, away part of the soil over which it flows, and carries it to the sea. This is *pluvial denudation.*

2. The present form of the basin determines the course of the river; but the rain has given rise to the present form of the basin.

3. The action of the rain again is determined by the nature and the arrangements of the beds of which the ground forming the river basin is composed.

4. Rain and river dissolve away chalk, rub down flint into gravel and sand, and wash clay into mud.

5. The Thames carries down to the sea not less than 14,000,000 cubic feet of solid material, either dissolved or as mud, every year. At the present rate of denudation, the whole basin would be washed down to the sea level in 1,000,000 years; and the surface of Britain would everywhere be washed down to a plain, level with the sea, in less than 5,000,000 years.

6. The undissolved matter carried down by river is deposited, in the form of layers of mud, sand, and gravel, in its estuary or delta. In any given place the undermost of these layers must needs be oldest.

Manufactures.

A New Material for Hats and Bonnets.—A new process has lately been started in the City for making imitation straw hats and bonnets. The invention is of American origin, and is being worked by a company, under the title of the Sultana Hat Company. The material is a composition, which, by the addition of certain sizing ingredients, is rendered tough and strong, and capable of withstanding the action of water. Imagine a steam-engine cylinder and piston turned topsy-turvy, the bottom being previously taken out, the piston-rod working through a stuffing-box from below. Imagine, instead of tho piston, a mould, made of wire gauze in the shape of the hat required, and strengthened beneath with perforated copper, so as to bear the pressure. The piston, or rather this mould, fitting accurately to the inside of the cylinder, being at the bottom of it, the composition, in a thin state, is poured into the cylinder; the mould then, by means of suitable machinery under the control of the workman, rises, and, in so doing, creates a vacuum beneath it, causing the water, by the atmospheric pressure above, to be driven through the mould, so that, by the time the mould has risen to the top, all the water has passed through, leaving on the mould a solidified sheet of pulp of the shape required. A reversal of the motion, for the descent of the mould, in readiness to receive another charge of pulp, at once frees the hat from it, from whence it is taken, and placed on a wire tray, and when a sufficient pile of them has accumulated, they are taken to the drying-room. In the course of a few hours all moisture has evaporated, and the hat is ready for the next process, that of stamping. A metal die, of the proper shape, and duly cut to give the resemblance of straw plait to the surface, is placed under a powerful fly press, and on this the hat is placed, where, with one blow, its final shape and surface is given to it. The hat then passes into the hands of a girl, who puts on the proper colour, to suit the tastes of the wearers, which, at the same time, imparts a waterproof surface to the hat. A second trims off tho rough edge; a third fixes a wire to it; a fourth binds it; whilst a fifth makes and puts in tho silk lining, after which they are sorted for sale to the wholesale houses. The hats are tough and strong, and are thoroughly waterproof. They are undistinguishable in appearance from straw, and their cost is little more than half.

Commerce.

The Pepper Trade.—The *Straits Times* states that "for a long time back the scarcity of pepper and the high prices paid for it have been greatly augmented by

a very steady, and, on natural grounds, a very extraordinary demand for exportation to Saigon—itself a pepper-producing country. Even if not a single pepper vine bore fruit in French Cochin China, the quantities imported there were far in excess of the small local consumption; the fact is, the entire bulk was taken up for transhipment to France. A roundabout traffic this, certainly, but one that, nevertheless, must have had very satisfactory results to those engaged in it. The administration of the French Empire, patriarchal ever in its disposition towards its offshoots, determined to aid the development of its promising Eastern colony, and, among other things, to induce a greater effort to be made in the production of pepper. For this purpose the duties leviable in French ports upon the importation of this article were entirely remitted in the case of Cochin China produce, or what was the same thing, so far as the Imperial authorities could judge, Saigon exported produce. The differential duties thus created were very considerable—so considerable that, as we have seen, it was much more profitable to send pepper up to Saigon, to be there shipped to France as of Cochin China growth, than to send it on, at much less expense and much smaller freight, direct from the Straits. The Imperial government were powerless either to detect, or, if they did detect it, to control this abuse by any action taken in France, for it was impossible for them, on arrival of a cargo, to sift the growth of other countries from that of Cochin China, but owing to the remonstrances of the Chamber of Commerce at Saigon the local government there has taken the matter in hand, and issued a decree which, while not interfering with the freedom of the port, it is hoped may check the evil. For the future, certificates of origin will be required upon all pepper allowed to be exported to France, and none but such as is declared on shipment to be of Cochin China origin will be admitted free of duty on arrival at France."

Colonies.

New Zealand Finance.—The estimated expenditure for the colony, for 1869 to 1870, is £969,587, as follows:—Civil list, £27,500; permanent charges, £274,089; permanent provisional account, £137,416; domains, £2,480; public departments, £40,890; law and justice, £51,808; postal and telegraph, £134,334; customs, £40,475; native service, £21,407; miscellaneous, £31,513; militia and volunteers, £27,669; armed constabulary, £118,000; contingencies, defence, £32,000. The revenue is estimated as follows:—Customs, £816,000; bonded warehouses, £5,000; stamps, £66,000; post office, £48,000; telegraph, £25,000; miscellaneous, £72,000; total, £1,032,000.

Sugar in Queensland.—It is stated that the growth and manufacture of sugar in the north of the colony, are proceeding with extraordinary rapidity and success, and there is every reasonable prospect that, in a very short time, Australian consumers will be entirely independent of foreign producers.

Agriculture in New Zealand.—The total number of acres now under cultivation is 687,015, of which 152,568 acres were in Otago, and 122,394 in Auckland. The average yield in New South Wales, during the last ten years, is 15 bushels per acre, whilst that of New Zealand is 25 bushels per acre, Canterbury, the largest wheat-producing province, yielding 21, Otago 34, and Marlborough 19 bushels per acre. The gross produce amounts to 1,619,169 bushels; the population, according to the census of 1867, was 218,484, so that, after reserving 6 bushels per head for food, and 4 for seed, about 454,457 bushels remain over for shipment. Otago, the largest producer of oats, yields an average of 37 bushels per acre, and Canterbury 26 bushels, over 713,850 acres of land. The yield of barley is larger than was expected. Canterbury yields 21 bushels 32 lbs. as the average of 191,562 acres.

Commerce and Railways in Victoria.—According to the official returns, lately published, the value of the imports and exports at the Port of Melbourne, up to September 4th, 1869, is as follows, compared with the corresponding period of the previous year:—Imports, 1869, £9,173,692; imports, 1868, £8,239,486; exports, 1869, £8,181,387; exports, 1868, £9,366,549, showing an increase of £934,206 in the value of the imports, but a decrease of £1,185,162 in the exports. According to returns lately published, it appears that a large increase in the revenue of the government railways, up to 2nd September, has taken place. The total revenue amounts to £383,518 1s. 11d.; against £365,812 15s. 10d. for the corresponding period of last year.

Notes.

Proposed Memorial to the Late Sir James Ross.—Several naval officers, men of science, and friends of the late Admiral Sir James Ross, F.R.S., consider that his eminent public services as a navigator deserve some suitable public memorial, to record his great achievements. The Antarctic expedition, under his command, is the most renowned voyage, as regards its results for the objects of science and geographical discovery, since the days of the illustrious Captain Cook. The discovery of Victoria Land, on the Antarctic Continent, could only have been accomplished by an officer long inured to Polar service. Sir James C. Ross served in every Arctic expedition under Sir Edward Parry and his uncle, Sir John Ross; he passed nine winters and sixteen summers in the Arctic Regions. Among his great achievements he planted the British flag over the position of the North Magnetic Pole, whilst serving with Sir John Ross in the expedition to Felix Boothia; and it was his glory to attain the highest latitude in both hemispheres ever reached by man—in the north when he served with Parry, and in the south when he commanded the Antarctic expedition. The committee invite the support of any who desire to join in this tribute of honour to the memory of so renowned a navigator, and propose to raise a sum of money for the purpose of placing a portrait of him in the painted hall of the Royal Hospital, Greenwich, near to that of the great navigator, Captain Cook. This object is supported by General Sir Edward Sabine, K.C.B., President of the Royal Society; Sir Roderick Murchison, Bart., K.C.B., F.R.S., President of the Royal Geographical Society; the Right Hon. Sir John Pakington, G.C.B., M.P., F.R.S.; Lord Henry G. Lennox, M.P., Chairman of the Council of the Society of Arts; Major-General F. M. Eardley Wilmot; Captain Sir F. Leopold McClintock, F.R.S., A.D.C., R.N.; Professor Huxley, F.R.S.; Professor Tyndall, F.R.S., and many others. Communications may be addressed to the honorary secretary, Rear-Admiral Ommanney, C.B., 6, Talbot-square, Hyde-park, W.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. 1. Mr. Ney Elias, "Exploration of the New Course of the Yellow River of China." 2. Hon. W. G. S. Jerningham, "Failure of Earthquake Predictions in Peru."
Medical, 8.
London Inst., 4.
Social Science Assoc., 8. Mr. G. W. Hastings, "Review of the Discussion, at the Bristol Congress, on the Relations between England and her Colonies."
Inst. of Surveyors, 8. Mr. W. Hope, "The Distribution and Agricultural Use of Town Sewage."

Tues ...R. Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on Mr. Gaudard's paper,

"On the Strength and Resistance of Materials." 2. Mr. Edward Dobson, "On the Public Works of the Province of Canterbury, New Zealand."
Ethnological, 8. 1. Sir George Grey, "On some Quartzite Implements, of Palæolithic Type, from the Drift of the Cape of Good Hope." 2. "On the Races and Languages of Dardistan hitherto undescribed."

Wed ...Society of Arts, 8. Mr. Thos. Dickins, "On Silk Supply."
Geological, 8.
Archæological Assoc., 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Philosophical Club, 6.
Mathematical, 8.
London Inst., 8½.

Fri ......Quekett Club, 8.

Sat ......R. Botanic, 3¾.

Patents.

From Commissioners of Patents' Journal, November 12.

Grants of Provisional Protection.

Adhesive compounds—3095—J. H. Johnson.
Artificial fuel, manufacturing—3164—J. Dewar.
Artificial stone, &c., manufacturing—3174—R. Spice.
Axle boxes—2919—D. Parrish.
Boilers, &c., apparatus for feeding—3152—J. C. Mewburn.
Bottles, apparatus for stopping—3065—J. Becker.
Boxes for preserving letters, &c.—3083—J. Casb and J. Cash, jun.
Bridges—3071—F. Jenkin.
Carding engines—3168—A. Thornton and B. Senior.
Cartridges—3162—B. Bianchi.
Cartridges—3175—G. White.
Cement, manufacturing—3143—G. Burge, jun.
Cigars, machinery for manufacturing—3144—B. J. B. Mills.
Circular saw benches—3099—W. B. Haigb.
Clocks, &c.—3090—L. Meurin.
Coal, apparatus for cutting and getting—3135—A. Knowles.
Coffee, &c., apparatus for roasting, &c.—3073—R. J. Goodbody and R. E. Donovan.
Cooking and lighting by gas, apparatus for—3182—S. Leoni.
Cooking apparatus—3149—O. Fahnehjelm.
Copper, &c., manufacturing—3120—J. B. Elkington.
Cornets, &c., chromatic slides for—3165—E. Ford.
Counting and registering apparatus—3079—W. J. Rivington.
Cupboard doors, &c., turn buckles for—3127—G. Tubbs.
Dock-gates and caissons—3194—E. Finch.
Drawing frames—3131—W. E. Newton.
Drying machines—3158—W. B. Espeut.
Electric telegraphs—3196—H. Wilde.
Fire-engines, &c., machine for cleaning hose pipe used for—2985—B. Calvert.
Fireplaces—3101—T. Hoey.
Flax, &c., machinery for breaking, &c.—3155—A. P. Wright.
Grain-mashing machinery—3019—F. F Whitehurst.
Guns for bayonet drill—3171—P. Jensen.
Horses, apparatus for singeing—3138—T. Taylor and J. W. Davies.
Horses, &c., clipping—3126—J. W. More and J. Norman.
Hot-air engines—3172—B. Tower.
Human excrement, apparatus for receiving, drying, and deodorising—3129—F. Taylor.
Hydraulic presses, &c., wrappers used in—3105—J. H. Nutt.
Iron girders—2968—T. Stevenson.
Iron, &c., electro-coating—3159—A. Minton.
Iron, &c., welding—3153—W. E. Gedge.
Lace, &c., manufacturing piles on—3184—T. Wright and I. Fox.
Ladies' and children's combined under-garment—3000—G. W. Rowley.
Lifting apparatus—3157—T. Moore and C. A. Head.
Liquids, measuring, &c.—3186—H. J. H. King.
Locomotion, means of—2942—A. H. Brandon.
Lubricating compounds—3145—J. H. Spencer.
Lubricators—3141—M., L., and E. Darnbrough.
Marble, &c., compounds in imitation of, to be used in manufacturing fancy articles—3190—E. Snell.
Marine steam engines, regulating the speed of, when the screw is lifted out of the water—3200—C. de V. Wells.
Metal columns, apparatus for moulding and casting—3140—C. D. Abel.
Metallic elastic packing, self-lubricating—3136—W. W. Girdwood.
Metallic sheets, &c., apparatus for bending and jointing—3134—J. James.
Metallic vessels for preventing inflammable substances from igniting—3185—F. F. Samier and A. Anthoine.
Metals, machines for shaping—3111—A. Bowater.
Motive-power engines—3154—L. Wray.
Motive-power engines—3178—A. H. Brandon.
Motive-power machinery—3176—R. Davies.
Paper pulp, treating wood, &c., for the production of—3193—G. Sinclair.
Presses for compressing cotton, &c.—3123—J. Watson.
Pulley blocks—3156—R. Marsden.
Railway carriages—2618—J. Edwards.
Railway carriages, &c., axles for—3130—N. R. Vail.
Rotary blowing engines—3067—W. R. Lake.
Salts of ammonia, manufacturing—3146—R. J. Everett.
Saws, &c.—3122—R. Ventress.
Scotch bonnets, manufacturing—3179—A. Wyllie.
Sewing machines—3075—H. A. Bonneville.
Sewing machines—3169—W. Birch.
Sewing machines, apparatus for making tucks applicable to—3202—A. Russell.
Ships' rudders, &c.—3173—C. G. Gumpel.
Ships, &c., armour-plating—3113—W. Llewellyn.
Ships, &c., propelling—3087—T. Hydes and J. and J. E. Bennett.
Ships, &c., raising sunken—3128—L. P. Muirhead.
Sink traps—3198—M. Wilson.
Smoke, consuming—3170—W. and J. Jackson and J. Cowgill.
Spindles used for preparing and spinning flax, &c.—3166—R. C. Addy.
Spinning and doubling machinery—3148—J. Elce & W. J. Gradwell.
Steam boilers—2848—R. Crickmer.
Steam boilers and generators—3132—S. C. Salisbury.
Steam carriages for common roads—3142—A. Nairn.
Steam generators and surface condensers—3139—J. A. Miller.
Steam lubricators—3103—J. P. Rennoldson.
Stopcocks, self-acting—3187—T. S. Martin.
Suction siphons—3160—E. de Lagillardaie.
Tanneries, obtaining valuable products from the waste liquors run off from—3124—S. Bennett.
Timber, machinery for sawing and cutting—3191—J. McDowall.
Tin ores, &c., separating—2627—R. and W. W. Martyn, W. C. Trevena, and T. H. Harry.
Toy bricks for children—3109—C. Simpson.
Tramways, &c.—3180—C. E. Cawley and J. Newton.
Ventilating apparatus—2814—W. Chambers.
Watches, tools for manufacturing parts of—3192—W. Gardner.
Water-closets—3177—W. Connell.
Water, controlling the flow of, from constant supply pipes—3181—J. P. Hawley and E. E. Hill.
White lead, &c., manufacturing—3093—W. R. Lake.
Wire, apparatus for reducing the diameter of—3115—O. L. Hopson.
Wire rope, flat—3097—J. Edge.
Wrought-iron, &c., manufacturing—3150—C. Sacrè, S. Perkins, and W. Smellie.
Yarns or threads, machinery for doubling—3161—W. R. Watson and R. Murray.

Inventions with Complete Specifications Filed.

Gas meters—3216—P. and A. Walker.
Hemp, machines for heckling—3226—W. R. Lake.
Steam boilers, generating steam in—3218—N. Shaw.

Patents Sealed.

1367. J. Bullough.
1471. J. Fawcett.
1477. I. and J. H. Storey, H. Lea, and T. Lane.
1480. J. T. Griffin.
1482. H. B. Barlow.
1485. F. Hedley.
1494. F. E. Saxby and I. M. McGeorge.
1495. W. Wilkinson and M. Boss.
1502. H. G. Whitehead.
1531. E. Taylor.
1549. W. McAdam.
1558. C. C. Parker.
1629. J. Snape.
1670. J. Hauworth and H. Horsfall.
2027. J. Knight.
2329. J. Bapty and A. Hall.
2712. A. Collingridge.

From Commissioners of Patents' Journal, November 16.

Patents Sealed.

1505. A. Dunn and A. Liddell.
1515. T. and J. Fagg.
1519. A. M. Clark.
1520. G. Allan.
1535. A. V. Winkle.
1538. W. Martin.
1540. G. Martin.
1543. J. E. Dowson, jun., and A. Dowson.
1560. A. A. Rossignol.
1569. J. G. Tongue.
1573. A. Munro & W. B. Adamson.
1571. E. H. Pulbrook.
1667. J. Cockshoot, jun., and H. Weatherill.
1668. P. Kirk.
1706. H. Larkin and W. White.
1747. H. Kinsey.
1862. J. H. Banks.
1985. J. H. Johnson.
2089. W. R Lake.
2435. E. H. C. Monckton.
2551. J. Ritchie.
2684. J. J. Bodmer.

Patents on which the Stamp Duty of £50 has been paid.

2926. H. A. Bonneville.
2948. G. Crawshay & J. Thomas.
2957. G. Crawshay & J. Thomas.
3065. G. Haseltine.
2960. A. Hawkins.
3012. J. M. Dunlop & F. Crossley.
3061. P. G. B. Westmacott.
2959. J. R. Cadman.
2986. T. Page.
2976. J. F. Belleville.
2978. J. Whitehead.

Patents on which the Stamp Duty of £100 has been Paid.

3038. W. Palliser.
3111. J. B. Edmondson, J. Carson, and J. Blaylock.
3136. J. Taylor, jun.
3097. C. W. Harrison.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 26, 1869.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at eight o'clock :—

December 1.—" On an Improved Means for Laying a Tunnel for the Transit of Passengers across the Channel." By Zerah Colburn, Esq., C.E. On this evening Captain Tyler, R.E., will preside.

December 8.—" On Prints and their Production." Being a sequel to a former paper, entitled " Engraving and other Reproductive Art Processes." By S. T. Davenport, Esq.

December 15.—" On India-rubber, its History, Commerce, and Supply." By J. Collins, Esq.

December 22.—" On the Recent Improvements in Small Arms, British and Foreign." By Capt. O'Hea.

Cantor Lectures.

The first course of Cantor Lectures for the present Session will be " On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., and will consist of three Lectures, to be delivered on Monday Evenings, the 6th, 13th, and 20th December, at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing two Friends to each Lecture. Tickets for this purpose have been forwarded to each Member.

India Committee.

At a meeting of the Committee, held on Thursday, Nov. 11th, it was resolved that the Council be recommended to memorialise the Secretary of State for India to take measures that the visit to this country of Niaz Mahomed, a native of Yarkand, may be made useful for the promotion of our commercial interests in High Asia.

The Conferences on subjects relating to India will be resumed this evening (Friday), the 26th instant, when a paper on " Irrigation," by T. Login, Esq., C.E., will be read and discussed. The chair will be taken at 8 o'clock by Lieut.-General Sir Arthur Cotton.

The Council, on the recommendation of the Committee, offers the silver medal of the Society for the best treatise on the profitable production of tea. Competing treatises must be sent in to the Secretary of the Society of Arts, on or before June 1st, 1870. Each treatise must bear a distinguishing motto, and be accompanied by a sealed envelope, containing the name and address of the writer, with a corresponding motto on the outside.

The following suggestions have been drawn up by the Committee, for the guidance of intending competitors :—

1. The medal is offered in consequence of the conflicting opinions expressed on the subject by practical men in England, as shown by the reports of the two conferences on tea cultivation, held by the Society.

2. The treatise to be on—" The profitable Production of Tea in India, from the First Purchasing or Renting of the Land to the Arrival of the Tea in the London Market," with especial reference to the following points :—

The cost, *i.e.*, the price or rent, of land, and its judicious selection as to soil and climate.

The best method of raising and planting out tea plants, and the effect of the use of manure.

The relative advantages of planting in the " shade" or the " open."

The use of mechanical inventions and contrivances, as tending to reduce the cost of production and manufacture, more especially in leaf-rolling ; the application of steam or hot air to the roasting or drying processes with a view to economy in fuel ; and machinery to simplify and cheapen the manufacture of tea-boxes.

The manufacture of brick tea, such as will find a profitable sale in Central Asia, and successfully compete with that from China.

The utilisation of tea seed in the arts and manufactures, or in feeding cattle.

The rolling and sifting of tea.

The condition of the supply of labour.

The size of tea packages.

The cost of cultivation in full detail.

The cost of manufacture in full detail.

The nature and cost of transit in full detail ; first to sea-port ; second to London.

The chemistry of tea manufacture.

The causes of " sour" tea, and how they may be avoided.

The causes of past failures.

3. The attention of writers is especially called to the treatises of Ball, Fortune, Bruce, and Morice.

Mechanical Committee.

The Council have appointed a Committee to consider and discuss questions, relating to mechanical inventions, which may appear to be of too technical a character to be brought before the Society at the Wednesday evening meetings.

Donations to the Library.

The following works have recently been presented to the Library, and the thanks of the Council have been communicated to the donors :—

The Complete Concordance to Shakspeare, by Mary Cowden Clarke ; presented by M. Mason.

Catalogue of the Library of the South Australian Institute ; presented by the Institute.

Memoir of the late Henry Booth, by Robert Smiles ; presented by Miss Booth.

Guide to Sericiculture, by Thomas Dickins, President of the Silk Supply Association, with the Report on the Silk Districts of Japan, by F. O. Adams ; presented by Thomas Dickins.

Subscriptions.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed " Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

SECOND ORDINARY MEETING.

Wednesday, 24th November, 1869; FRANCIS BENNOCH, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Beamish, William, 5, Elgin-road, St. Peter's-park, Paddington, W.
Berthon, Charles Septimus, 20, Margaret-street, Cavendish-square, W.
Dashwood, Captain F. L., 6, Park-street, Westminster, S.W.
Foord, John Ross, Mayor of Rochester.
Lesingham, Henry, Victoria College, Bayswater, W.
Ludlam, Thomas Edward, Marlborough Lodge, Brentford-end, Isleworth, W.
Thomson, Robert, L.D.S., Denmark-hill, Camberwell, S.W.

The Paper read was—

ON SILK SUPPLY,

By THOMAS DICKINS, Esq., Chairman of the Silk Supply Association.

Fourteen years since, I had the honour of addressing an audience in this room, on the subject of the "Silkworm and its Products."* I then endeavoured to make my paper interesting, by a description of the nature, habits, and unrivalled properties of that wonderful insect. The silk trade was at that time comparatively prosperous, and the present scarcity and high prices of its raw material were contemplated by no one. Unhappily, since that period, very disastrous times have come upon us, and have brought with them such a combination of crushing misfortunes as to cause a partial paralysis of our silk industry. Many of the most eminent manufacturers have closed their mills and abandoned their trade; thousands of weavers have been thrown out of their accustomed employment, and compelled to labour at other work, for which they were often most unfitted; and a melancholy feeling of depression has affected all concerned.

I propose to consider some of the causes of these calamities, and to show that it is possible, not only for the silk trade to emancipate itself from present difficulties, but that it may so resuscitate its prosperity as to anticipate a very satisfactory future.

The silk manufacture of this country, from its earliest introduction, has been, and not without abundant reason, jealous and afraid of foreign competition, always seeking from our government protection in one form or another—always relying on adventitious support, instead of trusting to its own strength. At one time, bounties were granted on silk goods exported; at another, foreign silks were prohibited, and wages were regulated by Act of Parliament. Such enactments having been found to operate disadvantageously, they were repealed, and heavy duties imposed upon the importation of foreign manufactures. Those duties were gradually reduced to about 10 per cent., at which rate they existed when the French Treaty was entered into. That treaty admits into this country, free of duty, fabrics made wholly or partly of silk; but France admits duty-free only certain descriptions of silk goods. All other silk fabrics are subject to duties; and mixed goods, that is, fabrics partly of silk, pay a duty averaging about 10 per cent.

During these periods of prohibition and excessive protection, our silk manufacture was, in degree of excellence, so much below the Continental standard, that foreign silks were smuggled at great cost and risk. The ladies, who are always entitled to have the best, and certainly the most beautiful things they can get, would have them at any price, because of their superior beauty. Indeed a smuggled silk dress was the more appreciated because of its contraband character.

With relaxed duties, and a fairer competition, our manufacturers were stimulated to improvement, and, for some years prior to the treaty, the trade was not unremunerative. It had in one respect, unfortunately, attained such a degree of confidence and prosperity, that a large number of manufacturers memorialised the government to repeal the duties on foreign silk manufactures. I say unfortunately, because that memorial probably assisted the French government in obtaining consent to their imposition of the duties I have mentioned.

It was just then that a series of adverse influences commenced to press upon the trade. The immediate consequences of the treaty were most injurious to our home manufacturers, in a way not previously imagined —consequences which will always act much to our disadvantage.

Previous to the treaty and the American war, the surplus and job silks of France were exported chiefly to America; but, when our ports were opened, the major portion of such goods were sent here, because of the greater facilities of transit, and of the more ready conversion of them into money; and thus our manufacturers had, and have still to contend, not only with superior excellence, but with goods forced upon their markets at ruinous prices, thereby reducing the value of home manufactures, and causing frequently most serious losses. This constantly recurring, and ruinous competition, is one of the main causes of the present depression. The following figures will show to what an extent French has supplanted English manufacture. The importation of French silks has advanced in value from £3,111,698, in 1860, to £10,214,700 in 1867. A large portion of that amount consists of goods not immediately saleable at cost prices, and therefore sold at great reductions, partly from being not suited to fashion, and partly from the monetary requirements of the manufacturer. Another portion consists of goods of superior taste, and of greater merit and value than our own. Thus, it is evident that the English manufacturer has a hard battle to fight, not only in competition with goods of superior excellence, but with a constant influx of goods sold below their cost.

Another difficulty still exists — the difference in cost of labour. The French and Swiss silk artisans are paid at the rate of fourpence per yard for the same work, which here obtains in wages sixpence per yard.

These are the foreign facts which have pressed so heavily upon the silk trade; but there are several home foes and difficulties, all of which must be subdued before we can get out of the wood, and reach safety, profit, and independence. We must meet and overcome the following obstacles, *inter alia*, scarcity, high prices, bad qualities of raw material, defective knowledge, and injurious trade combinations.

As to scarcity:—The causes of the diminished yearly crops of silk are—the disease which has devastated almost all the silk-producing districts of Europe, and the wars in China, whereby the mulberry plantations were destroyed to an immense extent. These deficiencies will probably continue for some years; we must therefore look elsewhere for supplemental supplies.

Considerations such as those I have adduced, led to the formation of the recently-established Silk Supply Association, the objects of which, although probably well known to most of you now present, I will briefly enumerate:—

1. To stimulate the production of silk in every country where the mulberry-tree is capable of giving food to silkworms.

2. To encourage the introduction and exchange of the eggs of the best kind of silkworms in silk-producing districts.

3. To offer practical suggestions and encouragement to

* See *Journal*, vol. iii., p. 197.

producers of silk for improving the quality, for securing a better classification, and for ensuring greater care in the reeling of silk.

4. To promote the cultivation of silk in the various silk-producing districts in India, where the production of silk has not recently increased, and in other districts of India, where the cultivation of the silkworm has almost ceased, but where certain special advantages, both as regards the growth of the mulberry-tree and the habits of the people, are known to exist.

5. To promote the exportation of cocoons from countries readily able to reel them.

6. To communicate with the Foreign, Colonial, and Indian Departments of her Majesty's Government, and with the authorities in the British colonies, and with the consular agents in all foreign countries, with the view of obtaining their aid to promote and extend the cultivation of silk.

It is intended that all the officers in connection with the proposed association shall be honorary, and that no payment shall be made, except for rent, clerks' services, printing, postages, and office management. It is estimated that a subscription of one guinea a-year will produce a sum sufficient to cover the necessary expenses of the association for the present.

Estimating the proceedings of the association hitherto, I have no doubt that, if moderately supported, we shall be successful in the work we have undertaken. We have found all the authorities to whom we have applied, whether in our colonies or elsewhere, most willing to afford us all possible assistance; but with regard to information on silk culture, we find ourselves able to give more than we receive. We are becoming a central means for collecting knowledge on silk culture, which we gather chiefly from Continental sources, and disseminate in appropriate form to new districts. In aid of this chief object I have, at the request of the association, compiled a small "Guide to Sericiculture," which, I believe, will not be without value to all desirous of silk instruction.

Another and more powerful means of promulgating useful information will be the "Journal of the Silk Supply Association," which will be published monthly, commencing on the 1st of January next, and will be transmitted free to all members of the association paying the annual subscription of £1 1s. I believe the circulation of this journal will be extremely beneficial to the interests of silk industry, as a means of establishing direct communication between all persons concerned in silk products, and as a medium for mutual instruction on all matters affecting the silk trade. Every friend to silk industry should be a member of the Silk Supply Association, and thereby assist in the restoration to prosperity, and in the further development, of an important national industry.

I will now briefly refer to those countries which we expect will materially aid our supplies.

India is capable of sending us contributions to an enormous and incalculable extent; but the whole system of silk production there, with the exception of European filatures, is of such rude and defective character, and consequently comparatively unremunerative, that we shall not induce the growers to extend their operations, unless we encourage them by such information as will stimulate their efforts to more profitable results. In very many districts, the worms and the trees are not suitable to each other, and, as the government commissioner reports, the native method of reeling the silk and tending the worms is as rough and untidy as it is possible to imagine. There, as in all eastern silk-growing countries, the natural means of production are very large, and, therefore, it is reasonable to expect increased quantities, when such information shall have been afforded as will enable them to profit by their advantages.

Our information from China is aggravating in the extreme, because there the worm and its food exist, notwithstanding ravages by wars, in an abundance which gives just opportunities for improvement and development; consequently, it is provoking to observe the falling off in quantity and quality. The difficulty of turning the Chinese from their old courses and accustomed proceedings is very great; they are obstinate conservatives. It is intended, however, to acquaint the intelligent and money-loving Chinaman, by information, to be published in his own language, that fine silk will pay him better than coarse and irregular silk, and that the greatly increased value will amply compensate him for a small increase in the cost of reeling.

From Japan we may expect much additional supply. Mr. Adams, Secretary to Her Majesty's Legation at Yokohama, visited, only a few months since, in company with four other gentlemen well versed in silk culture, the silk districts of Japan, and there found an extensive increase going on in mulberry plantations. His description of silk reeling shows how primitive is their system, and how much room there is for improvement. The report which Mr. Adams sent home is published in the "Guide to Sericiculture," and will be found exceedingly important.

An eminent mercantile house at Yokohama will be appointed agents of the Silk Supply Association, and will regularly transmit the most authentic information on the silk productions of that country. The Japanese silk is of the most valuable kind, and if it were reeled with European machinery and skill, would realise the highest obtainable prices.

California is making such extraordinary advances in mulberry cultivation that, in the course of three or four years, that country should produce at least one to two million pounds of silk. Mr. Warren, a commissioner from St. Francisco, told me that they had already planted about seven to eight millions of mulberry trees, and were proceeding to plant as many more; that statement is confirmed by other reports. The total number of mulberry trees in France is about seventeen millions, so that California is rapidly approaching that country in silk producing importance. "It is a question," says Mr. Warren, "to be determined this year, whether corn, wine, oil, or silk will be their chief product.

Egypt will soon help us materially, and the specimens of raw silk recently brought from there (some of which are now before you) are of first-class value. The information we possess of the capabilities of the country, and the encouragement which Nubar Pasha assured me the Viceroy would give to emigrants proceeding there to cultivate silk, affords good reason to expect that, in the course of a few years, Egyptian silk will rank among our valuable imports.

Going on to the Cape and Natal, we there find immense tracts of land suitable for profitable silk cultivation. A few enterprising growers have commenced operations under very encouraging prospects, and, estimating their primary products and reports, there can be no doubt of silk culture becoming a large and valuable occupation in that colony.

The *Sydney Morning Herald* says:—"Silkworms were introduced here some years ago; but the venture failed, in the first place, because no market was then open for the cocoons and silk; in the second, because the persons who undertook the business were imperfectly informed of what was to be done to insure success. The market now appears to be accessible through the agency of the association, and all we now require is the knowledge of which I speak. If this can be imparted in the way suggested, all will be plain sailing, or rather plain winding, for the mulberry will grow everywhere in New South Wales."

The following letter on the subject is most interesting:—

"Government Silk Commission, Cape Town,
"Cape of Good Hope, October 3rd, 1869.

"Dear Sir,—As the subject of sericiculture has lately occupied the attention of the legislature as well as the

agricultural societies of this colony, I shall feel much obliged if you can furnish me with any practical suggestions and assistance in carrying out this new branch of industry. The government have already imported from France and distributed 25,000 trees of the *Morus alba*, and six bushels of seed; and some thousands of eggs were also procured, in 1868, from Japan, through the British Consul, who, being Cape-born, naturally took a deep interest in tho welfare of the colony.

"The government have also sent a lady, Mrs. Povall, who may already have called at your office, to learn the art of reeling in Europe. She is at present in a factory near Berlin, and will probably bring out the most approved machinery on her return next year.

"The main difficulty is to procure healthy eggs; and any assistance that you may be able to render the colonists in this first essential of silk culture, will be much appreciated both by the Commission and the colony at large.

"I shall forward you by this opportunity a practical treatise, which has been largely circulated by the government, as a guide to those who wish to pursue this branch of industry, and from which you will see that the mulberry tree not only thrives in every part of the colony, but that the species known as the Cape mulberry must have been originally introduced from Japan by the Dutch East India Company at a very early date, and has since been so thoroughly acclimatised as to receive the appellation of the 'wild mulberry,' being found even in forests and the remote districts along the frontier, and beyond the boundary-line.

"This fact alone is sufficient to justify the encouragement of silk culture, an industry particularly well suited to the native population, who cluster together, without any fixed employment, in villages and missionary institutions. A very favourable report, too, has been received from the Crown agent, regarding the quality of some cocoons which were sent to London, and from which some interesting specimens were manufactured. Should you wish for any samples of either cocoons or reeled silk, please let me know, and they shall be forwarded by the earliest opportunity. In the meantime, any publication containing practical suggestions and statistics concerning the exact number of worms, &c., will be thankfully received. "I am, &c.,

"J. C. Holding,
"Secretary to Silk Commission and Parent Agricultural Society.

"David Chadwick, Esq., M.P."

Nature, always bountiful and provident, is singularly assisting the extension of the valuable mulberry therein alluded to, for it is stated that "birds greedily devour the fruit; their digestive process does not affect the vitality of the seeds, which are voided in due time uninjured, often in the most solitary places, where they spring up, and in time become trees, and bear fruit, from whence again the same progress goes on."

Australian reports are even more satisfactory. The capabilities of that colony for silk production are practically unlimited. With good seed, knowledge, capital, labour, and skill, this country will, in due course, rival any other part of the world in sericiculture. Turkey, Persia, Russia and several smaller countries are now persevering in silk production.

With reference to increased supplies from France, Italy, Asia Minor, and Syria, these countries are still suffering from tho fatal disease which has fearfully diminished their crops and the value of their plantations, but when that scourge shall have been overcome, the silk cultivators will know well how to profit by past experience.

And now, though last not least in importance, let me introduce the consideration of silk cultivation in this country. It has been carefully and practically tested by Capt. Mason, who expresses his conviction it may become a valuable agricultural produce. Tho cocoons and silk produced by Captain Mason, specimens of which are on the table, will bear comparison with the first qualities. It should be known that every mulberry-leaf, of whatever species, may be converted into silk, if duly elaborated by the silk-worm. In London and the neighbourhood, there are about 30,000 fine mulberry-trees, the leaves of which would suffice for a production of 10,000 lbs. of silk; extend this calculation to the southern parts of England and Ireland, and it will demonstrate the possibility of a large home production.

The ladies are certainly the most concerned in any efforts for obtaining better and cheaper silk. They must miss the useful qualities formerly to be had at 4s. per yard; and, doubtless, they would rejoice if the present ten-guinea dresses could be had for half the money. Well, if they would systematically educate a small family of silk-worms, and send their cocoons to the silk merchant, they would very materially increase the supplies. The world is capable of growing more silk than cotton. Yorkshire contains more acres than all the cotton producing acres of Georgia; but there is not a country on the earth, excepting in the frigid zones, where the mulberry will not thrive—and mulberry means silk. I recommend a system of division of labour, not generally practised on the Continent.

In all existing silk districts, the mulberry plantations and the "magnaneries" are in close proximity, and the cocoons produced therein are, excepting such as are exported, usually reeled in the neighbouring filatures. There is no necessity for this combination, and a due consideration of the fact should materially help home silk production.

The cultivation of the mulberry may be left to the agriculturist, who would supply the leaves. The rearing of the worms and production of cocoons might then be carried on in any localities, where suitable buildings and young people and children might most advantageously be found; and the cocoons so produced might then be sold to the silk reelers, throwsters, and manufacturers. Or the cocoons, instead of being sold for reeling purposes, might be retained for reproduction; and on this point I will give you the opinion of an eminent French sericiculturist, an opinion confirmed by Dr. Wallace and other scientific and practical men, to the effect that the mulberry of this country will, by reason of its hardy nature, and of its leaves containing an unusual proportion of silk-forming substance, viz., sugar and resin, nourish the worms to such a degree of health and vigour, that their eggs would reproduce a superior breed, and would be valued accordingly. There is, therefore, much inducement for the introduction of this valuable occupation. There are numerous uncultivated places where the mulberry would thrive, and there are scarcely any places where its cultivation would not be remunerative. The leaf production would be much later than on the Continent, but the incubation of the eggs may be retarded, so that the worms need not be hatched until their food is ready for them.

The annual failure of silk eggs from European races compels silk cultivators universally to rely upon eggs from Japan. Consequently, the immense demand made upon that country, and the greatly increased value of the eggs, has induced the Japanese to produce them in preference to silk, and hence the supply of silk from there has much diminished, while the exportation of eggs has increased to such an extent, that the quantity sent last year to Europe exceeded two million ounces. This fact urges another good reason for cultivating the mulberry, and breeding silkworms in this country for purposes of reproduction.

Having, then, reasonable expectations of a considerable increase in quantity, let us consider how the quality may be improved. The quality of silk depends entirely upon the number of cocoons reeled together, and so forming single threads known as raw silk. This process is carried out to the greatest present perfection in France and Italy, and in other countries where the filatures are under duly skilled management. The branch of cocoons

before you will attest the excellence of French "education" of silk worms; but, in China, Japan, India generally, Persia, and other parts of Asia, the native reelers, possessing only the most clumsy machinery, and being unable to appreciate the superior value of fine and even silk, reel off their cocoons in such a careless manner that the silk so produced is very inferior to what it might be. This fact alone demonstrates that the formation of silk threads from cocoons, suitable for the various branches of manufacture, should be carried on in manufacturing countries. France has well understood the importance of reeling for her own manufactures. It is time we should imitate her example. Therefore, whether we grow silk at home or not, there can be no doubt of the importance of introducing silk reeling, and thereby inducing all new silk-producing countries to send their cocoons to English instead of to foreign markets. On this point there is a singular want of information, which I will endeavour to supply. It is generally supposed as indispensable to good reeling, 1. That the external climate must be dry and bright, such as that of France and Italy. 2. That the cocoons must be fresh, *i.e.*, not desiccated, nor packed with any pressure. 3. That the process of reeling is a labour unsuited to our operations. 4. That the cost of labour on the Continent is so much less than in this country, as to preclude profitable competition.

As to climate:—All cocoons are reeled in very hot water, a condition which may be had in any country.

As to cocoons:—The general practice in all countries is to dry the cocoons under a hot sun, or by artificial heat, generated by hot air or dry steam. This is an obvious necessity, for if the chrysalides are not suffocated within a few days after the formation of the cocoons, they will, as moths, work themselves out of their shrouds, and destroy the value of their labours; and, unless thoroughly desiccated, the juices of their bodies will, under pressure in packing and removal, materially injure the silken filaments.

The reeling is a very simple operation, performed by women and children of very ordinary intelligence, who, by force of habit, acquire a ready mode of manipulating the delicate material; their wages are about the same as those paid to our silk winders. I affirm positively that, if properly established, the important business of silk reeling may be as profitably carried on in this country as on the Continent. It would enable our manufacturers to readily obtain silk threads suitable for their fabrics, instead of having to make fabrics to suit the present varied, and never to be relied upon, qualities of raw silk.

An inspection of the bonded silk warehouses will satisfy any visitor of the slovenly, careless, and wasteful manner in which raw silk is originally packed. A cotton-spinner would be ashamed of it. Bundles of silk worth £20 are made up with less care than are bundles of cotton worth only 20s. Unfortunately, the reeler and the manufacturer do not meet in those rooms, and, consequently, they have no opportunity of conferring on their mutual grievances. The sales are effected by the middle-men—the silk brokers and merchants—gentlemen whose interests are not so much concerned in quality and condition as in large amounts and proportionate commissions.

The greater portion of silk passing through these warehouses is from China and Japan. The annual sales exceed £5,000,000, and almost the whole of that silk is so defectively reeled, that the value of it is not worth, by 10s. per lb., what it would realise if it were skilfully reeled. Oh! if the cotton trade had such a chance of improving their raw material, how soon they would commence the reformation.

But, in addition to obtaining more silk and improving its quality, there still remains much to be done before we can successfully compete with the looms of Lyons, Zurich, and St. Etienne. Neither protection nor reciprocity can restore prosperity. We must manufacture, not only as well, but as cheaply, as our rivals, if we are to compete with them in the general markets of the world. Manufacturers and their weavers must be better instructed in their trade, and schools of theory and practice, of design, and general technical education must be established, and must be appreciated by every superior operative. And here I would venture to suggest to the Council of the Society of Arts that the introduction of schools of manufacture would, in my opinion, be a very appropriate subject for them to take up, for their establishment would most materially aid the improvement of the industry of the country. The hand-shuttle of Spitalfields must be replaced by the fly-shuttle of the North; the old-fashioned modes of winding and warping must be superseded by modern improvements; the hand-loom is doomed, and must make way for its iron competitor the power-loom, and the whole system of our silk manufacture must be regenerated and brought under factory discipline. The present depression of the trade, and a certain amount of apathy, impede the progress of improvement; but when we get cheaper and better silk, and when all available economy of labour and skill are combined, the poorly-paid artisans of the Continent will have hard work to match the productions of mechanical appliances perfected by science and art. France buys her cotton at the same price we do, but the looms of Lancashire and Yorkshire can, even with present duties, meet numerous French productions in their own markets. Silk manufacturers may do the same, if they will set the right way about it.

There is another barrier which occasionally impedes beneficial progress—the regulation of wages by trades' unions or societies combined for the same purpose. All such general laws cramp the individual will of the operative, and fetter the power of the master in competition with the foreigner. Supposing a manufacturer, by means of enforcing lower wages, to obtain an advantage over his competitor, such unfairness will rectify itself by the extra demand for the productions, to meet which, and to obtain additional labour, additional remuneration must be paid. High wages, if they cannot be maintained, eventually ruin the class which temporarily enjoys them. I recollect the time when sixpence per yard, for ordinary low qualities of silk goods, was paid to the Spitalfields' weaver, under his book regulations, for precisely the same work performed in Lancashire for fourpence. The difference was, of course greatly to be regretted on the part of the Spitalfields' weaver, but the consequence was most natural—that branch gradually left London and settled in the north. Such mistaken policy has often been pursued in manufacturing trades, and invariably to the loss of those who would not acknowledge the irresistible force and power of competition.

I have been very severe in my strictures upon an industry in which I am personally interested, and which has my best sympathies and wishes, but I have exposed its short-comings, because I believe there still exist in the trade a vitality and a strength which, if duly exerted, will in time render the silk-trade profitable to all concerned as merchants and employers, and will give to thousands of additional operatives—especially women and children—an occupation which, in regard to cleanliness, pleasantness, and healthiness, is not surpassed by any other employment.

At the conclusion of the paper, Mr. Dickins drew the attention of the audience to a collection of cocoons from France, showing the remarkable manner in which the silkworms arranged themselves on the shrub. A smaller spray was also shown, of English growth, with cocoons upon it, equal in size and quality to the French, and specimens of the wound silk, produced by Captain Mason, were also laid on the table, together with skeins and cocoons from Egypt, Natal, Japan, and elsewhere. The most remarkable object, however, was a small collection of cocoons from the Royal Gardens at Kew, being the second generation in the present year. Mr. Dickins

said he believed this was the first occasion on which such a thing had been seen, and it was a most gratifying fact, inasmuch as it went to show that two crops of silk a-year might be produced in England.

DISCUSSION.

Mr. Cobb, of Natal, said the advisability of reeling silk in England had been suggested in the paper, but the truth was, that in respect to the colonies, it was an absolute necessity, there being no skilled labour available for the purpose there. The Silk Supply Association was, therefore, he believed, very wisely recommending the colonies to cultivate silk, as far as the production of the cocoons, but not to attempt the reeling. The great difficulty at present, however, was, that there was no market for cocoons in England, the fact being that Lyons and Marseilles were the only two markets in Europe. The Americans, being alive to this fact, were introducing in California machinery for reeling and manufacturing the silk in close proximity to the place of production. After all, however, the reeling was a very simple operation, in no way affected by climate. He had, in China, seen a decrepit old woman engaged in reeling silk on a machine made of bamboo, and she had probably been many years engaged in the same occupation; and last year, in South Africa, two or three young English ladies determined to make the attempt, and the specimen on the table, which was the result of only their third trial, would compare not unfavourably with the work of the best French reelers. This showed how easily the process might be acquired, and at a time when thousands of silk winders in Coventry and Macclesfield were starving for want of employment, it seemed a great pity that some efforts should not be made to introduce a branch of industry so nearly allied to that to which they had been accustomed, and which they could very soon learn. As to the quantity of silk which South Africa could produce, he had no hesitation in saying, from having visited nearly 180 miles of coast-line, abounding in hills and valleys, and resembling both geologically and botanically the best silk-producing districts of Japan, that it could easily produce a quantity equal to the whole of Italy. He had reason to believe that the same conditions prevailed in many parts of New South Wales and Queensland. In California, there were already nearly half as many mulberry-trees as in all France, and specimens of silk had been produced equal to the majority of Italian. He had no doubt that, before long, an increased supply would come from Japan, but it would be many years before the Chinese silk-districts would recover from the effects of the adverse influences to which they had been subjected. Promising accounts, however, had recently been received of the cultivation being introduced into fresh localities, especially near the northern part, where Europeans had recently been admitted. The rearing of seed, or silk-worm's eggs, was a most important point, and one that should not be lost sight of in England, where there was no doubt that healthy seed could be produced, so as to supply the deficiency on the Continent. Last year the exports from Japan were over two millions of cards, whilst, this year, it was anticipated that not more than one million could be exported, only half that quantity having as yet been obtained; the price, in consequence, had risen from about 5s. to 22s. 6d. per card. It was therefore an important question, whether the agriculturists of England could not plant sufficient white mulberry-trees to supply food for the silk-worms, which other people, who might give their time and attention to the matter, might rear.

Mr. Anketell, being called upon to state the results of his experiments in Egypt said he had met with great difficulties, arising, in great measure, from the ignorance of the natives, and the dishonesty of Europeans; and he was obliged to give a great deal of personal attention, in order to ensure success. He had no doubt that the cultivation could be successfully carried on there, if it were properly conducted, but this had not yet been done. When he began his experiments, he was told that the hot winds would be an insuperable difficulty, for that, on a former occasion, a mud wall two feet thick had been built, and the worms shut in during the prevalence of these winds to prevent the ill effects; the consequence, no doubt, was, that they died of suffocation, which was not to be wondered at. He found, however, that the hot winds might really be turned to advantage. He intended to return to Egypt, and renew his experiments, provided that the present differences between the Sultan and the Viceroy did not end in a state of things which might prevent the cultivation of anything whatever.

Mr. Briggs stated his belief that the depression in the English silk trade was due, in part at least, to the weight of taxation, which, as he alleged, pressed more heavily on British workmen than on their continental rivals, and thus rendered them unable to compete on equal terms.

Mr. P. L. Simmonds said the subject of silk supply, both home and foreign, had often occupied the attention of the members of the Society of Arts, and might frequently, even yet, be discussed with advantage. Although he was not quite so sanguine as to the success of any attempt to produce silk on a large scale in England as Mr. Dickins, yet the effort deserved encouragement. The Society of Arts had frequently stimulated and encouraged the production of silk in England, but as yet no very extensive results had been obtained. The whole question of our foreign supply of silk, and the condition of the silk manufacture at home and abroad, was of the greatest interest, and one which, for many years, he (Mr. Simmonds) had studied with much care. Associated as he had been, as honorary secretary from the formation of the Silk Supply Association, and having carried on the official correspondence with the various heads of public departments, he necessarily felt a warm interest in its success. Although circumstances had led to a cessation of his active co-operation, still his sympathies would always be with the association and its able president. The paper on the production of silk in India, which he (Mr. Simmonds) had read before the members, some few months ago, had attracted attention on the Continent, since he had met with it translated into German, French, and Italian. In addition to the information respecting Australia which Mr. Dickins had furnished, he might state that the colonies of Queensland, Victoria, Tasmania, and New Zealand, were all energetically occupied with the question of silk production; and in South America, the Republics of Ecuador, Venezuela, Chili, Uruguay, and the Argentine Confederation, were also turning attention to it, and sent very fine specimens of cocoons and silk to the Paris Exhibition. Without endorsing to its full extent the statement by Mr. Dickins, that "there is not a country on the earth, excepting in the frigid zones, where the mulberry will not thrive," there was ample room for its extension. He would not further detain them, but would send to the secretary for publication some notes, which might be considered as supplementing Mr. Dickins's remarks.

Mr. Hyde Clarke congratulated the members present on the progress which the subject of silk cultivation was evidently making. It might be an open question whether they would be more successful in producing a large crop of silk in this country at present than they had been in the past; but the samples before them that evening showed conclusively that, with care and attention, very good results might be obtained. There was, however, at the present moment, one thing of even greater importance than the production of a large crop of silk in England, and that was the carrying out of a series of experiments with regard to the cultivation, having reference especially to the health of the silk worms. He would, therefore, urge very strongly upon the consideration of all who had an opportunity of devoting attention to this subject, the fact that there

was in all countries a great want of judicious and well-conducted experiments, with regard to the disease which had latterly afflicted the worms. It was in Italy that the most successful observations had been made on this subject, but in many silk-growing countries, there was no educated, intelligent body of persons who could conduct such observations. No greater good, therefore, could be done than for ladies, and others who had time at their disposal, to pay careful attention to the rearing of the worms, and to communicate the results of their observations to the Silk Supply Association. In order that this might successfully be done, however, it was necessary that there should be a much better supply of food, by an increase of the white mulberry, which was stated by a high authority, Dr. Hogg, to thrive very well in England. He should recommend, therefore, an effort being made, not only in private gardens, but in the public squares and parks, to cultivate some of these trees, which would afford sustenance to the silkworms, and by this means an impetus might easily be given to silk production. Of the many important subjects mentioned by Mr. Dickins, he did not think there was any more deserving attention than the suggestion which he made as to the breeding of what was called "grain" or silkworms' eggs in England, and it seemed to him that, in many localities, it might become a means of both amusing and profitable employment. It frequently happened that when one country was afflicted with disease, another was comparatively free, and a good supply of healthy eggs at such a time would be a source of considerable revenue. With regard to the process of reeling, he had often seen it in operation in Turkey, and, as had been said, it depended in no way upon climate, the cocoons being always placed in hot water; and there was no reason why Englishwomen should not earn their living at such employment as well as Turks, Greeks, and Armenians.

Mr. PHILIP PALMER thought it would be useful if Mr. Dickins would give them a little more detailed information. For instance, if he would state how many thousand silkworms it might be worth while to rear; how many were required to make a pound of silk; and how many acres of mulberry-trees would be necessary to give a good start to the cultivation.

Mr. DICKINS said all the information asked for was to be found in the little book referred to in his paper, and published by the Associtaion, price one shilling.

Mr. BOTLY thought they must all feel indebted to Mr. Dickins for the very able and practical paper he had given them. All those who were interested in the colonies—and there were few who were not so in some way—must be much gratified to find what prospects of prosperity there were before them through the cultivation of silk; and he could not but believe that the efforts which the Silk Supply Association was making to diffuse information would produce good and lasting results. He could fully endorse, from his own observation, the remarks which had been made with reference to the dirty and untidy manner in which the silk was packed abroad for exportation.

Mr. ELLIS DAVIDSON said he should not have felt qualified, as a teacher, to take any part in the discussion, but for the reference which had been made by Mr. Dickins to the establishment of schools of manufacture. There was no doubt in his mind, that in such schools, as in the constitution of the Society under whose auspices they were met together, the arts, manufactures, and commerce should be combined. The great value of the paper they had listened to with so much interest was its eminently practical character, but he should like Mr. Dickins to state whether the great impediment to the culture of silk in this country hitherto had not been the fact that the mulberry tree bore leaf at a different time from that at which the silkworm would naturally be developed from the egg.

Mr. DICKINS remarked that he had already touched upon that subject.

Mr. DAVIDSON said he had not observed it, and at any rate it was a most important point to be kept in view, for it was a very different thing to produce results artificially by experiment, and to establish a national industry. At the time of the Paris Exhibition of 1855 a question had been suggested which had not yet, as far as he was aware, received any satisfactory solution, and it was this:—If, as was admitted, the mulberry leaf contained the whole of the constituents of silk, what was the chemical action which took place in the internal organism of the silk worm which converted the one material into the other. If this could be definitely ascertained, the time might come when they would be independent of the silkworm, and be able to manufacture silk for themselves direct from the leaf.

Lord HENRY G. LENNOX, M.P., Chairman of the Council, being called upon to propose a vote of thanks to Mr. Dickins, said he had much pleasure in undertaking this agreeable duty, but his parliamentary experience taught him that, while it was very pleasant to sit and listen to the discussion of matters which one did not thoroughly understand, it was much the wiser part to say nothing oneself on a topic which one had not thoroughly mastered. He should not, therefore, think of inflicting upon the audience his own views on matters which many amongst them knew so much more about than he did. He might say, however, with some pride, as Chairman of the Council, that this was a subject to which the Society of Arts had long paid attention. The secretary had put into his hand one of the Society's records, about 25 years old, which stated that the Society's gold medal had been awarded to a lady for the silk which she had produced, the locality being the south of Hampshire, in the district near Lymington. At that time the failure, he believed, arose from a difficulty in finding a market for the silk after it was produced. He quite reciprocated the wishes of the gentlemen opposite, who desired that all taxes might be taken off, but he feared there was not much probability of so happy a result being attained. Whatever their opinions might be upon such matters, however, he was sure they would all cordially join in a hearty vote of thanks to Mr. Dickins, and in wishing that every success might attend the endeavours he was making to promote a branch of industry which seemed so well calculated to prove beneficial, not only to the mother country, but to almost all her dependencies and colonies.

The CHAIRMAN, in putting the motion, said knowing, as he did unfortunately, the miserable condition of the operatives of Coventry, Congleton, Macclesfield, Manchester, and, above all, of Spitalfields, he felt that anything which could be suggested for the amelioration of it deserved the most earnest attention of the public. If it were the fact that they could produce in England silk of as good quality as that produced in France and Italy, all that was required being to bring capital, land, and labour together, surely they had sufficient of each in England for the purpose, and every right feeling ought to induce them to do all they possibly could to relieve the starving populations he had referred to, by promoting an industry so well fitted to their previous education. He had formerly been of opinion that the place for reeling silk should be somewhere near the place of its production, but when he remembered the rapidity with which transit was now effected between all parts of the world and England, he no longer clung to that old opinion, and was disposed to think that the best plan would be, when the worm had done its work, to bring the raw material to this country, where all the necessary labour might be concentrated upon it. There could be nothing in the climate to prevent it being properly reeled, for at present this operation was always conducted in sheds, artificially heated or cooled. In our climate it was scarcely ever too hot, and the requisite degree of heat could always be obtained artificially within a single degree. If they could, by setting up reeling establishments in the centres of the silk manufactures, produce precisely the quality of silk

required for the various fabrics to be produced, surely it was a matter demanding the very serious attention of the nation, and of the legislature. Mr. Dickins had done great service in bringing this matter forward, and he was sure that if a sufficient quantity of cheap material could be brought to this country, our operatives possessed skill and intelligence which would enable them to compete with any country in the world. The weavers in the various districts were as well up to their work as any that could be found either in France, Switzerland, or Germany, and it was an insult to our female population to suppose that they were not capable of taking up the finest filaments of silk and reeling them properly, especially when they considered that this was at present done by the clumsy fingers of the peasant population in Italy and France. If this could be done, and he was sure it might, there was every reason why all the influence they could individually bring to bear upon this question, should be put forth, and that, at all events, an experiment should be tried. Captain Mason had already proved that the production of silk could be successfully carried on in this country, for he (the chairman), as a man practically acquainted with the subject, could say with the greatest confidence that the silk that gentleman had produced was as good in every respect as that brought from France or Italy. If that were so, why should not the same thing be carried further? It was no new question in England, for in the time of Queen Elizabeth large premiums were offered to persons who would plant mulberry-trees and breed silkworms, and hence the large number of mulberry-trees which were to be found in some parts of the country, especially in the South-Midland counties. The importance of this subject could hardly be overestimated, when it was considered that some hundred thousand people, who ought be occupied at the present moment in the silk trade, were, many of them, going into coal pits, and other branches of labour altogether different from that to which they had been accustomed. One suggestion had been put forth by Mr. Dickins, which he, as an old member of the Society, and formerly a member of the Council, might be excused for saying one word upon, the introduction of schools of manufacture. This was a very large question. The Society professed to encourage arts and manufactures, but to establish schools of manufacture was, he thought, a little beyond their power. He held that every manufacturing town ought to have in itself a school of manufactures, and not only so, but that every manufactory itself ought to be a school of manufacture, and the head of the establishment ought to be so intelligent and so well acquainted with every department, that the whole of his dependents would be like so many scholars who were gradually being educated up to his own ideas. It was a bold statement, but he had made it before, and he now repeated that he did think there were ten men conducting the silk manufacture in England who were themselves practically acquainted with every process through which the silk passed. On the Continent it was far otherwise. In France, Switzerland, or Germany you could hardly find a large silk manufactory in which the head of the establishment was not the most skilled man in it, having gone through every department, from the reeling and winding of the silk to the last process in the manufacture. When the ill-trained or rather untrained manufacturers of England had to compete with such men as these they naturally had no chance. The chairman concluded by putting the motion proposed by Lord Henry Lennox, which was carried unanimously.

Mr. Dickins thanked the meeting for their appreciation of his efforts to promote the prosperity of the silk trade, which he should always endeavour to do by every means in his power. He briefly alluded to the observations of the various speakers, none of which called for particular remark except the statement of Mr. Botly, confirming his own, as to the state in which the silk arrived in this country. He should have been much pleased if any one had been able to deny it, for it was a positive disgrace to the trade that the silk should be allowed to come over as it had for the last fifty years or more. The brokers were the only persons through whom they could reach the foreign merchants, and he did hope they would do something to change the present state of things. Mr. Davidson had referred to the weaving schools of Lyons, and his impression was, that that was one of of the most important points they had had under discussion. From a residence of some duration at Lyons and elsewhere on the Continent he was able to say that, so much were these schools appreciated there, that not only mechanics, but persons of superior station, were in the constant habit of attending these establishments, in which theory and practice were combined, and to this, more than anything else, he attributed the superior excellence which all must acknowledge was possessed by the foreign silks. There was no reason why Englishmen should not be equally well taught, and then he had no fear of their producing equal results. In conclusion, he expressed a hope that many of his audience would join the Silk Supply Association.

Captain Tyler then proposed a vote of thanks to the chairman, and said that he had no doubt that if the Association could experimentally prove, on a substantial scale, that silk cultivation could be successfully carried on in England, it would soon be taken up and developed by capitalists and others.

Mr. P. L. Simmonds writes as follows:—"An important British industry is just now suffering materially from a deficiency of the raw material, and Great Britain is not the only sufferer. The silk trade in Europe generally is languishing, owing to the long-protracted effects of the disease in the silkworm. Up to 1824, the period of the removal of prohibitions by Huskisson, and after many ages of protection, the silk industry in England may be said to have merely vegetated, and the number of looms for weaving ribbons and stuff never exceeded 24,000. Six years after the removal of the prohibitions, viz., in 1830, there were 50,000; and, in 1855, the number exceeded 100,000. In 1862, judging by the quantity of silk taken for consumption, there were more than 150,000, producing manufactures of the value of £12,000,000, of which the sixth part only was exported. Raw silk has advanced in price enormously of late years. There are no sumptuary laws now in existence restricting the use of silk to any class, and it is worn more or less by all ranks of society in most countries; indeed, with the spread of wealth, its more extended use is only retarded by the extravagantly high prices. The stagnation and decline in our own factories is shown by a comparison of the two last official returns of the Factory Commissioners. In the close of 1861, there were 771 silk factories at work in the United Kingdom, with 1,338,544 spindles and 10,709 power-looms, giving employment to 52,429 hands, of whom about 37,000 were females. At the close of last year, there were but 591 silk factories, with 1,159,706 spindles and 14,625 power-looms. These employed 41,017 hands, of whom about 29,000 were females. Many of these factories have since been closed, and we thus find more than 12,000 persons, formerly profitably engaged, have been thrown out of employ, and 180 factories closed in the past seven years. This tells terribly upon the great centres of the silk industry, Macclesfield, Coventry, Manchester, &c. But the Continent, which gives more attention to silk manufacture, is suffering equally with ourselves from a deficiency in the supplies of this important trade material. Silk production has been sorely tried in France during the last twelve years. In the greater number of the departments, where the rearing of the mulberry formed considerable riches, there reigns a general desolation. Of the various countries which give attention to silk production, Italy and France stand in the first rank,

and thoir winding and throwing establishments have rapidly increased, each country contesting which can turn out the best productions. Austria follows in the movement; Turkey and Russia are not strangers to progress; while Spain also produces silk of a good quality. The quantity of silk produced by France and Italy is much more considerable than that of all the other States of Europe; but attention has of late years been much directed to the seats of production in Eastern Russia, Turkey, and Japan, which have not been attacked by the fatal disease which has proved so injurious to the silk-worms of parts of Europe. In 1853, the production of cocoons in France was about 26 millions of kilogrammes (of $2\frac{1}{5}$ lbs). This represented at least 2 million kilogrammes of raw silk of the value of 150 millions of francs. In 1854 and 1855, the production began to decline to under 20 millions, the disease called pebrine having manifested itself in the worms. In 1856, the evil increased, the rains were heavy, the crop of cocoons did not exceed 8 millions, and the price reached the unheard-of figure of $7\frac{1}{2}$ to $7\frac{3}{4}$ francs per kilo. From 1857 to 1860, the production stood at about 9 millions. In 1861 and 1862, the production again fell, and so continued, notwithstanding the introduction of new seed from Japan, until, in 1865, it had declined to about 5 million kilogrammes of cocoons, and the price rose to 7 and 9 francs the kilo. They have since then even gone higher, 8 and 10 francs being asked and paid. In 1866, all the efforts of Europe were turned to the introduction of healthy seed from Japan, more than $2\frac{1}{2}$ million ounces of eggs having been shipped from there to various countries. Unfortunately, a very mild winter brought forward the eggs too soon, and a great loss was sustained, so that, instead of the production anticipated, the crop in France did not exceed 10 or 11 million kilogrammes of cocoons. In 1867, about 2 million cards (each card contains on the average 25 grammes) of silk-worms' eggs were shipped from Japan, of which three-fourths were for Italy, and the rest for France. The amount of insurance effected on these while in transit was something enormous. Considerable loss and inconvenience were experienced at first by extensive frauds perpetrated. The eggs of Chinese silk-worms were sent over to Japan, and there re-packed under the seal of the French Consulate, fraudulently obtained or imitated, and this was sent off to Europe as pure and healthy Japanese seed. The import and export figures speak prominently and forcibly as to the importance of the silk industry in France. The average annual value of the silk imported into France, from 1837 to 1846, was 60 million francs, from 1847 to 1856, $122\frac{1}{3}$ millions. In 1860, it was $260\frac{1}{2}$ millions; in 1865, 429 millions; and in 1866, 383 millions. The raw silk exported was to the value of 45 million francs in 1859, and 107 millions in 1865. The value of silk goods of all kinds exported was 1,347 million francs average, 1837 to 1846; 2,747 from 1847 to 1856; 4,548 in 1860; and 4,677 in 1866. In 1862, the value of the silk manufactures, &c., locally used, was set down at 220 million francs, and of those exported at 440 millions; making a total of 660 millions. The value of the French silk manufacture can now scarcely be estimated at less than £40,000,000 sterling. The value of our imports of French silk manufactures has increased $6\frac{1}{4}$ millions since 1860. There are stated to be about 2 million workpeople directly or indirectly interested in silk production and manufacture in France. The quantity of raw silk produced in Italy, before the outbreak of the silkworm disease, was 3,710,000 kilogrammes; since then it has yearly decreased, and in 1868 it only reached 1,900,000 kilos., or little more than half. But this is not all. About 10 to $10\frac{1}{2}$ kilos. of silk used to be obtained from 100 kilos. of cocoons in Tuscany; now it is with difficulty that $7\frac{1}{4}$ to $7\frac{1}{2}$ kilos. of silk are obtained from the same quantity. In Russia, the total production of silk fabrics exceeds $2\frac{1}{2}$ millions sterling. In Switzerland, two or three small cantons employ about 60,000 looms, and export silks and ribbons to the value of 4 millions sterling, to England and North America. The German Customs Union is, however, closed to foreign silk manufactures, since they possess factories, which work from 10 to 15 per cent. cheaper. Although the production of silk extends in China over all the zone comprised between the 37 and 23 degrees, and more especially between the 33 and 29, no part produces it so abundantly as the province of Tché-kiang, which is equal to that of all the rest of the Empire. If, in a good average year, China produces 120,000 bales, it may be said that Tché-kiang furnishes 60,000, which represent a value of about 180,000 millions of francs. But as it is from the departments in the north of the province, and those which approach to Shanghae, which produce the largest part of this silk, there comes to Ning-po only that which is raised in the plains of Shao-chin, which, before the rebellion, yielded 10,000 bales. In 1863, the export was but 50 piculs; in 1864, 949; and in 1865, 1,914. A part of this silk, of too inferior a quality for Europe, is used up for native fabrics. The silk manufacture constitutes one of the principal industries of Tché-kiang, and especially of the capital, Han-tchéou. There was exported, in 1865, to the value of 1,794,000 francs, against 102,000 francs only in 1864, a proof of the increase of prosperity of the silk industry in Tché-kiang.

Proceedings of Institutions.

Alnwick Mechanics' Institution.—A most creditable exhibition was opened on the 4th of November, under the auspices of the above institution, in the Corn Exchange. The walls are decked with a very numerous collection of oil and water-colour paintings, as well as many cases of English and foreign birds; while the tables were covered with fossils, coins, sculpture, and curiosities. In nearly every case the contributors are local people—many of them being the painters or sculptors of the art subjects shown. The inaugural ceremony was performed by his Grace the Duke of Northumberland, in the evening. Additional interest was attached to the proceedings, by the presentation of prizes to the successful candidates in connection with the Science and Art Department and the Society of Arts. Mr. A. Robertson, jun., one of the hon. secretaries, read the annual report in connection with the science and art department of the institute. After describing the nature of the grants and facilities which the government afforded in order to enable the students to obtain a superior education at a mere nominal fee, and noticing the nature of the prizes awarded as an incentive to excellence, the report went on to show the progress which had already been made. In the year 1860, there were in the United Kingdom only 500 individuals who availed themselves of the aid thus given; but, in 1867, the number had increased to 10,000; and during the last session of 1869, there were 21,000 students receiving instruction in science schools. Northumberland itself was a fair illustration of this advance. When the school began in Alnwick, there was not another in the county, and yet no less than ten could now be found in the great centres of industry. Less than two years ago, a meeting was held in the Alnwick Town Hall, under the presidency of the Rev. Court Granville, to hear a lecture by Mr. Buckmaster on the subject; and it was not until then that classes in drawing were established, under Mr. T. Collinson, assisted by Mr. Brown, and in mathematics under Mr. T. Muxlow, B.A. No fewer than 86 members at once enrolled themselves as students; and, although the session was far advanced when the classes began, the examinations resulted in the award of 34 certificates of merit, and 10 Queen's prizes. After the summer vacation, a class was formed for the teaching of organic chemistry, under Dr. McVail—the total number of students, in all classes, then being 93; but, in addition to the examinations of the Science and Art De-

partment, recently concluded, many of the students had submitted themselves to the Examinations of the Society of Arts, and 46 certificates and 14 prizes had been gained. It was thus seen that the students of the Alnwick school had obtained 80 certificates and 25 Queen's prizes; while there had also been received from government, in capitation grants to teachers and towards the purchase of examples, no less a sum than £70. The report concluded by referring to the satisfactory results which had followed from the classes. The Duke of Northumberland then delivered an address, and presented the prizes to the successful candidates. Various short lectures were then delivered, and the evening concluded with a *conversazione.*

WHITWORTH EXHIBITIONS.

The £25 exhibitions which Sir Joseph Whitworth offered last year, previous to the competition for the £100 scholarships, proved so successful in bringing together a number of students, who, by the aid of the exhibition, had been able to devote a considerable time to their preparation for the examination for the scholarships, that Sir Joseph has this year offered sixty £25 exhibitions, in preparation for the 1871 competition. These exhibitions have only just been awarded as follows:—

	No. of Exhibitions.
Bath, Proprietary College	1
Birkenhead, Collegiate Institution and Proprietary School	1
Bolton, Science and Art Institution	1
Belfast, Queen's College	1
Birmingham, Birmingham and Midland Institute	1
Birmingham, Grammar School	1
Bristol, Trade and Mining School	2
Cambridge, University	2
Cardiff, the Mayor	1
Cheltenham, the College	1
Clifton, the College	1
Crewe, Mechanics' Institute	1
Cork, Queen's College	1
Darlington, the Mayor	1
Derby, Derby School	1
Dublin, Trinity College Engineering School	1
Dundalk, Chairman of the Town Commissioners	1
Durham, University	1
Edinburgh, University	1
Edinburgh, High School	1
Edinburgh, Watt Institute	1
Galway, Queen's College	1
Glasgow University	1
Glasgow, Anderson's University	1
Glasgow Mechanics' Institute	1
Halifax Working Men's College	1
Harrow, Harrow School	1
Leeds, Grammar School	1
Leeds, Mechanics' Institute	1
Huddersfield, Mechanics' Institute	1
Kilmarnock, the Provost	1
Liverpool, Liverpool Institute	1
Liverpool, Northern Institute	1
Liverpool, Free Library Classes	1
London, University College	1
London, City of London School	1
London, Christ's Hospital	1
London, King's College	1
London, St. Peter's Collegiate School	1
London, Birkbeck Institute, Southampton-buildings	1
Manchester, Owens College	2
Manchester, Owens College (Evening Classes)	3
Manchester, Free Grammar School	1
Manchester, Mechanics' Institute	1
Manchester, Salford Working Men's College	1
Marlborough, School	1
Newcastle-on-Tyne, the Mayor	1
Northampton, the Mayor	1
Nottingham, High School	1
Nottingham, Mechanics' Institute	1
Oldham, Lyceum	1
Oxford, University	2
Plymouth, the Mayor	1
Preston, the Institution, Avenham	1
Rossall, School	1
Sherborne, the King's School	1
Southampton, the Hartley Institution	1
Stockbridge, Queenwood College	1
Sheffield, the Mayor	2
Woolwich, &c.	1
Wokingham, Wellington College	1
Wolverton, the Institute	1
Worcester, the Mayor	1
Awarded on the results of the competition for Scholarships, 1869	10

It is to be hoped that the competition of 1871 will be as well attended as this year's was.

INSTRUCTION IN SCIENCE AND ART FOR WOMEN.

Professor Huxley continues his course of lectures, at South Kensington, on "Physiography." The farther into the subject he takes his audience, the greater becomes the amount of interest. The fifth lecture, upon the reparative agents of nature, is particularly engaging; and there can be no doubt that the information regarding the interior of the earth, as well as the explanation which Professor Huxley has given of volcanic action, will tend to clear away many of the misgivings which possibly most of his audience have had on the subject. The following are the notes:—

Lecture IV.

1. Every thousand pounds of Brighton sea-water contains about twenty-seven pounds of common salt, and eight pounds of other solid matters, making thirty-five pounds in all. If a certain measure of pure fresh water weighs a thousand pounds, the same quantity of Brighton sea-water weighs a thousand and twenty-seven pounds. A thousand pounds of the water of the Thames at Twickenham contains only a little more than five ounces of solid matter, the greater part of which is carbonate of lime. If a certain measure of pure fresh water weighs a thousand pounds, the same quantity of Thames water weighs about a thousand pounds and five ounces.

2. The sea is set in motion by tides, currents, and winds. When in motion, it tends to wear down the land, and gives rise to marine denudation.

3. Cliffs and beaches, shingle and sand, are the results of marine denudation, accompanied or not by pluvial denudation.

4. The motion of the largest waves is almost perceptible at a depth of three hundred fathoms (a fathom = 6 feet). The denuding action of ordinary waves must be insignificant at a third of this depth. The sea therefore acts upon the land as a sort of rotating chisel, and tends to cut it down to the depth of 100 fathoms below the surface.

5. Other things being alike, the indentations and headlands of a coast depend upon the nature and arrangement of the strata of which it is composed.

6. Supposing rain and rivers to have reduced all the land of Britain to the sea level, marine denudation would gradually plane down what was left, until, in place of the land there was sea 100 fathoms deep.

7. The materials thus worn down into fine sand would be carried away by tides and currents into deeper parts of the sea.

8. Snow and ice accumulating in elevated regions, give rise to glaciers, or ice rivers, and there effect glacial denudation, and transport solid materials for indefinite distances over land and sea.

LECTURE V.

1. All denudation, whether pluvial, marine, or glacial, tends to transport the dry land into the depths of the sea, and there deposit it in horizontal beds, or strata. Therefore, given time, denudation must finally reduce all the land to a submarine plain, which will exist for ever, if there be no reparative natural agency competent to produce new dry land.

2. Two such reparative agents exist in nature; the one is plutonic, the other vital. The plutonic agent is the hot inner substance of the earth; the vital agent is protoplasm.

3. The interior of the earth is hotter than the surface, the increase of temperature taking place at the rate of about 1° Fahrenheit for every 50 feet of vertical descent. If the temperature increases regularly at this rate, the heat at a depth of 20 miles must be great enough to melt all substances with which we are acquainted.

4. As a matter of fact, melted rock is being constantly thrown out in many parts of the world, and in enormous quantities, from certain vents, or holes in the crust of of the earth, which are called volcanos.

5. The matters thrown out are steam, volcanic ashes, and stones; mud, and streams of melted rock called lava. The heap of these matters which accumulates round the vent is a volcanic mountain.

6. The same plutonic agent which gives rise to volcanos also effects movements of the crust of the earth, which may raise strata formed by denudation above the sea level, and convert them into a new dry land. On the other hand, it may depress existing strata, and, bringing them within range of the melting point, give rise to a sort of igneous denudation.

7. From these considerations it follows that the solid matter of the globe is undergoing the same eternal circulation as the water of the Thames. The immediate agent of that circulation is in all cases water, in its three forms of ice, water (commonly so called), and steam; the remote agent is heat—firstly, of the sun; secondly, of the interior of the earth.

TECHNICAL EDUCATION IN MIDDLE-CLASS SCHOOLS.

In connection with the remarks made by Lord Henry Lennox, in his opening address as Chairman of the Council (see last *Journal*, page 10), on the Rev. Wm. Rogers' school, the following, which appeared in the *Times* of the 23rd inst., will be read with interest:—

"The Honorary Secretary of the Middle-class Schools Corporation presents his compliments to the Editor of *The Times*, and will feel much obliged by the insertion of the accompanying letter.

"The growing conviction among the most thoughtful of our citizens, as to the national importance of technical education, seems to render any apology for this request unnecessary.

Cowper-street, City-road, E.C., Nov. 22.

"4, Queensberry-place, South Kensington, Nov. 20.

"MY DEAR SIR,—To-day I visited the City of London Middle-class School, and spent several hours in examining the system pursued in it, and the results attained during the short period of its existence. Had I nothing further to express than my thorough gratification with the scheme of the school, I would not trespass on your time; but I am anxious for a still further development, and, therefore, venture to ask your attention to my proposal. The school, if it be properly supported by the citizens of London, may become one of the glories of the metropolis. To make it worthy of the first commercial city in the world, you must develop its resources for teaching science, in its relations to those technical subjects which lie at the foundation of commerce.

"As part of your freehold, I observed some inferior houses, the site of which would be admirable for chemical laboratories and scientific museums in relation to commerce. I should like to see built upon this site a building suited for these purposes, open to the school during the day, and to the working classes in the evening. No boy with such advantages need leave the upper classes of the school, without being able to examine the various kinds of merchandise which he will meet within his occupations, so far, at least, as would enable him to test chemically their relative excellencies or detect their adulterations. No boy need then leave the school without having had his physical and political geography copiously illustrated by objects of natural history, in their relation to the imports and exports upon which the prosperity of the country so largely depends.

"The cost and maintenance of such a building as that indicated, may be estimated at a sum of from £12,000 to £15,000. But what would this sum be to the great London corporations, which, by their recent public meeting, have shown their anxiety to co-operate in the advancement of technical education. Abroad, we see much larger sums spent in the erection of mere chemical laboratories, to advance the industrial education of the people. Berlin and Bonn have recently erected them at the expense of £50,000 each, and Leipsic, I understand, at a cost of about £30,000. The much smaller sum that I have indicated as sufficient for your wants might be subscribed in a single day by such wealthy corporations as the Goldsmiths', Grocers', Mercers', Haberdashers,' Fishmongers', Drapers,' Skinners', Merchant Tailors', Clothworkers', and Salters' Companies, and others with which you must be more familiar than myself. They have expressed themselves zealous and willing, and I am sure could not engage in a more profitable expenditure.

"I am, my dear Sir, yours sincerely,

"LYON PLAYFAIR.

"The Rev. W. Rogers, Hon. Sec., City of London Middle-class School."

CERTIFIED INDUSTRIAL SCHOOLS.

THE CLIFTON CERTIFIED INDUSTRIAL SCHOOL.

BY GEORGE C. T. BARTLEY.

The certified industrial schools occupy a position in the educational system of the country somewhat between the reformatory and the industrial pauper schools. They consist of institutions in which industrial training is provided, and in which children are lodged, clothed, and fed, as well as taught, and which have been certified by the Secretary of State for the Home Department as fit for the reception of children sent to them, under the provisions of the Industrial Schools' Act, 1866.

The management of these institutions is left chiefly in the hands of local committees, under the inspection of an officer, who reports annually to the Secretary of State for the Home Department. This report is published and presented to Parliament. The increase of these schools is going on rapidly, no less than fourteen having been created during 1868, making a total of seventy-seven in England and Scotland, in working order, up to the end of last year.

The children detained in these institutions may be divided into four classes:—

1. Those who are apparently under fourteen years of age, and who have been sent under a warrant from a magistrate, or two justices, on account of—

(*a*) Begging or receiving alms in the streets.

(*b*) Having been found wandering about without proper guardianship or home.

(*c*) Having been found destitute, either as orphans or the children of imprisoned criminals.

(*d*) Having been found in the company of reputed thieves.

2. Those under twelve, who have been charged before a magistrate with an offence punishable by imprisonment or a less punishment, but who have not been convicted of felony.

3. Those apparently under fourteen, who have been

represented before a magistrate, by their parents, as too unruly to control at home.

4. Those apparently under fourteen, who are refractory in the workhouse or the pauper school, or whose parents (one or both) have been convicted of crime, and punished with penal servitude.

In all these cases, a magistrate or two justices has power to send such children, for a certain time, to a certified industrial school, but the period of detention must in no case extend beyond the time when the child attains the age of sixteen years.

The object desired to be attained by these regulations is to remove children from temptation and evil company at an age when they are most susceptible for good, and while habits of industry and usefulness may still be engrafted. As such training is effected better at an early age, and as it is a condition of entrance that the children shall not have been convicted of felony, it is not surprising to find that they are taken in considerably younger than at the reformatory schools. The average ages of 2,488 children were as follows:—

	Per cent.
Under 7 years of age	3·7
Between 7 and 9 years of age	21·0
" 7 " 11 "	30·8
" 11 " 13 "	33·8
Above 13 "	10·6

Proportion who were illegitimate	3
" who had lost both parents	12
" " " one parent	40
" " " been wholly deserted	11
" " " one or both parents destitute or criminals	3
" " " parents living, and able to take care of them	30

A large number of the inmates being thus received at an early age, and the attendance being compulsory, and subject to no interference on the part of parents or others, it follows that these schools have great advantages over such institutions as the one at Hanwell. In another respect, however, they labour under a disadvantage, and that is from their having so small a number of pupils. At the 69 schools for which the details are published there was, in 1868, an average attendance of 8,659, or at the rate of 125 in each school. This number in itself is too small for a well-organised industrial school; but when the larger institutions are taken away from the calculation, such as the Middlesex School, with 732 pupils; the Kirkdale, 549; and ten others, each having more than 200 pupils, the average attendance at the remaining 59 schools, is reduced to 77. Some, indeed, have as few as 50, 40, 28, 26, 17, and even 8 pupils. The staff of the school with 8 pupils is two, and that with 28 (Shustoke) no less than four. At Leeds, with an average attendance of 221 children, a staff of eight only is required, at a cost, for salaries and rations, of £198 12s. 5d., or 18s. per head. The four officers to look after the 28 boys at Shustoke cost no less than £99 4s. 5d., or over £3 10s. per head.

Nothing shows more clearly the disadvantage of small schools than the varying cost of the officers and their rations, to say nothing of the increased efficiency and advantage of numbers in promoting rapidity of instruction. The cost of officers' pay and rations at the Gem-street school of 77 pupils, amounts to £423 8s. 10d.; whilst at the Somerset school, with 70 pupils, it is only £183 2s. 1d. Numerous cases of a similar description could be pointed out. It would seem that, as the children are not able to be removed when once placed in the school, it would be much cheaper, and far more efficient, to combine these schools into a few very large model institutions. The only additional cost of this would be the travelling of the children on joining—a nominal item in comparison with the present outlay on the numerous petty staffs.

The income of these schools is derived from the following sources:—

(a) Treasury allowance.
(b) Payments from the parents of some of the children.
(c) Payments from the parochial boards on account of children detained on their application.
(d) Contributions from rates.
(e) Private subscriptions, legacies, &c.
(f) Payments from voluntary inmates.
(g) Profit on industrial departments.

As regards the first and chief item, viz., the Treasury allowance. By the Industrial Schools' Act, 1866, the Treasury is empowered to contribute such sums as, from time to time, the Secretary of State shall think fit, from sums voted by Parliament, towards the custody and maintenance of children in certified industrial schools. This sum varies. In Scotland it is 4s. 6d., but at Clifton, and at most other places in England, it is fixed at 5s. per head per week.

The parents' contribution in no case can exceed a sum of 5s. per head per week; though it is, as a rule, very much below that sum, and, in many cases, the payment cannot be enforced at all, owing to their inability to pay.

The parochial board's payment, for those children whom it has been instrumental in handing over to the certified school, is a matter of arrangement between that body and the managers, subject to the approval of the Poor-law Board.

The contribution from the rates, from the parish from which the child is received, is a considerable item in the receipts, amounting, at Clifton, and in many other cases, to as much as 1s. per head

The subscriptions, &c., form the largest item next to the Treasury payments, and correspond to the local assistance obtained by most national and other schools.

The profits on the industrial departments amounted, according to last year's report, to no less than £4,830 in the year; but the exact particulars and details are difficult to ascertain with any degree of certainty. The mere fact of there being a decided pecuniary advantage derived from the industrial work is of itself sufficiently satisfactory.

In the case of additional buildings being required, the authority of the Secretary of State has to be obtained in each case, and contributions towards the expense of building, establishing, or acquiring land for such schools, may be made, on certain conditions, from the county and borough rates.

The rules for each school have to be printed and approved by the Secretary of State, and every school has to be inspected annually by the Home Office Inspector. Religious instruction is given, and many of the schools are entirely for Roman Catholic children. In cases where the religious persuasion of a child is different from that of the general school, a minister may visit, at certain times, for the purpose of instructing him in religion, according to any sect to which he may belong.

The licence system is largely in operation in these schools, and its extension is a good sign that the work and training are really sound and effective. By this plan a child, after he or she has served eighteen months in the school, may be sent to live with some trustworthy person who is willing to take charge of him or her. These licences are renewable every three months, and the time thus spent is considered part of the period of detention. By misconduct, the licence may be withdrawn, and absconding from such a situation is considered equal to absconding from the school.

The punishments inflicted for serious offences at these schools are chiefly, for the elder children, short terms of imprisonment, with a sentence of servitude for a term of years at a reformatory school established under the Reformatory Schools Act, 1866.

Such is an outline of the plan of these schools, which

are situated in all parts of England and Scotland. The largest at present established, are as follows:—

	Children.
Middlesex Industrial School, at Feltham	732
Kirkdale School, Liverpool	549
Hull School	478
Glasgow School	446
Liverpool Institute School	330
Glasgow Orphanage	305
Newcastle School	254
Aberdeen School.........................	250
Edinburgh School	250
Manchester	226
Liverpool, St. George's Roman Catholic School	225
Leeds School	221

Schools have also been established on the following ships, which have been given up for the purpose of training the boys as sailors:—The *Havannah*, at Cardiff, with 108 pupils; the *Wellesley*, at South Shields, with 46 pupils; the *Southampton*, at Hull, with 17 pupils. The success of this plan of providing old-fashioned ships as schools renders it probable that the number may be considerably increased.

The remaining schools have less than 200 pupils, and the institution situated at Clifton Wood, Bristol, concerning which a few remarks will now be made, contains just 100 boys.

The school premises are situated close to the river at Bristol, in a busy part of the town, and are somewhat cramped for room. They are conducted on the half-time system entirely, and receive children from the city of Bristol and county of Gloucester, together with some from Stafford.

The industrial work pursued is—

1. Tailoring.
2. Shoemaking.
3. Brushmaking.
4. Laundry-work.

In all these branches a considerable profit is made, after deducting the whole cost of material and tools, and likewise the wages of the teacher. Forty boys are employed in the tailoring trade, and they make the whole of the clothes for the school, as also the uniforms for the Volunteer band. The net profit in this branch last year was £96 18s. 5d. In shoemaking, eighteen boys were instructed, and produced boots and shoes for the school, at a profit of £30 2s. 7d., that is to say, had these articles been purchased, they would have cost that sum over and above the outlay on the materials and the wages of the teachers. The brushmaking business is conducted somewhat differently, as, of course, the manufactured articles are of no use to the school. It is the practice for a manufacturer to send the materials, and for the boys to make them into the style of brush required. By this means the school runs no risk, and ample employment is given to the boys, at a remunerative rate. During the year, a sum of £116 9s. 4d. was paid for making brushes, which yielded a profit of £76 2s. to the institution. The laundry is also considered an industrial department, as indeed it is; and since this work has been done by the boys themselves, a large saving has been effected, besides useful work being found for the children. The profit for last year was £29 4s. From this, it appears that the total net profit to the funds of the school accruing from the industrial departments, in the year 1868, was £228 11s. 5d., or considerably over 11 per cent. of the entire cost of the institution.

This great success may be partly accounted for, from the excellent plan of giving the children themselves an interest in their work. In all cases, part of the profit goes to the boy, that is, on the number of articles he has produced; the earnings, therefore, of each are strictly on results. The money thus earned is deposited in the savings-bank, and on the boy leaving, it is given to him to help as a start in life. Several, by this means have accumulated £4 or £5.

Six of the most deserving boys received their freedom on licence during last year; and, up to the present time, the managers report that in only one instance since the licence system was introduced has the privilege been abused.

A drum and fife band has been formed, composed of the children of the school, and its efficiency is so well known that on several occasions urgent requests have been made for the loan of it at fêtes, &c. The managers, however, wisely think that it is hardly advisable to allow the boys to go out for such occasions, when they would be removed from the eye of their officers, and liable to get into mischief. For school purposes, that is, for maintaining the tone and life of the children, as also in assisting in the systematic drill which is carried on, the superintendent considers that, with such children, a band is an essential means of instruction and improvement.

The subjects of education, apart from industrial training, are necessarily elementary, the three "R's" being about all that is expected, the rules of the committee stating that other subjects may be added, as the limited time and capacities of the boys may warrant. In a few cases, when any child shows a superior amount of intelligence, the course may be somewhat extended, though the principal object of the school is the industrial training of the boys, in order to form habits of labour, neatness, order, and general usefulness.

The punishments necessary to maintain discipline are left to the superintendent, though he is required to report them to the committee. During 1868, thirty-six were inflicted, consisting of forfeiture of rewards and privileges, reduction of food, separate confinement, and, for the severest offences, moderate personal correction with a common school rod or cane.

The expenses of the school are rather high, amounting to £2,051 13s. 9d. for the year 1868, or at the rate of £20 10s. per head. It is true that the profits on industrial work reduce this by £2 5s., but still there can be no doubt that even then it is too high. Under the excellent management in which the school now is, it would seem probable that were the size of the school increased the cost would relatively be much reduced. Within a very short distance of this institution there are two others precisely similar, the one at Park-row, for sixty-nine boys, and the other at Cotham-road, for twenty-eight girls, each requiring the expense of a separate staff, rental, &c. This might be much reduced besides being made more efficient, by uniting all three together.

The results of the training on the children in their after life are certainly satisfactory, though the fruits do not seem to be so great as at the large pauper schools of Norwood, &c. This may probably be accounted for from the fact that the average age of the children on entering being greater at Clifton than at Hanwell, they have, unfortunately, in too many cases, had the seeds of crime profitably sown in them by their companions before entering the institution. The number, however, who are permanently rescued from a life of villany is very great, being not less than 80 to 85 per cent. From a return made of those who left this school in the years 1865, 1866, and 1867, it appeared that 31 were doing well; 5 were doubtful; 4 had been committed to prison; 1 to a reformatory; 3 had disappeared; 2 were dead; total 46. Of the five doubtful cases, and the three who had disappeared, the larger number subsequently were found to be doing well, so that really only five of the forty-six were known to have been trained in vain.

In conclusion, it may be affirmed that these certified industrial schools supply a most important want, and that their rapid extension is highly desirable. Were sufficient schools created to contain all the children in the kingdom who come under the first and second categories of those at present in the existing institutions, as explained at the commencement, and were the law not

permissive, *but obligatory*, that all such children should be sent to them, it would seem that a great part of the work sought to be achieved by compulsory education would be accomplished.

Fine Arts.

Picture by Raphael for Sale.—A fine work by Raphael, formerly belonging to the Court of Naples, but now in the possession of an ex-ambassador, is said to be now offered for sale at the price of half a million of francs (£20,000.)

Opening of the Fine Art Season in Paris.—The auction mart of the Rue Drouot is begining to exhibit activity, and a large number of sales are already announced. It is expected that the coming season will be one of great interest, and that the number of pictures and other works of art brought to the hammer will be unusually large.

Acquisition to the Louvre.—One donation almost invariably produces others; the fine collection of the late M. Lacaze has just become the property of the French nation, and now another well-known collector, M. Duclos, is about to present to the famous gallery one huudred of the best pictures in his collection. Already the whole of the new rooms of the Louvre are occupied, and great changes have to be made, to afford space for the Lacaze Gallery; but the completion of the great gallery, and the removal of the Salle des Etats will soon furnish more space, which, however, will soon be filled.

Paris Schools of Fine Art.—The new session has just commenced at the Ecole des Beaux Arts, and the following is the list of students in the various sections:—School of painting, seventy pupils, and ten supplementary, or candidates for admission; sculpture and medal engraving, twenty-seven pupils and supplementary; architecture, thirty-nine pupils. Total, 156 titulary and supplementary students.

Commerce.

Commercial Treaties between England and France—The coming revision of the commercial treaties between France and England is beginning to give rise to very active exertions in various parts of the French empire, and there is no doubt that great efforts will be made to obtain an increase of the protective duties, already, in many instances, nearly prohibitive in favour of French manufactures. At present Rouen is prominent in the movement—which, however, commenced in the north and east of France—which has for its object the defence of the interests of all classes of manufacturers, gravely compromised, say the protectionists, by existing treaties. The President of the Chamber of Commerce of Rouen has laid before the members of that body a report, which is considered by the protectionists to prove, beyond all question, that the tariffs must be modified in favour of national productions, and that, if the present system be longer maintained, French industry must infallibly be completely ruined. The report gives, amongst other matter, a comparative statement of the expenses of French, English, and Swiss spinners, the conclusion being that, under the heads of machinery, installation, fuel, interest on capital, and labour, taken together, England has an advantage amounting to $23\frac{7}{10}$ per cent., and Switzerland very nearly the same. We are told that this conclusion is arrived at, "figures in hand," but these are not published, and thus the inference remains, for the world at large, an assertion only. M. Cordier, the author of the report in question, is a protectionist of the old school; he asks for the remission of all the charges which weigh on the introduction of foreign fuel, the diminution of the railway and all other charges which burden industry, and an increase on the import duties on the manufactures of England and Switzerland. The report was, we are assured, received with acclamation by the Chamber. The action of the Chamber of Commerce has been followed by a public meeting, at which about four hundred persons were present, and at which the treaties of commerce were denounced in energetic terms, and amidst shouts of applause. M. Pouyer-Quertier said that, before raising the protective duties, the existing treaties should be entirely abolished as "incompatible with the government of the country by the country itself." He considered that the question of temporary admission of iron and other materials should be considered entirely apart from the general tariff. A committee has been appointed to consider the best means of associating the working classes in the movement, or, in other words, of raising a popular demonstration against the proposed renewal of the treaties by the government. Mr. Ozenne, Conseiller d'Etat, is visiting the factories of Rouen and Roubaix on the part of the government, and the other day he was present at a meeting of the Rouen Chamber of Commerce, where memoirs were presented to him by cotton and flax spinners, and the whole question was discussed at great length. The action of the advocates of increased protection has naturally given rise to a counter-movement in Bordeaux and other places interested in the reduction of the British duties on French products. It is well to mention, in connection with this important subject of import duties, that it is asserted in Paris that the project of a customs' union on the Continent, which was for a time abandoned, has been revived, and is now under serious consideration. It is further asserted that, in addition to France, Belgium, and Holland, the governments originally included in the proposition, Sweden and Denmark are now added. It will be at once seen that such a proposal is very unlikely to have effect, as any exclusive arrangement of the kind would militate against the efforts of the French government to improve its commercial relations with England and Germany. However, during the excitement created by the proceedings of the advocates and opponents of free-trade, all kinds of schemes will, doubtless, be started, and will demand examination.

Tea Cultivation in the United States.—The *Produce Markets Review* says:—We have several times called attention to the suitability of the climate of the Southern States to the cultivation of tea, and if the threatened immigration of large numbers of Chinese takes place, skilled labour might be obtained without great difficulty. American planters must, however, not run away with the idea which nearly ruined our Indian planters at the beginning of their enterprise—that all Chinese understand the growth and preparation of tea. Ordinary Chinese know as much of the subject as the Irish do of the cultivation of the grape; and the labourers, to be of any use, must come from the best tea districts in China, or else they must be Indians from the British plantations in Assam, Cachar, and other parts of India." The same journal quotes from the *American Grocer* to the effect that, in various parts of North Carolina, the tea plant has been cultivated successfully. It also appears that this is the case in South Carolina, though here it is still a matter of experiment.

Colonies.

Sugar and other Products of Queensland.—The cultivation of sugar in this colony is being developed in a highly satisfactory manner, the results from various portions of the colony being reported superior to anticipation. Several cargoes of cane have recently been conveyed from various farms on the river Brisbane to the mills at Cleveland, and it is anticipated that the growers will receive a satisfactory return. The mineral resources of the country are being most encouragingly developed. The

manufacturing element is also beginning to be developed in the colony. A sugar-mill and engine have recently been completed at the foundry of Messrs. Smellie and Company, equal in manufacture, and at a considerably less cost than if it had been procured from England. Coke has also been manufactured in Queensland, which is said to be of better quality than that imported from New South Wales. Maize meal of a superior quality has been manufactured, and, from the samples shown, they deserve praise for fineness of dressing and quality. Owing to the increased demand for this article, two mills have been erected, capable of turning out a large quantity, and the price for the manufactured article and the charge for grinding are very reasonable.

MEAT PRESERVING.—A Melbourne paper says that the satisfactory intelligence received by the last few mails, respecting the disappearance of the prejudice once existing against Australian preserved meat as an article of food, has not only led to the formation of several new companies, but has encouraged manufacturers at present in the field to extend their operations. A company re-commenced operations in June last, since when they have shipped 300 tons of meat in tins, and the whole has met with a ready sale.

Notes.

SIR W. FOTHERGILL COOKE.—Last Friday's *Gazette* contains the official announcement of the honour of knighthood conferred on Mr. W. Fothergill Cooke. We understand that, in the letter in which the Prime Minister announced to the Secretary of State her Majesty's pleasure that this honour should be conferred, Mr. Gladstone stated that it was bestowed in recognition of Mr. Cooke's great and special services in connection with the practical introduction of the electric telegraph.

Correspondence.

A BLOW TO THE ENGLISH LANGUAGE AND SCIENCE.—SIR,—The effect of the Commissioners' Report on Military Education will be disastrous to useful education, unless a stand is made against it. Allow me to quote what the *Times* of the 24th inst. says on the subject:—"The commissioners having decided to accept for admission to the army the scholars actually produced by our great schools, found themselves under the necessity of recognising and prescribing the following subjects of examination:—Mathematics, classics, modern languages, English, experimental sciences, and drawing. These they valued in the proportion of five marks to classics, four to mathematics, four to modern languages, one and a-half to English, one and a-half to science, and one to drawing. We remarked, on a former occasion, that this valuation represented, in point of fact, a compromise between what was desirable and what was to be had. Existing subjects of study were necessarily taken for the proposed examinations, but their relative places were shifted. The commissioners put mathematics first, Latin second, Greek third, French and German on a level with Greek; below them, on a level with each other, natural science and English, and drawing last. In the actual course of our schools, these subjects would be ranged rather in the succession following—Greek, Latin, mathematics, French, and German. Science, we suspect, would hardly find a substantial place at all, nor drawing either; while, as to English language and literature, they would be picked up principally by studies more or less voluntary. It follows, therefore, that the actual course of our school education is far from satisfying what the commissioners consider to be the requirements of the military profession, and what we wish now to ask is whether there is any other profession which would have better reason to be satisfied. Taking the average stamp of proficiency, we may say that the strongest point of a good scholar from one of our great schools would be his Greek. It is unquestionable that he would know more of classics than of any other subject, and almost certain that he would know more Greek than Latin. In short, the best of his time would have been spent upon Greek, to the necessary prejudice of other studies. What, let us ask, is the profession or occupation for which this is the most suitable preparation? In what position of life is the man to be placed whose interest it will be to know Greek, not only better than any modern language, but better even than Latin? Of Latin it may be said, and appears, indeed, now to be felt, that it cannot be excluded from any scheme of education professing to be liberal; but can as much be said of Greek? Of course, an acquaintance with Greek may be held indispensable to a consummate knowledge of Latin, but of such advanced acquirements we are not now speaking. As much Latin scholarship as would suffice for the needs of even a learned profession, might be acquired without any recourse to Greek, and Greek, otherwise, leads to nothing at all. Take next, the case of modern languages. Of these, English is certainly one, and, surely, not the least valuable to an Englishman; but the commissioners have been compelled to depress it below the languages of the Continent, and to act as if a knowledge of German were not merely desirable in itself, but more desirable than that of the mother tongue. Can that be right? Is there any station of life in which a command of English would not be more useful than a command of German or French? Be it observed, too, that at this point another element of incalculable importance enters into the question. It is through and by the mother tongue exclusively that the arts of written communication are learnt and practised, and we know of no acquirements more precious. How many men in a hundred can write a good letter—a letter telling concisely, lucidly, and easily, what requires to be told, and neither more nor less? Yet, of all the needs of every-day life, such a faculty of writing is about the most imperative. An official report or description is nothing but a letter elaborated; in fact, a man who can write one can write the other. If composition be a beneficial exercise, can it take any better form than this? Again, the value placed by the commissioners on mathematics, has, of course, a reference to the intended profession of the candidate, and elementary mathematics, to say the least, would be exceedingly valuable to an officer. But what shall we say of arithmetic in its more practical forms, such as book-keeping and other commercial or pecuniary calculations? To illustrate the difference between the two studies, let us take examples from daily life. The financial transactions of late years have called into existence a class of "experts," with knowledge almost exclusively its own. When some enormous concern goes into liquidation, with liabilities of a million or two, the books are too mysterious for any scrutiny but that of a professional "accountant," who is accordingly called in. Now, is it to be supposed that these keen and comprehensive calculators, whose eyes no figures can either escape or deceive, are also mathematicians? We think it probable that the referees, whose names appear constantly in our columns, never heard of trigonometry or conic sections, while, on the other hand, we have good reason to know that a proficient in geometry and algebra may be utterly incompetent to understand a balance-sheet, analyse a prospectus, or sift the figures of a common railway report. Is not the practical arithmetic available for such purposes an "exact science," at least as useful as mathematics? Our object in these remarks is to suggest to those intrusted with the conduct of education a revision of the studies it now includes. We have seen that the scholar, as at present turned out from the best of our schools, is not such as the military authorities would have him if they

could get their own way. Is he such as any other authorities would have him? Is it conceivable, for instance, that a man in after life should be so situated as to find his account in having spent the best days of his youth upon Greek plays? As far as the working professions are concerned, would not a knowledge of Hindostanee, Arabic, even Chinese, be more probably useful than a knowledge of Greek. Be it remembered that the Eastern half of our empire contains 200 millions of people, all in our charge. We have described the successful scholar of the present time. He is an excellent Grecian, not so good a Latinist, and possesses, perhaps, but an imperfect acquaintance with any modern language. If he is a good mathematician, he is probably nothing else, and his mathematics may not include the practical arithmetic of every-day life. Suppose, instead of this, the model scholar of ten years hence were to be a thorough master of English, tolerably well acquainted with Latin, able to converse in French, and competent to apply the principles of arithmetical calculation, on any scale, to questions of finance—would he not thus be more perfectly as well as usefully accomplished than the scholar of the present day? If this question be answered in the affirmative, our schools have the matter in their own hands." The Society of Arts, with its numerous examinations, may very properly memorialise the Secretary at War on the subject, and put in claims for English, science, and common sense.—Yours, &c., John Locke Milton.

MEETINGS FOR THE ENSUING WEEK.

Mon......Social Science Assoc., 8. Adjourned discussion on Mr. G. W Hastings' paper, "Review of the Discussion at the Bristol Congress on the Relations between England and the Colonies."
British Architects, 8.
Medical, 8.
Asiatic, 3.
London Inst., 4.
Actuaries, 7. Mr. Bumsted, translation of a paper by Herr Hopf, entitled, "Suggestions for a Law to regulate the Calculation and Investment of the Reserve in Life Assurance Companies."

Tues ...Civil Engineers, 8. 1. Renewed discussion upon Mr. Gaudard's paper, "On the Strength and Resistance of Materials." 2. Mr. Edward Dobson, "On the Public Works of the Province of Canterbury, New Zealand."
Anthropological, 8.

Wed ...Society of Arts, 8. Mr. Zerah Colburn, "On an Improved Means for Laying a Tunnel for the Transit of Passengers across the Channel."
Pharmaceutical, 8.
Obstetrical, 8.

Thur ...Antiquaries, 8½.
Linnæan, 8.
Chemical, 8.
London Inst., 7½.

Fri ......Geologists' Assoc., 8.
Philological, 8½.
Archæological Inst., 4.

Patents.

From Commissioners of Patents' Journal, November 19.

Grants of Provisional Protection.

Boots and shoes—3228—C. Mole.
Bottles, securing corks in—3220—J. V. Michaux.
Brushes, machines for manufacturing—3077—C. E. Fuller.
Caoutchouc, &c., treating—3254—J. H. Johnson.
Casks, &c., withdrawing liquids from—3252—G. Simpson & L. Strauss.
Electricity and means of telegraphing—3147—E. H. C. Monckton.
Filters and filtering apparatus—3081—C. A. Ofverberg.
Fire-arms, breech-loading—3258—H. Rochatte.
Furnaces and crucibles for melting steel, &c.—3206—J. M. Stanley.
Horse gear—3246—M. Tuthill.
Human excrements, converting into manure—2623—F. Wicke, J. Brönner, T. Petersen, and J. G. Zehfuss.
Kilns for burning limestone, &c.—3244—H. Robinson.
Locks and latches—3256—W. Harris.
Malt, &c., brewing—3248—J. McCormick.
Metallic ores, &c., treating—3204—C. Crockford.
Motive-power engines—3212—R. Douglas and L. Grant.
Packing, &c , materials for—3107—T. Briggs.
Paper waste, treatment and application of—3163—J. Dewar.
Retorts—3224—A. C. Kirk.
Rock-boring machines, stand or carriage for—3240—F. B. Dœring.
Roofs, &c.—3231—J. Riley.
Safety lamps—3232—E. Thomas.
Sewing machine needles—3208—W. R. Lake.
Textile fabrics, ornamenting—3242—J. Logan and W. Gardner.
Umbrellas, &c., sticks for—3230—J. and H. Tracy.
Velocipedes—3214—H. Livesey.
Water-closets—3238—J. Ingleton.

Inventions with Complete Specifications Filed.

Combination locks—3250—W. R. Lake.
Horses, &c., apparatus for clipping—3296—H. A. Bonneville.
Submarine telegraph cables—3236—F. Jenkin.

Patents Sealed.

1570. S. Jackson.
1578. C. J. Foster.
1580. J. Hudson and C. Catlow.
1585. E. T. Hughes.
1594. B. F. Weatherdon.
1596. M. H. de Goësbriand.
1598. G. Salt and W. Inglis.
1599. A. Barclay.
1602. J. Dick.
1609. L. Roman.
1697. J. Fletcher.
1806. J. Hill.
2364. W. E. Newton.
2440. H. Pinkus.
2486. W. R. Lake.

From Commissioners of Patents' Journal, November 23.

Patents Sealed.

1592. W. Furness.
1593. W. Mitchell.
1608. A. McNeile and J. Slater.
1614. H. D. McMaster and A. Dale.
1615. T. Vaughan & E. Watteeu.
1619. C. F. Chew.
1621. C. Hanson & J. Bottomley.
1624. G. H. Ellis.
1632. F. A. Barrow.
1636. T. Bradford.
1639. B. T. Newnham.
1653. J. Frazer and L. and R. Simon.
1672. B. Littler.
1685. F. A. Calvert.
1781. H. W. Hammond.
1798. W. A. Gilbee.
1813. C. Mather.
1807. R. Duckworth, W. Greenwood, J. Pearson, and J. Langtree.
1851. R. Hornsby and J. E. Phillips.
1852. R. Hornsby and J. E. Phillips.
1957. W. R. Lake.
2015. G. Palmer.
2289. H. S. Heyman.
2342. W. Brown.
2547. W. R. Lake.
2556. J. Holdsworth.
2666. S. Simpson.
2719 N. J. Dor.
2807. G. T. Bousfield.
2819. J. Buchanan.
2894. J. Clayton.
2948. J. H. W. Biggs.

Patents on which the Stamp Duty of £50 has been paid

2990. W. R. Lake.
2995. J. Nichols.
3016. J. Bolvin.
3033. J. H. A. Gruson.
3034. T. Greenwood.
3035. J. H. A. Gruson.
3040. W. Chambers.
2990. W. R. Lake.
3036. W. A. Gibbs.
3048. J. Robertson.
3050. J. Howard and E. T. Bousfield.
3062. J. Barker.
3063. P. Gledhill.
3327. W. R. Lake.
3079. W. H. P. Gore & R. Green.
3129. H. Timmins.
3145. W. Brookes.
3341. W. Gilbey.
3060. E. Morewood.

Patents on which the Stamp Duty of £100 has been Paid.

3113. G. A. Buchholz.
3124. W. Bottomley.
3127. J. Townsend.

Registered Designs.

5055—Sept. 21—The revolving whistle and mouth-piece—L. P. Noble Albany-road, Camberwell.
5056—Sept. 24—Shoulder sustainer—George Gibbs, Birmingham.
5057—Sept. 28—A shield or guard for the nipples of feeding tubes—Maw and Son, Aldersgate-street, E.C.
5058—Oct. 4—Kitchen boiler top—W. Lees and Co., Manchester.
5059—Oct. 8—Combined hot-air and gill stove—Kennard and Ferguson, Glasgow.
5060—Oct. 11—Fastening for the lids of charcoal box irons—W. Cross, West Bromwich.
5061—Oct. 13—Improved hat brush, to be carried inside a hat—T. Higgins, Warrington-gardens, W.
5062—Oct. 14—Sprinkler scent bottle—C. Asprey, New Bond-street, W.
5063—Oct. 14—Sash fastener—T. Pemberton and Sons, Birmingham.
5064—Oct. 21—A board for a new game, entitled "Collision"—R. Hall, Crystal Palace, S.E.
5065—Oct. 21—Excelsior case for bottles—A. G. Avenell, Cambridge heath-road.
5066—Oct. 22—Hay and corn rack for sheep—Southwell, Adams, and Woodroff, Staffordshire.
5067—Oct. 26—Window fastener—W. Lea and Co., Wolverhampton.
5068—Oct. 28—Stanley's improved saddle tree—Stanley and Robinson, 22, Carlton-road, W.
5069—Oct. 30—A rounding machine for saddlery and harness work—W. S. Doulton and Co., Norwich.
5070—Oct. 30—Combined water-pot and garden syringe—W. S. Doulton and Co., Norwich.
5071—Nov. 12—A hand drill—Walker, Brothers, Sheffield.
5072—Nov. 13—Improved circulator for washing purposes—J. Hammond, Bognor, Sussex.
5073—Nov. 20—Jackson's self-acting chimney terminal—Wycliff terrace, Lavender-hill, Wandsworth-road, S.W.

Journal of the Society of Arts.

FRIDAY, DECEMBER 3, 1869.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at eight o'clock :—

December 8.—"On Prints and their Production." Being a sequel to a former paper, entitled "Engraving and other Reproductive Art Processes." By S. T. Davenport, Esq. On this evening, Henry Cole, Esq., C.B., will preside.

⁂ The Paper will be illustrated by a series of examples of early Dutch, Swiss, French, and English engravings by the line, mezzotinto, chalk, and aquatint processes; steel engravings by Charles Warren, &c.; wood engravings by Bewick, Clennel, and others; lithography of various periods; colour-printing and chromo-lithographs by Leighton, Rowney, Vincent Brooks, Hanhart, and Dalziel Bros.; Daguerreotypes; nature prints; photographs; photo-galvanographs; Pauncy's carbon prints; Woodbury types; Swan's carbon prints, or autotypes; prints by the Tessier du Motay process; Albert types; and composition photographs.

December 15.—"On India-rubber, its History, Commerce, and Supply." By J. Collins, Esq.

December 22.*—"On Wines, their Origin, Nature Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea." By J. L. W, Thudichum, Esq., M.D.

Cantor Lectures.

The first course of Cantor Lectures for the present Session will be "On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., and will consist of three Lectures, to be delivered on Monday Evenings, the 6th, 13th, and 20th December, at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing two Friends to each Lecture. Tickets for this purpose have been forwarded to each Member.

India Committee.

The next Conference will be held on Friday evening, December 10th, when a paper "On a Gold Currency for India" will be read by Andrew Cassels, Esq. The chair will be taken at Eight o'clock.

Mechanical Committee.

The Council have appointed a Committee to consider and discuss questions, relating to mechanical inventions, which may appear to be of too technical a character to be brought before the Society at the Wednesday evening meetings.

Members desirous of joining this Committee, and attending the discussions, are requested to send in their names to the Secretary of the Society of Arts.

* Captain O'Hea's paper on "Recent Improvements in Small Arms" is postponed till after Christmas.

Donations to the Library.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors :—

How to Make Money by Patents: or Hints and Suggestions to Inventors and Patentees, by Charles Barlow; presented by the author.

Monograms, Historical and Practical, by D. G. Berri; presented by the author.

Tables of British Commerce, taken from the Board of Trade Returns, with Map, showing the great value of the Colonial Trade, and that it comprises all the elements of true reciprocity, by C. W. Eddy; presented by the author.

Report of the Conference, presided over by the Duke of Manchester, on the question whether colonisation and emigration may be made self-supporting, or ever profitable to those investing capital therein; edited by W. Freston; presented by Colonel Francis Maude.

Life of John Gibson, R.A., edited by Lady Eastlake; presented by Longmans, Green, and Co.

Annual International Exhibitions of Select Works of Fine and Industrial Art and Scientific Inventions.

The following letter has been received by the Secretary :—

Office of Her Majesty's Commissioners for the Exhibition of 1851, 5, Upper Kensington-gore, W., 19th November, 1869.

Sir,—I am directed by Her Majesty's Commissioners for the Exhibition of 1851, to request you to call the attention of the Council of the Society of Arts to the accompanying announcement of a series of annual international exhibitions, the first to be held in 1871.

Her Majesty's Commissioners are fully sensible of the many and great services rendered by the Society of Arts to the various exhibitions, both national and international, since their first proposal in the year 1845, and especially to the great International Exhibitions of 1851 and 1862. Her Majesty's Commissioners are also mindful of the fact that the first educational exhibition held in this country was organised by the Society of Arts, and that the Educational Museum, at South Kensington, owes its origin to that Society, which placed at the disposal of the Committee of Council on Education the objects which had been exhibited at St. Martin's Hall, and which, at the close of the exhibition, were presented to the Society of Arts. They, therefore, particularly desire to obtain the valuable co-operation of the Society of Arts in producing a complete and effectual exhibition, especially in the educational class.

Her Majesty's Commissioners desire to call attention to the fact that the distinguishing principles of the proposed exhibitions are those particularly recommended by the Society of Arts itself, in their letter of the 15th December, 1858, addressed to Her Majesty's Commissioners for the Exhibition of 1851, in which they express an opinion "that the exhibition should consist of works selected for excellence, illustrating especially the progress of industry and art, and arranged according to classes, and not according to countries."

I am further to say that Her Majesty's Commissioners hope the Council of the Society of Arts will think fit to appoint a committee to co-operate with them in promoting the proposed series of annual international exhibitions, and especially in producing a complete exhibition of all matters relating to the important subject of education.

I have the honour to be, Sir,
Your most obedient servant,
Henry Y. D. Scott, Lt.-Colonel, R.E.,
Secretary.

To the Secretary of the Society of Arts.

[Enclosure.]

A.—Her Majesty's Commissioners for the Exhibition of 1851 announce that the first of a series of annual international exhibitions of selected works of fine and industrial art and scientific inventions will be opened at South Kensington, London, on Monday, the 1st May, 1871, and be closed on Saturday, the 30th September, 1871.

B.—The exhibitions will take place in permanent buildings, about to be erected, adjoining the arcades of the Royal Horticultural Gardens.

C.—The productions of all nations will be admitted, subject to obtaining the certificate of competent judges that they are of sufficient excellence to be worthy of exhibition.

D.—The objects in the first exhibition will consist of the following classes, for each of which will be appointed a reporter and separate committee.

I. *Fine Arts applied or not applied to Works of Utility.*—1. Painting of all kinds—in oil, water colours, distemper, wax, enamel, and on glass, porcelain, mosaics, &c. 2. Sculpture, modelling, carving, and chasing in marble, stone, wood, terra-cotta, metal, ivory, glass, precious stones, and any other materials. 3. Engravings, lithography, photography, &c. 4. Architectural designs, drawings, and models. 5. Tapestries, carpets, embroideries, shawls, lace, &c., shown, not as manufactures, but for the fine art of their design in form or colour. 6. Designs for all kinds of decorative manufactures. Copies of ancient or mediæval pictures, mosaics, enamels, reproductions in plaster, fictile ivory, electrotypes of fine ancient works of art, &c.

II. *Scientific Inventions and New Discoveries.*—Of all kinds.

III. *Manufactures.* — (*a.*) Pottery of all kinds, viz., earthenware, stoneware, porcelain, parian, &c., including terra-cottas used in building; with any new raw materials, new machinery, and processes for the preparation of such manufactures. (*b.*) Woollen and worsted fabrics, with any raw produce from new sources or newly prepared, and new machinery for woollen and worsted manufactures. (*c.*) Educational:—1. School buildings, fittings, furniture, &c. 2. Books, maps, globes, instruments, &c. 3. Appliances for physical training, including toys and games. 4. Specimens and illustrations of modes of teaching fine art, natural history, and physical science.

Detailed rules applicable to each of the above classes, and lists of the separate trades engaged in the production of objects of manufacture, will be issued.

IV. *Horticulture.*—International exhibitions of new and rare plants, and of fruits, vegetables, flowers, and plants showing specialities of cultivation, will be held by the Royal Horticultural Society, in conjunction with the above exhibitions.

E.—In Class II. and III. producers will be permitted to send one specimen of every kind of object they manufacture, such object being distinguished for novelty or excellence.

F.—The arrangement of the objects will be according to classes, and not nationalities, as in former international exhibitions.

G.—One-third portion of the whole available space will be assigned absolutely to foreign exhibitors, who must obtain certificates for the admission of their objects from their respective governments. Foreign countries will appoint their own judges. The remaining two-thirds of the space will be filled by objects produced either in the United Kingdom or, if produced abroad, sent direct to the building for inspection and approval of judges selected for the British exhibitors. Objects not accepted for exhibition must be removed according to the notices given, but no objects exhibited can be removed until the close of the exhibition.

H.—All exhibitors or their agents must deliver at the building, into the charge of the proper officers, the objects unpacked and ready for immediate exhibition, free of all charges for carriage, &c.

I.—Her Majesty's Commissioners will find large glass cases, stands, and fittings, free of cost to the exhibitors, and, except in the case of machinery, carry out the arrangement of the objects by their own officers.

J.—Her Majesty's Commissioners will take the greatest possible care of all objects, but they will not hold themselves responsible for loss or damage of any kind.

K.—Prices may be attached to the objects, and exhibitors will be encouraged to state their prices. Agents will be appointed to attend to the interests of exhibitors.

L.—Every object must be accompanied with a descriptive label, stating the special reason, whether of excellence, novelty, or cheapness, &c., why it is offered for exhibition.

M.—Due notice will be given of the days for receiving each class of objects, and, to enable the arrangements to be carried into effect, strict punctuallity will be required from all exhibitors, both foreign and British. Objects sent or brought after the days appointed for their reception cannot be received.

N.—Reports of each class of objects will be prepared immediately after the opening, and will be published before the 1st June, 1871.

O.—Each foreign country will be free to accredit an official reporter for every class in which objects made in such country are exhibited, for the purpose of joining in the reports.

P.—There will be no prizes, but a certificate of having obtained the distinction of admission to the exhibition will be given to each exhibitor.

Q.—A catalogue will be published in the English language, but every foreign country will be free to publish a catalogue in its own language if it think fit.

Henry Y. D. Scott, Lieut.-Col., R.E.,
Secretary.

Office of Her Majesty's Commissioners for the Exhibition of 1851,
5, Upper Kensington-gore, London, W.

This communication has been laid before the Council, and the following reply has been forwarded to Her Majesty's Commissioners:—

Society for the Encouragement of Arts, Manufactures and Commerce,
John-street, Adelphi, November 30th, 1869.

Sir,—I have brought under the consideration of the Council of this Society your letter of the 19th instant., in which Her Majesty's Commissioners for the Exhibition of 1851 draw the attention of the Council to a series of annual international exhibitions intended to be held by them, the first of which will be held in 1871, and expressing the hope of Her Majesty's Commissioners that the Council of the Society will think fit to appoint a committee to co-operate with them in promoting the proposed series of annual international exhibitions, and especially in producing a complete exhibition of all matters relating to the important subject of education.

I am directed by the Council to express their cordial desire to co-operate with Her Majesty's Commissioners in the important work they have undertaken, and they will at once take steps for the formation of a large and comprehensive Committee, representing the various interests connected with education, similar to that which conducted the Educational Exhibition of 1854, and they have every confidence that, under the care of such a Committee, they will be able to get together such a display of articles connected with education as will creditably represent that class in the exhibition.

I have the honour to be, Sir,
Your obedient servant,
P. Le Neve Foster, Secretary.

Lieut.-Colonel Henry Scott, R.E.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

INDIA COMMITTEE.

The first Conference of the Session was held on Friday evening, November 26th, Lieut.-General Sir ARTHUR COTTON in the Chair. The paper read was on—

IRRIGATION.

By T. LOGIN, Esq., C.E.

A short time ago, a missionary, who had been in Egypt and the East for several years, said to me that, next to the work of the missionary, irrigation was of the greatest good to the people of the East. If this be so, it is hardly necessary to say more as an apology for introducing the subject to the notice of the India Committee.

The subject is a large one, and there is no little difficulty in selecting the main points, so as to bring the question before this Conference in a manner that will be intelligible to non-professional men by one who is prone to enter into engineering details, which, though important, cannot be of interest except to canal engineers. On this occasion, I intend to treat the subject more as to its abuses than as to its advantages, throwing out some general suggestions, which, it is hoped, may lead to a discussion by gentlemen of varied experience, who would be able to arrive at sound views as to what will best further the true interests of both India and England, which are bound up one in the other.

The climate of India differs as much, if not more, in different localities than any other country in the world—from a burning sun, with the heat of the tropics, to the intense cold of the polar regions; and all degrees of moisture, from a deluge of nearly some fifty feet of rain in the year, down to less than one-hundredth part of that rainfall. These diversities of climate can, in a general way, at once be ascribed to the great natural features of the country, though, when we come to study the subject in detail, it will be seen that considerable changes can and have been effected by certain means within our reach, and what was once a flourishing country, by the misrule of man, has been turned into a burning, sterile desert, or a pestilential swamp.

Of the former, there are many evident proofs all over the plains of the Punjaub; for any one who looks at the lately-published revenue maps will observe remains of old towns and canals indicated where at present there are hardly any inhabitants, while, in the same manner, where there are now deadly swamps in the valley of Assam there are remains of extensive embankments. In Madras there are remains of extensive irrigation works, far exceeding anything of the present day.

Excess of moisture on vegetable life, under a tropical sun, unless at very high elevations, brings about rank vegetation; a deficiency of it, desert sandy plains—both prejudicial to animal life; but the excess of moisture, however, is not so much owing to heavy rainfall, but to bad drainage, and this defective drainage is one of the most serious questions in connection with irrigation, requiring most careful inquiry.

It is my opinion that, in all countries, in all climates, irrigation can be carried on with advantage to agriculture, let the rainfall be what it may; but at no place can it be adopted with advantage to either the climate or agriculture, if proper drainage be not attended to. Thus, not only in India, but on the Continent, and also even in England, unless stagnant water be not only drained off the surface, but also the spring levels be kept some given distance below that of the surface, both the climate and the vegetation must be more or less vitiated. In short, it would seem that all advantageous moisture must neither be stagnant nor ascend, but should invariably be on the move, either over the surface or descending through the soil, bringing with it, from the atmosphere and the surface soil which has been exposed to atmospheric influences, the properties which invigorate the plant. Where, on the other hand, the moisture which ascends from below in its course upwards brings with it certain salts already existing in the earth, which it holds in solution, and by capillary action conveys them to a considerable height above the spring level—if, therefore, these salts be brought thus to the surface, or even to such a height as to reach the roots of the plants, injury to vegetation must ensue, and a consequent deterioration of climate through the want of healthy vegetation.

It is thus that, in India, what were formerly rich cultivated fields are, year by year, becoming deteriorated, and are being covered with the efflorescence of these salts, locally known by the name of "rih;" and it is to be feared that, unless active steps be taken, very extensive areas of what at one time produced rich harvests, year by year, will become uncultivable. So this question is one of paramount importance, for not only is this raising of the spring level showing its evil effects out in India, but also in Europe, and more particularly in Italy. The evils here spoken of have been known in northern India on the older canals for many years back; for not only has the agriculture been injured, but the climate also, to such an extent that, I have been credibly informed, the zemindars of some of the older canal villages have difficulty in getting their children married to those of more healthy villages; while, by the lately published sanitary reports, it appears that the evil is becoming widely spread as irrigation is carried on in excess.

To understand the matter aright, it is necessary to know that our canals and watercourses are carried along the ridges of highest elevation, so as to admit of the water, from its own gravity, flowing over the fields. With a careless, improvident, and, it may be added, greedy population, who never think there can be too much of a good thing, the fields are often flooded to excess, and, at many points the water for long periods is kept stagnant, percolating by degrees through the soil. The whole soil thus in time becomes like an enormous sponge filled with water, and thus, even though it may not be apparent on the surface itself, yet, by digging down a foot or two, spring water is reached. Now, if we suppose a constant supply of water to be always running into the sponge along the most elevated portions, unless the evaporation be equal to the supply, which we know it is not, this sponge must get fuller and fuller as time advances; so, unless the drainage be as great as the supply, the water must appear at the surface, forming swamps; and thus, what should be a blessing to the country must in time prove detrimental, unless there be, at the same time, arrangements made for getting rid of the superfluous spring water. Knowing the matter thus, the magnitude and importance of this question becomes very great, and requires a most thorough investigation in all its bearings, for, whatever steps be adopted, it is evident that a very large expenditure must be involved. There are various modes of meeting this difficulty, but to understand them a few words require to be said on the different systems of irrigation.

The two great systems of irrigation are what is known in Northern India by the local term of "lore" and "dhall" irrigation, that is, in the first instance, the surface of the water is always at a higher level than

that of the country, and the water flows over the fields by its own gravity, while with "dhall" irrigation, it is necessary to raise the water by artificial means, and the system derives its name from the usual process of lifting, namely, by a basket, supported by four strings, and worked by two men. This description of scoop, generally a basket made water-tight, is called a "dhall," and, though a primitive mode, yet it is very effective. It is not intended that this paper should be full of statistical details, but those who wish to go more fully into the matter, will find at p. 466 of vol. xxvi. of the "Proceedings of the Institution of Civil Engineers," long tabular statements of the relative merits of the various modes of raising water. Suffice it to say, that having to raise the water even a foot or two adds very much to the cost.

On one occasion, when I went into this question of cost, I found, roughly speaking, that the price of labour nearly equals the total cost of the water as purchased from government in the first instance, to be estimated only by lacs on lacs of rupees for each canal.

To recommend such a constant tax on a country that is to be irrigated might, at first sight, appear almost regardless of the people's interests; yet, in the face of such facts, in 1865, when reporting on the irrigation of the Rechna Doab, I recommended this, to prevent the wholesale waste that now goes on, for no one would take the trouble to lift water, and not make a proper use of it afterwards.

This keeping the water "in soil," or above the surface of the country, is a question which has brought about very lengthened discussions, and at one time it was considered one of the fundamental errors of the Ganges canal; but this raising of the spring levels throughout the country, proves that no serious mistake was made in the design, by keeping the general level of the surface of the water below that of the country.

The important question now is, what steps should be taken to prevent this injury to the land and the climate by the rising of the springs? To excavate a system of drainage lines must involve a very great outlay, and yet something of the kind appears necessary, at all events under some circumstances. But before involving a great outlay, I would venture to suggest that preventive rather than remedial measures may be tried in the first instance. What I would suggest is, that certain rules be laid down for the guidance of the canal officers, empowering them to withhold a supply of canal water for "lore" irrigation where, during the wet season, the springs may rise to within three feet of the surface, and both "lore" and "dhall" irrigation where the depth to the spring water is met with at a less depth than two and a-half feet. This, I believe, would meet some of the difficulties, without altogether depriving the villagers of irrigation, for they could still, when the land required water, raise it from pits sunk in the fields. Possibly, the bad effects to the climate and the health of the inhabitants may thus be greatly modified, while one great advantage would be sure to accrue, namely, that it would reduce the waste of water, and thus extend the area benefited by the canal water.

I will not attempt to enter into statistics regarding the crops irrigated, or the volume of water expended on certain descriptions of crops, for the simple reason that doing so would be likely to mislead, for when the generally-accepted rules for measuring the mean velocity of a stream are not considered by some to be correct (and I am one of the number), how is it possible to say how much water flows down a certain channel.

It is not known with accuracy how much a given area of a given description of land is likely to produce of any description of crop, and almost always there is a great deal of hap-hazard estimate. This is not as it should be, and I am happy to see that there is every prospect of an early introduction of model farms, when not only will it be known what a certain area has yielded hitherto, but what it can produce under a better system of agriculture. I have long wished to see model farms tried, as tests of the expenditure of water and the yield of the fields, and I trust that, before long, proper steps will be taken, if they have not already been taken, to determine many, if not all, of the disputed questions above referred to.

With respect to the system of water rents in the north-western provinces and the Punjaub, the modes of calculating the returns are somewhat different; for in the latter country it has been attempted to partially include increase of land rent, due to the extension of irrigation, while in the north-western provinces this has not been taken into account, but taken for granted, and possibly this latter is the best, as it is the simplest. First, with as much care as possible, you should try to discover the increased cultivation due to canal irrigation; and, having done so, add it on as a per-centage at the end of the return, and neither trouble us here at home with mixed calculation, nor the cultivators out in India with variable collections, which go to unsettle their minds, making them suspect there is always something more coming. And to this uncertainty, I believe, in a great measure, is to be attributed the backwardness of the ryots in taking water in the first instance.

In the older canals from the Jumna, the distribution channels known by the name of "ragbahas" were made on the petition of the zemindars, and on their agreeing to pay for their construction of them. On the Ganges Canal, on the other hand, these "ragbahas" were constructed at the expense of government, a somewhat higher rate being charged as water-rent. The smaller distribution channels or water courses, known by the name of "gools," were made by and at the expense of the villagers, the canal establishment only assisting in selecting the line, if their other duties could permit of it; but it is always better to allow the villagers, if possible, to settle these minor questions among themselves, without the interference of government officials. In short, it is highly desirable that village communities should elect from among themselves parties to superintend all minor arrangements connected with irrigation; and so long as the water is not wasted, the canal establishment should not be called on to exercise any control. Only when serious disputes arise, should the irrigation officer step in, and that more in the capacity of a judge, than as one come to levy taxes and inflict fines.

To understand the present system, it is necessary to know that in the north-western provinces the land-taxes are fixed by a settlement officer for 30 years, and it is his duty to determine what revenue should be paid for the land. After him comes the canal officer, with his train of native officers, zilladars, chakidars, and no end of other "dars," too numerous to mention. Their chief duty is not only to superintend the proper distribution of the water to each villager, but to measure every field watered twice a year. Each description of crop comes under certain classes, which were formerly four in number, the rates varying according to the supposed volume of water and value of the crop. Again, different rates are charged for "lore" and "dhall" irrigation, which at once doubles the number of classes, and raises them to eight instead of four. Now, as the area of each field about equals half an acre on an average, and there is a separate proprietor for about every two or three acres of land irrigated, some conception can be formed of the enormous labour required, twice a year, to prepare reports, when it is known that the area watered is to be counted by thousands of square miles.

The late Col. Baird Smith tried to introduce a system of measuring the volume of discharge, but this failed, chiefly owing to the variation of the supply in the main distribution channels, and to get, in a measure, over this difficulty, I designed a new description of weir, which I called a zig-zag fall, a description of which is to be found in vol. xxvii. of the "Proceedings of the Institution of Civil Engineers;" and various models have

been designed to ensure a constant discharge, but they all, to work properly, require a constant amount of fall; and, be this fall ever so little, it cannot always be spared, for often a lowering of the level one foot stops "lore" irrigation for a mile or more. Expense is another drawback; but, in my opinion, a constant uniform discharge is not what is wanted, for to carry this out would most certainly lead to waste on many occasions—nay, it may be almost said in every instance—for a local shower of rain, the state of the crops, and a hundred other causes, a constant supply would do injury instead of good. What appears necessary is a maximum discharge measure, where the cultivator can, as he pleases, at all times, draw off as much less than this maximum or even none, but never more than this given maximum, but that to get any water whatever shall require a certain amount of labour, and that, up to the given limit, the volume will depend on the quantity of labour expended; for we may be sure few men will waste what they have worked for.

Having thus pointed out the system now in force in Northern India, what appears to me desirable to consider is (and it is a subject that is becoming more and more pressing every day), what steps should be taken to rectify the evils complained of, for there can be no doubt that though the present system of bi-annual measurements, sending in returns of the areas watered, and the nature of the crops produced, during the hot and cold weather seasons, is in theory all that is just and proper, yet the warmest supporters of the system must admit that not only false returns of areas and a wrong classification of crops are often submitted, with the object of defrauding government, but often large numbers of fields are omitted altogether in the returns, and so frequently is this the case, that when one learns that, last year, no less than 1,425,702 acres of land were irrigated in the latter way, we may safely say that the actual area equalled 1,500,000 acres, or even as much as 2,500 square miles; and is this to be wondered at if we look a little deeper into this question? With returns of some three million fields of different descriptions of crops, by two different systems of irrigations, "lore" and "dhall," with different charges on each; with this revenue to be collected from 500,000 or 600,000 cultivators, living in some 10,000 villages, dispersed over an area as large as England, and only about a dozen executives, with their two or three European assistants and native establishments, one would naturally ask, "Is it to be wondered at that government should be defrauded on the one hand, and the cultivators sometimes oppressed on the other?" Yet, wide as the door is to oppression and fraud, I have reason to believe that the falsification of returns is not 50 per cent. of the actual results, as some persons inform us, but that, to the credit of all concerned, it does not exceed five per cent. as to area, but what says still more for the native community is, that so long as they see an officer desirous to act justly, though firmly, in the execution of his duty, the natives are satisfied, even though, at times, this officer may pass a wrong order; and it is by this general feeling that the small body of Anglo-Saxons are enabled to govern India; but if the natives once suspect favouritism or worse, most serious complications may arise.

To return to the subject, what should be done to improve our present system of irrigation? And this is more easily asked than answered. I, however, venture to suggest that the engineering duties should be completely separated from the revenue ones, and a set of officers, be they engineers or not, should be selected for this latter special department, who would be under the direct orders of the Commissioners of Divisions (not district officers nor canal engineers) and the secretary of the local government for the irrigation or agricultural department. Their duties should be to receive a certain volume of canal water from the canal engineer, whose duty it would be to keep up the supply, and the works in order, while the irrigation officer has the sole responsibility of its distribution. The bi-annual measurements being in force, he would, in the first instance, have to adopt them, but my experience tells me that contracts, or rather settlements, could be made with heads of villages, in the first instance, for periods not exceeding five years, for a round sum yearly. Objections, no doubt, may be raised to this, and government may on some occasions lose some revenue, but it does so at present by fields being omitted altogether from the returns, or by wrong classifications; so why not let the villagers make money honestly, rather than by having recourse to fraud? The strong argument in favour of this plan of five-yearly settlements (it may afterwards be increased to 10 or 20 years) is the prevention of interference of canal underlings, and that the cultivator can raise what crops he pleases without having to pay more or less to government. Thus, there can be no appearance of any bounty being held out to grow inferior crops, which sometimes does happen by the present system. Perhaps it would be better for government and the cultivator that the amount to be paid into the treasury should fluctuate according to the average price of grain in the markets within a given area. For example, suppose the standard price of wheat to be 25 seers per rupee, and the annual amounts fixed to be paid were 500 rupees yearly, as the price of grain lowered, so would the water-tax fall till it reached some limits, say 35 seers per rupee, when in such seasons there would be no water-tax whatever on lands irrigated; while, if the prices rose so that only 20, 15, or only 10 seers of wheat could be purchased for one rupee, the amount to be paid as water-tax would rise proportionally to 750 rupees, 1,000, or, in years of drought, like that just gone by, as high as 1,500 or 2,000 rupees. This, at first sight, may appear almost absurd, and like a gambling transaction on the part of the government and the cultivators, but, in reality, it is no such thing, for it seldom happens that more than one-third of the area of a village lands, owing to the levels, can be irrigated, but, even if the whole could, it makes no great difference.

First, let us consider the present constant rate. Be their rain or be there not, the zemindar has one fixed amount to pay as land tax to government, and one fixed water-rate. In a year of drought, villagers who have no canal water, or very little, even if their fields should produce little or nothing, have the same amount to pay as in a favourable year, as a land tax, which sometimes brings ruin on the village community; while in a year of plenty, they are better off than canal villagers, who have the fixed water-tax to pay also, should they make use of the canal water, which is optional. As a natural consequence, these canal villagers, so as to save this water-tax, hold off as long as they can, at the very time the fields would be most benefited; that is, just after sowing, and the canal water has to run too often to waste, so long as the speck of a cloud is to be seen in the heavens; but, when the sky becomes cloudless, and everything is drying up, then there is an out-cry for water, perhaps when it may not be available.

Now, if the cultivators knew that in a season of plentiful rain those who took water would have no more to pay than those who did not, but that the water-tax would be enhanced on a proper "sliding scale," according to the enhanced value of the grain in the market, and that only in seasons of drought would they be called on to pay high water taxes, which they could well be able to afford from the produce, due alone to this irrigation, being more valuable in such seasons, there would be no longer this watching the clouds, or hesitation in taking water when the crops would be most benefited.

It may be said this would introduce great irregularities in the canal revenue. Most certainly it would, but what of that, is there not a compensation for this? In years of scarcity, are there not large remissions of revenue to the cultivators, so to government, as well as the villagers, there would, by this very irregularity, be greater

uniformity, for the elevations on the water-tax would just fit into the depression of the land-tax.

Let us now consider the general effect. With the irrigation officer, his exertions could no longer show themselves in direct returns, as they would be most fluctuating, but by the increase of area irrigated, which it would be the interest of all to extend, for this, after all, is the great end,to distribute the benefits over as large an area as possible, and thus be a check on the over and injurious irrigation before alluded to. In addition to canal irrigation, the duties of this new description of officials would extend to all descriptions of irrigation, from wells, tanks, &c., and not even end here, but also have the power of fixing enhanced taxation, owing to the raising of the spring levels due to a canal. For example, a country, prior to the introduction of a canal, may have the spring water so low that it is unculturable by want of well irrigation; but, by raising the springs, well irrigation could be carried on at a profit, and as this is solely due to the canal, the canal should be benefited by the same in some degree. In short, these irrigation officers would become settlement officers for all artificial improvements of a country, while the work of the land settlement officer, as well as district officers, would be simplified and reduced, for the former would only have to fix the tax on the land according to its natural and local advantages, such as climate, soil, easy transport and proximity to large markets; while the over-worked district officer would have nothing to say to irrigation of any kind, but simply collect the fixed land and water rates, and thus be relieved of very arduous and difficult duties, which none but a man who makes it his sole and only work can perform properly, which certainly is extensive enough, for it is the main work towards the agricultural improvement of India.

To old and experienced canal men, and also to many standing high in the service, the laws now suggested may, like my theory about the flow of water, appear at least novel, if not revolutionary. But I venture to thus make them public, after having arrived at most of them during the famine of 1860, and my experience since has gone far to confirm me in these laws, as may be seen in any of my canal reports. I have carefully studied the subject; not in a library, but in the fields; not from books, but from men whose livelihood depended on it, both in the north-western provinces and the Punjaub; and though I have rather drawn a dark picture than a glowing one, it is on the same principle as a chart is prepared, leaving the deep water without a mark, but bringing permanently forward what appears to me the rocks and shallows, with the sets of the currents, or native feelings on the question. So, as this paper has probably exceeded its proper limits, I will conclude by saying that, after all I have said, I quite agree with the missionary referred to at the commencement of this paper, as to the benefits of irrigation in India.

On the invitation of the Chairman,

Mr. Edwin Chadwick, C.B., said:—As it is the wish that we should give to the East the information of the West, I beg to offer some remarks on the great organic question before us; but it is in the way of warning, and "how not to do it"—how not to do ill by legislation and administration. I observe that it is stated in some correspondence from Calcutta, that, for the advancement of irrigation works, it is proposed to make occupiers or owners of lands that are irrigable pay for irrigation works brought to those lands, whether they irrigate them or not. To make occupiers or owners pay for benefits, whether they accept them or not, appears to some minds there, as it would to landlord legislative minds here, "a most severe," and, to say the least of it, "a most objectionable course." Now, my sanitary service has carried me much into the details of subsoil land drainage, which must be the base of good irrigation work, as well as into those of irrigation, for the application of the sewage of towns. In my report on the sanitary condition of the population, I have adduced evidence of the effects of a good subsoil drainage on the health of men, of cattle, as well as of vegetation, and I have written instructions, formed on the best experience, how such works may be best carried out in England. I may state, as the general economical results of the subsoil drainage works that have been carried out in Great Britain, that the general average of good, bad, and indifferent works—stone drains as well as tile drains—have repaid the cost in about ten years. But the later good tile drainage works have repaid the cost in five and even in four years. The fact has recently been noted to have arisen, as was foretold in the sanitary report, that the subsoil drainage of the sites of towns has been attended by a considerable reduction of the cases of consumption, of which excessive damp, as well as over-crowding, is one active cause. The ill-drained lands of Cheshire and of other places have been marked by an excess of cattle disease. Yet, notwithstanding the clear, undoubted gain in improved vegetation derived from even partial land-drainage, it is estimated that, of all the land in England that would be benefited by subsoil drainage, there is not more than some fourteenth part yet drained. I speak of partial land-drainage, because a farm or a tract of land may be perfectly well drained of itself, and yet the vegetation may be chilled and acted upon injuriously by the atmosphere of the surrounding ill-drained and damp neighbourhoods. There are data for the estimate that, if all the land of England requiring subsoil drainage were drained completely, the general temperature of the country would be raised an average of some six degrees. Why, then, in the face of all the proved benefit, does so much inferior culture and evil continue? From want of the power of local initiation, from jealousy and want of the power of agreement amongst the many, and from the despotic power of maintaining mischief by the misuse of property given by bad law and bad administration to a few. To drain efficiently and economically, you must drain from the dividing line of the watershed at the hill top, down to the dividing brook or river, the outfall at the valley bottom. Here, valley men would drain, but they have difficulty in keeping out the wet from the ill-drained uplands of the hill men who will not drain. There, the upland men would drain, but the valley men will not agree to let them have any outlets. Excellent plans after plans have I seen devised for district drainage, but then the outfall—the key to the position—was possessed by someone who, though it might clearly be for his own benefit, refused to allow any outlet through his land. The most flagrant despots and oppressors we have here are the owners of old water-mills, who oppress the occupiers or the owners of the land above them by backing up the flood waters upon them. I have known such instances as the owner of a water-mill not worth more than twenty or thirty pounds a-year, doing some thousand pounds of damage annually by the backwater, and by obstructing the drainage above him, refusing a compensation that would have given him steam instead of water-power in perpetuity, and refusing benefit to himself, and proportioning his exactions to the extent of the despotic power allowed him of doing or maintaining damage to others. On such grounds, I consider that the well-spoken officer, Colonel Strachey, and the others proposing the new irrigation works in India, are thoroughly right in making all owners of irrigable lands pay, whether they use them or not, and that these legislators are to be sustained against their opponents, who are thoroughly wrong. Centralisation, in my view, means the maintenance of the liberty of the many, and the promotion and the protection of their benefit against the despotism, oppression, and obstruction of the few. I presume, from experience in England, to say that there will be no getting on without it in India. Be thoroughly confident

of the benefit to every individual, and then confidently make every individual pay for it. But then, to get on, you must see that the work is complete in every part, so as to ensure the benefit you charge for. Great engineers are wont to confine their schemes to great trunk lines, and leave the private people, farmers or others, to form the capillaries, or make the connexions how they may—to leave to uninformed and unskilled people the trouble of getting a work done which they do not understand, and to make immediate outlays for which they may not have the means. I may illustrate this by the common course of house and town drainage work in England. A contractor who has made interest with a local board for a work of town drainage, drives large sewers down the centre of streets, without any proper notice, care, or preparation for connections with them from the houses. Then, there are orders to the owners or the occupiers to make the connections, or they are left to do it or not, as they choose. The occupier says the work is of the nature of a permanent improvement; that he only occupies from year to year; and that it is the owner's business to have it done. The owner denies that it is an improvement, says he let the house without it, and he will not do it, and protests against the work as an oppression. The English law defines the owner to be the person in receipt of the rents and profits, but it is common that the person in receipt of the rents is only a lessee, with a few years of the lease to run; and I have known orders for such permanent works by local boards to operate as confiscation of rents. To charge owners for the full immediate payment for such works is to enter into entanglements of short and long life interests, short and long lessees, some of whom had really parted with the ownership by long leases to the occupiers. To avoid such complications, I was obliged to assume that there were no owners, and only occupiers, and no occupiers who could afford immediate outlays, or who could do anything; that they must all have the work planned and done for them, under a common contract, and that no immediate outlay was to be expected from them. In these cases, however, of changing occupations, and in those conditions where the owner received his rents weekly, or less frequently than quarterly, I treated him, for the convenience of collection, as the occupier, as it were, of a lodging-house. I assumed that the works were to last for a generation, or thirty years. I got tables constructed for the adjustment of annual payments for them, by equal annual instalments of principal, and equal instalments of interest within those thirty years. Thus, the cost of the private works required being for abolishing the cesspool within a house, laying down a soil-pan or water-closet with a self-cleansing drain; carrying in water and adjusting it, with water-pipe for a sink, and a return-pipe for the waste, say £4 10s., under contracts on a large scale, instead of asking the occupier for that sum, he would be simply asked for eighteen-pence a quarter, to repay the principal and interest. Thus, the occupier for a year, who would have a thirtieth part of the benefit of the work, would pay for that thirtieth part and no more; and so with the occupier for the quarter, or the occupier for the week, who would pay his three half-pence a-week. On this principle the entire cost of sanitary works for a city—a water-supply carried into every house, the waste water and the excreta carried from every house, and from the house through self-cleansing sewers to fields, to be there applied by irrigation works—would be about a halfpenny per week per head of the population, which would be a means of a great saving to them. I am unaware of any town - drainage works that have been carried out anywhere completely, except on this principle, except, indeed, in the instances of large owners who have chosen to do the entire work themselves, and who have generally had to pay more for them. In many instances, however, there have been lions in the path of improvement, in the shape of private town builders, private town contractors who have had interest enough in the town councils to prevent the execution of "private improvement works," as they are called under a common contract, as depriving them of what they chose to consider their rights of trade profits, and as an infringement of the rights loudly vaunted "of private enterprise," on the necessities of the population. Moreover, local authorities have been improperly permitted to treat sanitary works of water supply as convenient means of taxation, and to levy excessive amounts beyond the real cost of the service, and to raise outcries against them. What, I have then to submit is, that these administrative principles are applicable to irrigation works; that it is not enough to lay down main arterial lines of water distribution, but that the capillaries must be regarded as part of the system and provided for; that private fields must be prepared by drainage sometimes for the reception of the irrigation water; that the engineers must instruct themselves, and, through their officers, instruct the occupiers how to do the work or have it done for them, and also teach them to keep it properly going. The necessity for this is shown in the extensive creation of malarious swamps along extensive lines of expensive irrigation in India, wasting means, as well as injuring the public health. I directed the attention of my late lamented friend, Colonel Baird Smith, to the irrigations of Northern Italy, which the wisdom of the Company enabled him to examine, and he made reports in two volumes, containing lessons which do not appear to have reached all places in India. It is well that such observations as to the progress of improvement in Europe should be repeated from time to time, for the instruction of engineer officers; and Lieut.-Col. Scott Moncrieff has been well employed in examining the practice of irrigation in Southern Europe, which he has published in a useful volume. In the course of it he observes that:—"In North India, where manuring is not much understood, the natives frequently change the crops, sowing on the same land one year a crop requiring a quantity of water, and the next year one that is not irrigated at all. But, even then, it is often said, there is a decided deterioration of crops, and the land is becoming exhausted. Where irrigation, too, has been long practised, the ground has become so soaked that water is to be met with only a very few feet below the surface, and much thought is being bestowed on the best system of extended drainage, which we have found must accompany irrigation in these flat plains." This statement is comprehensive enough as to how much is to be learnt of rudimentary truths by the directors of such works, and how much they have to teach the people for using them; and, foremost, the doctrine of De Candolle, the vegetable physiologist, that the future of agriculture will be in giving food with water at the same time. One point which the passage I have cited displays is, that it has yet to be learned there what is the level at which the water-table must be kept for good culture. In parts of Lincolnshire it has been found that, if they pump some inches above or below a given point, they are doing too much or too little for good culture; and so, by drainage works, the water-table may be kept too high, or reduced too low. The experimental farms (which are creditable to the government to have established) might be well applied to determine such a point for the different districts; it is a great point, for it is a point of salubrity as well as of culture, and I might dwell upon the principle, if this were the occasion, that in the tropics good sanitation and good culture—economical culture—go together more than anywhere else. I may notice that the old method of irrigation by submersion appears to have been hastily and rudely adopted in some parts of India. In Italy, as Colonel Baird Smith has shown, it has been provided that such irrigation works are to be kept six miles from any city. It is proved that in the now ancient water-meadows in this country it creates marsh surfaces, and generates ague in men and rot in

sheep; and is, moreover, expensive in the works and wasteful in the water. In the irrigations at Edinburgh, sixty inches annually of sewer water is used, where ten or twelve inches, under a better system, would suffice. The value of the land occupied by carriers would pay for the apparatus for the distribution by steam-power through pipes. For the avoidance of the expense of forming water tables, and the waste and inconvenience of the method of distribution by submersion, it occurred to me to suggest distribution by movable flexible carriers with lateral apertures, which were not adopted here, but which may be seen in successful operation near Paris. We had also some successful trials of water and manure, by flexible hose distribution by steam-power from canals, for which I should think horse-power, now applied to boats successfully in the United States, might often be applied, especially in the commencement of irrigation works in India. On the whole, I conceive we ought to press, as a service due from the council and the government of India, the active examination and promotion of all improvements of this class. For the maximisation of subsistence, abundance, security against evil from every source, and against physical calamity, are surely the chief direct ends of government. For these, one chief means is the careful storage of water and its distribution, as a means of fertilisation and the prevention of famine. We may say that the good government of water supply is a chief means of the good government of India. We should try and stimulate our government to emulate the advance made by the Moguls in this direction in their days, by the best practical applications of art and science in our days, for the benefit of the natives under our rule.

Mr. Hyde Clarke said that the remarks of Mr. Chadwick showed how much the question admitted of illustration. We were apt to think that India was not only a peculiar country, but that its peculiarities were limited to itself. This, however, was not the case, and there were many interesting facts to be gathered from different climates, yet bearing on the subject. For his own part, he believed that wherever submersion was resorted to, it was always injurious to the health of the people, and he could conceive nothing more beneficial to their engineering friends in India than that the government, from time to time, should enlarge the experience of the officers in India. The difficulties to which officers were exposed in India, and the necessities attending the duties of their employment, gave them little time for book studies, and it would be well if they could be taught to bring some practical knowledge to bear upon the printed reports of their predecessors. Mr. Login, in his paper, had raised a very important question, namely, the necessity of adjusting the supply of water, and that not only the users should pay in taxes for the expense of the same, but that all who benefited should be subjected to pay. Another great question was with regard to the means of transit. He knew of a case where a railway had been made, and still the camel-drivers would continue to run alongside. They had no occasion to do so, because there was plenty of work for them in the country, but they preferred to be in the city, where they could spend their earnings in debaucheries, and this competition was carried on at great loss to the government. He was called upon to point out remedial measures, and the consequence was that a decree was issued, preventing those persons contiuing the competition. The result was, they had to remove to the country, and the traffic on the railway was much increased. This might not have been strictly within the limits of political economy, but it affected the welfare of the people. It was always desirable, when considering the government of India, to remember the history, traditions, and constitution of the past; and, although it was wise to introduce from Europe certain beneficial matters, yet, on the other hand, existing institutions should always have the preference.

The Chairman said that he could not express his belief in the importance of discussing Indian matters outside the Council of India. He thought that to have the Council of India composed solely of old Indians was a great mistake. There should be some good Englishmen amongst them, and he also thought it a mistake to have no young men in the Council. He did not think much good would come out of it till its constitution was altered. In the case of famine, for instance, in this country, if one person died, there was an inquiry as to how he came to his death; but in India they had no such inquiry. It seemed to be taken for granted that people should die of famine. So they had one and a-half million die in the late Orissa famine, and no one inquired who was to blame, and no efforts were made to save them. There were public works going on at present of great importance, one of them 500 miles of navigation, and it was to be stopped to save £15,000. This great highway, connecting important places, was to be stopped for want of that paltry sum of money. Referring more immediately to the subject of the paper they had heard read, he considered that a great question was, Why does not India supply an overwhelming quantity of cotton? That was a question closely connected with the irrigation question. In India the seasons were so irregular, especially with regard to the supply of rain—there was not a deficiency, but an irregularity—that a great deal of labour was required to supply the necessaries of life, and the consequence was, that a large area was employed not in the cultivation of cotton, but in the cultivation of food, and if a great portion of this could be set at liberty, a larger quantity of cotton could be produced. An irrigated area would yield at least three times more than an unirrigated one; and, of course, the people thus set at liberty could become cultivators of cotton. Therefore one of the first things to be done was to relieve the population in this respect. The cotton-growing districts of Nagpoor could produce cotton that had been sold in Manchester at a better price than the best Upland American cotton. There was a project for making an immense canal, taking the water from the Lower Ganges; it was to be 150 yards broad, and 200 miles long, and it was expected that the rates of transit on such canals would be so low that they would meet all the exigencies of the country. On the line of the Godavery, one of the finest cotton countries was at Hingenghât, and at the delta of the Godavery was the best district for food. All depended upon the transit being sufficiently cheap to allow of these things being carried from place to place. It seemed to him that it would be better to use the word "regulate," instead of "irrigate." A few miles from Calcutta, there had been a deadly fever raging for many years. It was going on now, and the sole cause of it was, that the people had both too much water and too little. They had too much in the monsoon, living up to their knees in mud; while, in the summer they had no water whatever. This was solely for want of the regulation of the water; and the question was—Could this be effectively done in India? The great Ganges canal had been a failure, so far as money affairs were concerned; but it was now paying six per cent., and was, therefore, beginning to be profitable after twenty-five years. Was that the case generally? Certainly not; for the neighbouring East and West Jumna canals were both paying well, and yet they had precisely the same difficulties to deal with as were met with on the Ganges Canal. After fifty years' experience, and having had in hand ten or twelve of these great works in Madras, he was as confident as he was of the existence of St. Paul's, that, if fundamental mistakes had not been made in the project, the Ganges canal would have paid 25 per cent., instead of only 6 per cent. The great mistake was that, instead of beginning below the hills, as they ought to have done, and as they did on the Jumna, they went up into the hills, and it cost one million to bring the water into the plain. It was most essential that this point should be considered, and it was impossible to get these things fairly considered in the Council of India.

They would hear nothing against the Ganges Canal. It was their idol, and they would not allow the slightest fault in it. This showed the necessity of independent discussions upon Indian matters. With regard to finances, there were in Madras three irrigated districts, and they were yielding half a million a year revenue each. They had increased, since the irrigation was commenced, nearly a quarter of a million each. He quoted other instances, showing the enormous increase to revenue through irrigation, and then said that all that was known and acknowledged. There was, therefore, nothing to be said against irrigation, so far as money was concerned. Sir Charles Wood used to ask where was the money to come from to carry out irrigation schemes, but, when they wanted six millions additional for the Abyssinian War, it was soon found, though £15,000 could not be found to open the great line of transit between the food producing districts and the cotton producing districts. One word more about the famine. How was it that so many people died of the famine at Orissa? A considerable number died in Ireland at the last famine, but a very small proportion compared to those who died in India. There was, however, this simple diference—in Ireland the government fed the sufferers; they fed a million of people, and spent a million of money a month; but in India they did not feed them. One single million sterling would have saved the lives of one-and-a-half million who perished. When he was ordered to Cuttack, he said the question was one affecting not only the inhabitants of Cuttack but the whole population of Orissa. That was in 1858. Some years afterwards, the Irrigation Company took up the matter, but they were too late. This sort of thing would go on till Englishmen and un-Indianised men noticed them in the House of Commons, or got a footing in the India Council. Was it creditable that the English government knew there were swarms of living skeletons in the streets of Calcutta, and yet made no effort to save them? Referring again to the Ganges Canal, he would say that the country through which it ran was much easier to work than the Madras districts, and it ought to pay 30 or 40 per cent., or more. He would like members to insist upon the fact that there was no limit to the work of irrigation in India. There was one more very material point he would like to mention. It was said that railway systems were necessary for the military holding of the country, as if we could not move the military by steamers as well as by railways; and, therefore, if for no other reason than the military holding of the country, a large water transit should be carried out throughout the country. Passenger traffic would also be very much increased. A great deal was said about the number of people who travelled in India by the railway, but we heard nothing of those who did not. He should think about five-sixths travelled by the ordinary roads. Where 500 travelled by railroad there were 5,000 per day who travelled in the old fashion.

The Chairman then pointed out upon a map how, by making a few connections, the whole of the Indian empire could be traversed by one great system of waterworks.

The attention of the meeting was directed by the Secretary to a new map of Bombay, by Mr. W. J. Addis, C.E., and to the drawings and specifications of a new cart, designed by Mr. Addis, and sent for the information of the Committee by Sir Charles Trevelyan.

A Burmese MS., sent by Colonel Haly, was also shown.

Third Ordinary Meeting.

Wednesday, December 1st, 1869; Captain Tyler in the chair.

The following candidates were proposed for election as members of the Society:—

Ford, Stephen, Vestry Offices, Bermondsey, S.E.
Giles, Francis G., Clatsford, Andover.
Ikin, Alfred, Eccleston, Cheshire.
Mackie, Samuel J., 84, Kensington-park-road, Bayswater, W.
Pooley, S. A., South Side, Clapham-common, S.W.
Tyler, Captain, Board of Trade, S.W.

The following candidates were balloted for, and duly elected members of the Society:—

Ainsley, S. James, 13, St. Mark's-crescent, Regent's-park, N.W.
Anderson, William Mortimer, 1, Buckingham-gate, S.W.
Ashford, John Richard, 9, Cambridge-terrace, Clayton-road, Peckham, S.E.
Balfour, Major-General George, C.B., 6, Cleveland-gardens, W.
Banyard, William Barnard, 1 and 2, Great Winchester-street-buildings, E.C.
Barrett, John Woodward, 9, Ramford-place, Plough-road, Rotherhithe, S.E.
Bartholomew, Charles Eugene, 1, Chepstow-villas, York-road, Dartmouth-park, N.
Baxter, R. Dudley, 6, Victoria-street, Westminster Abbey, S.W.
Benas, Alfred, 62, Cornhill, E.C., and 148, Queen's-road, Bayswater, W.
Bishop, William H., jun., 7, Sumner-terrace, S.W.
Brightman, Richard, Sheerness.
Browne, William Lewis Clifton, Clifton-villa, Belsize-road, N.W.
Bulmer, Edward Sewell, Conservative Club, S.W.
Burnett, Rev. C. Compton, The Manse, Newmarket.
Buttery, Horace, 173, Piccadilly, W.
Carlill, John Burford, M.D., 42, Weymouth-street, Portland-place, W.
Chance, R. L., Glass Works, near Birmingham.
Cheverton, George, Tunbridge Wells.
Clark, William Chignell, M.A., Ph.D., Ongar, Essex.
Cowper, John Curtis, 27, Victoria-road, Kensington, W.
Crowloy, Frederick, Alton.
Dalziel, Davison Octavian, 47, Wood-street, Cheapside, E.C.
Dashwood, Thomas, Ryde.
De Stern, Baron, 4, Hyde-park-gate, Kensington, W.
Digby, George Digby Wingfield, Sherborne Castle, Dorsetshire.
Drummond, Rev. William Richard, All Saints Church, New Amsterdam, Berbice.
Eames, T. R., Bridge-house, Barnes, S.W., and St. Michael's-house, Cornhill, E.C.
Eaton, Richard, Basford, Nottingham.
Eddy, C. W., 49, Belgrave-road, S.W.
Ellis, Arthur William, Messrs. Simpsons, Payne and Co., Millwall, E.
Evans, Henry J., Cardiff.
Eyre, Charles, Welford-park, Newbury.
Fennell, John Greville, Barnes, S.W.
Fielden, Joseph, Witton-park, Blackburn.
Franklin, J. A., 58, Gower-street, W.C.
Franks, C. W., 2, Victoria-street, S.W.
Garford, John, 31, Russell-square, W.C.
Gaskell, Daniel, Lupset-hall, Wakefield.
Goodford, Rev. Charles O., D.D., Provost of Eton.
Gordon, Hugh M., 1, Lee-road, Lee, S.E.
Hickisson, James, 75, Southgate-road, N.
Higley, William S., London and Westminster Bank, 41, Lothbury, E.C.
Irvine, John R., Firhill, Springbank, Glasgow.
Isborn, George R., Oriel-chambers, Water-street, Liverpool.
Jahn, Adolf, 32, Alwyne-road, Canonbury, N.
Johnson, William, Bank-house, St. Helen's, Lancashire.
Kehde, H. A., 96, Denmark-road, Kilburn, N.W.
Lowe, William Drury, Locke-park, Derby.
Lyon, John George, Messrs. Burt, Boulton, and Heywood, Millwall, E.

Lyon, Joseph, Chapel-house, Ormskirk.
Mackinnon, William Alexander, Aerise-park, Canterbury.
Maitland, William, Addlestone, and 2, Royal Exchange-buildings, E.C.
Mayer, Joseph, Liverpool.
McCorquodale, George, the Willows, Newton-le-Willows.
Mechi, J. J., Regent-street, W.
Napper, H. F., Lakers-lodge, Loxwood, Horsham.
Oakden, Ralph, Exeter-house, Bournemouth.
Palmer, John Dalton, Brunswick-house, Barnsbury-park, N.
Pattinson, W. W., Felling-house, Gateshead.
Phillips, Josias, Literary Institution, Bodmin.
Powell, Thomas Harcourt, Drinkstone-park, Bury St. Edmunds.
Raphael, Alfred, 19, Princes-square, Bayswater, W.
Reeves, Thomas James, Woodhays, Wimbledon, S.W.
Roberts, Thomas, Hamilton-house, Milford.
Rosser, William, Llanelly.
Rothery, Charles William, Littlethorpe-villa, near Ripon.
Ryde, John, 155, Fenchurch-street, E.C.,
Samuda, Joseph, 3, Dartmouth-park-road, Highgate-road, N.W.
Sanders, Gilbert, 53, Claverton-street, Pimlico, S.W.
Steel, John. Southerfield, Abby-town, Carlisle.
Stephens, C., Woodley-hill, Earley, Reading.
Storer, Richard Milward, 16, Cranbourn-street, W.C.
Sturman, Edward Albert, LL.D., Packington-college, Packington-street, N.
Thudichum, T. L. W., M.D., 3, Pembroke-road, Kensington, W.
Turnbull, Maxwell Gartshore, 30, Upper Berkeley-street, Portman-square, W.
Varley, Samuel Alfred, 66, Roman-road, Holloway, N.
Waite, Charles, LL.D., St. John's College, Weighton-road, South Penge-park, S.E.
Ware, Charles W. Cumberlege, 21, Princes-gate, W.
Wilkinson, Frederick Eachus, M.D., Battle-cottage, Sydenham, S.E.
Williamson, G. J., 124, Lower Thames-street, E.C.
Yarrow, A. F., 42, Grosvenor-road, Highbury New-park. N.
Zanni, Geminiano, 29, Sidmouth-street, Gray's-inn-road, W.C.

The Paper read was—

ON AN IMPROVED MEANS FOR LAYING A TUNNEL FOR THE TRANSIT OF PASSENGERS ACROSS THE CHANNEL.

By Zerah Colburn, Esq., C.E.

From the period of the Roman invasion down to the present day, the English Channel has never been crossed otherwise than upon its own surface—unless the late Mr. Green's aërial voyage be an exception. Neither Julius Cæsar, however, nor William of Normandy lived in a railway age, and, but for the miseries of sea-sickness, they doubtless preferred the sail to the best roads of their respective times. But, since railways have become the recognised means of communication on land, the question has been pressed, and of late very urgently pressed, whether they may not be also made available for communication—not exactly upon the water, although there is a floating railway across the Upper Rhine—but over or beneath the water, and especially over or under the comparatively narrow and shallow strait which separates our island from the Continent. There are *soi-disant* patriots it is true, who would on no account witness the loss of our absolutely insular position, patriots to whom England is a castle, and the stormy Channel its moat, and who would not have so much as a drawbridge thrown across that moat, or a hidden way mined beneath it. Such considerations are, however, apart from the present purpose, which is, not to inquire into the international policy or financial expediency of solving this great intercostal problem, whether by a bridge, a ferry, or a tunnel, but to examine, very briefly, the engineering and constructive aspects of these proposed works. It is probable that the greater the apparent impracticability of either or all of these schemes, the greater general interest they attract, and perhaps the same interest may be said to exist also among the members of the engineering profession.

The question of bridging the Channel has been mooted, and at least one scheme has attained some degree of public prominence. The designer's first proposal was to jump the Channel at a single leap, but whether out of his regard, as has been asserted, for the wishes of the Emperor, or from a willingness to conform to certain immutable laws of nature, which render such a plan impossible, he subsequently modified his design so as to include ten spans, and it has since been heard that he is willing to extend their number and reduce their width to twenty, of one mile each. Whether even such a superstructure, to say nothing of the piers in a maximum depth of 200 feet above its surface, would or would not be practicable, is a question which may be safely left to those really competent to deal with it, and of these the designer himself can hardly be considered to be one.

Of the entire practicability and great advantage of a Channel ferry there can be no doubt whatever, whether it be established between Dover and Calais, or between Dover and Audrecelles. It is quite practicable to ship and unship passenger and goods trains bodily, and thus to run them through, both ways, between London and Paris. Boats suited for this purpose, and harbours capable of receiving them, could be constructed within a few years, at a cost much less than that of any tunnel, whether laid on the bed of the Channel, or carried through the chalk at any depth below it. Such boats would be in as striking contrast to the existing Channel service as that afforded by our finest hotels on the one hand, and the most uncomfortable lodging-houses on the other; or, if another illustration be needed, the most luxurious express saloon carriage, and the most cheerless third-class conveyance to be found on any railway in the kingdom. But any boat service whatever, however excellent it may be, has its necessary drawbacks. No ferry-boat, even if nearly as large as the *Great Eastern* itself, could wholly prevent the possibility of sea-sickness, that unspeakable horror of so large a proportion of all landsmen, of whatever nationality. The time occupied in shipping and unshipping trains, however expeditiously the work was performed, would be considerable, and however high the speed of the boat as a boat, it could not exceed one-half that easily attainable by a railway train. As to the relative safety of a boat service and a train service it is not now necessary to inquire, although something, if not indeed much, might be urged with reference to collisions in fogs or storms. But the chief objection to boats would be their high cost of working and maintenance. As it would not answer the convenience of the public to detain a boat until two, three, or more trains had arrived at either port, a boat would be required for every train, and its working charges might, therefore, be fairly compared with those of a single train. The consumption of coal alone, with boats of the proposed size and speed, would be from fifteen to twenty times as much as that for the train if run across by itself. The repairs and depreciation of the boats would be very much greater, per pound of their value, than that of the train, and the boats themselves could hardly cost less than £100,000 each, while the train carried, including the cost of engine and tender not carried, would not represent a cost much above £6,000 or £8,000. The wages of captain, engineers, firemen, stewards, porters, and crew would obviously be far beyond those of the three or four men working the train by itself, and these, and all other working charges, would be divided, mile for mile, upon a very much less number of miles per annum than the number made by the train if run by itself. There would not, of course, be any permanent way charges with which to debit

the boat, running on nature's own highway; but as to capital charges, the interest upon the cost of the harbour works alone would probably be equal to that upon a railway costing £100,000 per mile. It is morally certain that a large Channel ferry, with a full complement of steamers, could be maintained only by a very decided advance in the fares, whether between the opposite coasts alone, or between London and Paris. Assuming that even as many as one hundred passengers were taken across in a single train, the capital charges and working expenses would probably amount to £20 per trip, assuming the boat to make 1,000 trips, of twenty miles each, per annum, and thus the charge per passenger would be 4s. for twenty miles, or nearly 3d. per mile. The carriage of goods, specie, &c., would lessen this rate; but it is as likely also that the average number of passengers per trip would be very much less than one hundred. Nor is it at all certain that each boat could make four trips daily for 250 days in the year. None of these reasons, however, patent as they are to the observation of all, are conclusive against the Channel ferry. On the contrary, the ferry is the only means of maintaining comparatively expeditious and comfortable communication, of which the absolute practicability is beyond all question, while it could be got to work within probably two, three, or at most four years, and at a cost, including harbours, of probably little more than £2,500,000.

That branch of the question which possesses real interest,—surpassing interest of uncertainty—at least for the engineer, is that relating to a subaqueous way across the bottom of the Channel, or a regularly excavated tunnel a hundred yards or so deeper down in the grey chalk or clay itself. It is, perhaps, the certainty (the question of first cost being for the moment dismissed), that a tunnel, once made, would prove the very best of all means of crossing the Channel, and the qualified uncertainty whether such a tunnel is even practicable at all, that give to the tunnel question its great, its even seductive interest to engineers. It need hardly be said that tunnels under water, or rather through the earth beneath the water, are anything but new or unusual. For very many years the tin miners of Botallack, in Cornwall, have driven their headings to a good distance beneath the very bed of the Atlantic itself. Just sixty years ago, Trevithick nearly completed a tunnel beneath the Thames between Wapping and Rotherhithe, and, but for imprudently making a bore-hole from the roof through to the river bed, this tunnel would no doubt have been successfully opened. Ralph Dodd had made the same attempt before. Brunel's world-famed tunnel requires no remark; and it will be but a few days before Mr. Barlow's tubular subway will be carried through from the Middlesex to the Surrey shore. The longest tunnel under water is that, two miles in length, of the waterworks at Chicago, United States. This tunnel, although but 5 ft. in diameter, is carried out to where the water above it is 40 ft. deep, the tunnel itself being 30 ft. below the bed of Lake Michigan. There is also a tunnel under the Chicago River at the same place. At home, we have no less than three schemes for tunnelling beneath the Mersey at Liverpool, and three for tunnelling beneath the Severn below Gloucester, and in both instances one of the three schemes will in all probability be yet carried out. Provided only the bed of the channel or river beneath which the tunnel is to be made is nearly or quite impervious, under-water tunnelling is no more difficult than underground tunnelling. And there may be shafts even to under-water tunnels, just as the Chicago lake tunnel has its shaft through which the water supply is taken, but which was employed, during construction, for the ordinary purpose of giving a second working face and for discharging the excavated materials—this shaft being two miles from shore. This tunnel was carried through a continuous bed of tenacious clay, as impervious to water as marble itself. But in the proposed Channel tunnel, to be made at a depth of about 500 ft. beneath the surface of the sea, it is needless to remark that a single fissure in the chalk, however narrow, would be rapidly widened by the tremendous abrasion of water, under the great pressure of 200 lb. per square inch, so rapidly that probably no efforts to clear the workings could be expected to succeed. A fault of great vertical magnitude is well known to divide the chalk beneath London, although neither the precise line of this fault, to within a few yards, nor the width, if any, to which the chalk-bed is separated at the point, are known. Whatever may be inferred from the geological analogies of the chalk on the English and French coasts, it cannot for a moment be positively asserted that a fault beneath the middle of the Channel does not exist, nor, it is as well to add, can it be asserted, on the contrary, that a fault does exist. The question can only be settled by a trial heading or driftway, and, whatever the real danger, there are plenty of navvies and miners who, knowing no fear, are ready and willing to face it, when the eminent engineer, whose name is connected with the proposed undertaking, finds himself in a position to give the word. Let two headings, each eleven miles long, once be carried out to meet each other beneath mid-channel, and the success of the tunnel, so far as its completion is concerned, is assured. It would be a matter of long and tedious boring and blasting, and one in which uncertain millions would certainly be swallowed up, but it would all come right at last, supposing, of course, that by previous experiments upon that thirsty material, chalk, no excessive infiltration of water, under a maximum pressure of 200 lb. per square inch, was found to take place; and there would be 24 acres of roof of each heading of 9 ft. in width, the ceiling, if it may be so termed, of each heading of 9 ft. width amounting to rather more than an acre per mile.

There are two distinct schemes for a tunnel beneath the bed of the Channel, but the same general certainties and uncertainties apply to both. It is only from geological inferences that either can claim superiority over the other. It would require space far beyond the limits of the present paper to deal even with the geological aspect of the question alone. It is but right, however, to remark that geological evidence, as far as it goes—for the materials at command are scanty—points strongly to the probability of the complete continuity and homogenity of the chalk which forms the upper beds of the broad and shallow submarine valley separating our island from the Continent.

Bridging, steam-ferrying, and tunnelling fall within the ordinary range of engineering. But no engineer has attempted to lay down a railway upon the bottom of the sea itself—a railway, the passengers of which, like the Israelites of old, should go over, or rather under, dry-shod, not only with a dense wall of water on either side, but with 30 fathoms or so over their heads. It is not the purpose here to enter at length upon the relative advantages and disadvantages of subaqueous ways—a term employed merely to distinguish railways on the Channel bed from those in tunnels beneath it—as compared with railways deep down in the chalk. As, however, the remainder of the present paper will be chiefly devoted to the examination of the mode of constructing subaqueous ways, it will be but fair to enumerate the objections which may be urged against them. They are these:—

Beyond some amount of uncertainty necessarily attaching to the laying of such ways, they might possibly be injured by the dragging anchors of vessels, or broken in two by the sinking wreck of an iron steamer dropping upon them. They might, possibly, suffer at the shore ends, where they rose to within the action of the waves in heavy storms. They could always be destroyed wantonly, and with little fear of detection, by sinking a charge of gunpowder upon them, at any portion of their length, and then firing the charge, at a safe distance, by electric wires. It might be urged, too, that a large tube, especially where it rose like a huge groyne in shore,

might cause injurious disturbances of the Channel bed, thus affecting navigation. In any case, the tube could be started and carried forward from one end only, as it would be out of the question to attempt to bring together, water-tight, the two closed ends, or, for that matter, the open ends of two tubes in mid-channel.

These appear to be the principal, if not all, of the possible objections which could be urged against subaqueous ways. The weight of these objections depends probably more upon the individual opinions of those who advance or refute them, than upon any evidence capable of demonstration. As for the dragging of anchors, the various proposals (and there are several), for tubes on the bed of the Channel provide for routes well off the Varne and Colbert banks, and, it need hardly be said, miles to the westward of the Goodwins; routes upon which vessels would seldom have occasion to anchor at all, even in the worst storms. Were an anchor dragged, however, with a force of even 150 tons—the highest chain cable test of Lloyd's proving-house—this could not make any definite impression upon a continuous tube weighing eight tons or more per foot of its length, for, to move at all, at least a quarter of a mile of tube weighing 10,000 tons would have to be dragged upon the Channel bottom. As for breaking the tube, say 4½ in. thick of cast iron with a lining of one foot of brickwork, the chances would appear extremely improbable. But a greater security will appear when it is considered that a cast-iron tube, say 14 ft. in diameter, and having no outer flanges, presents no point upon which an anchor could bite. The chances of an iron vessel foundering exactly across the line of the tube are, to say the least, by no means numerous. In shore, that is to say in shoal water, the tube would require to be protected by strong parallel breakwaters, as much as to prevent vessels grounding across it as to prevent the action of the waves upon it. The risk of possible destruction by malice—the crushing in of the crown of the tube by the explosion of gunpowder upon it in ten, twenty, or thirty fathoms of water—is a risk of which each one must form his own estimate. This mode of destruction, the consequences of which would be irreparable for all time, could most certainly be resorted to by hostile or merely malicious feeling, with almost no chance at all of detection; whereas neither a bridge, nor a tunnel deep down in the chalk, could be destroyed without some difficulty, and the certainty of the timely discovery of the attempt.

The various proposals for laying subaqueous ways upon the bed of the Channel are as distinct from the ordinary range of bridge and tunnel engineering as the making and laying of submarine cables are distinct from the construction of land telegraph lines. Of what is technically distinguished as mechanical engineering, very little is now required for the construction of an iron bridge, or a tunnel in earth or rock; but the construction and laying of a subaqueous way would be, to a large extent, the work of the mechanical engineer. Such a work, upon any plan, would be attended with many contingencies, and so far as mere ingenuity is concerned (not that the necessity for greater ingenuity is in itself an objection), the subaqueous way would incontestably require far more originality of design, for its making and laying, than any other mode whatever of crossing the Channel. But, as engineers always rise to the occasion, it may be assumed that a plan, physically possible in the abstract, would never fall through from the want of that elaboration and improvement which are summed up in the mind of the engineer in the single word "detail."

Perhaps the first quasi-practicable plan proposed for crossing the English Channel by means of a subaqueous way, was that contained in an anonymous pamphlet printed in Dublin, in 1858. The author proposed to construct a 15ft. tube from Dover to Calais, extending it, foot by foot, along the bed of the Channel, from the English to the French coast. Starting from the English coast, with a structure named a "head," or a "bell," this head fitting water-tight around the exterior of the tube to be extended, he proposed to put together each successive length of the tube within the head, and to push the latter forward as fast as the work proceeded, the head meanwhile lying on the bed of the Channel. The calculations of resistance, and of the quantities to be employed in the tube itself, were carefully worked out, and, so far the author has tested them, these calculations were correct, upon the data assumed. This mode of construction ensures the advantage, if it be an advantage, that each portion, whether of 10ft. or even a mile, of the length of the tube, once laid, is not again disturbed at any subsequent stage of the work. But the designer appears to have foreseen an element of possible weakness when he asserted that, even were the tube rolled over in the Channel, no harm could result to the passengers, and no interruption to the train service; inasmuch as the atmospheric system was relied upon for propulsion, and the passenger compartments were to be shot through circular tubes, it might not, perhaps, make any difference to the passengers whether their carriages bottomed upon one part of the tube or another, but it would be interesting to know what would become of the shore-ends, and, for that matter, the passengers themselves within the tube, if a few miles of the latter were really to turn over in mid-channel.

The anonymous idea of 1858 has been lately worked out, in much greater detail, by an eminent English engineer, whose labours have been assisted by an Austrian member of the same profession. Their plan, which has now been for some months before the public, provides for a cast-iron tube of 13ft. internal diameter and 4in. thickness, to be carried out in 10ft. lengths, each length being formed of six segments. The work of putting together the successive lengths of the tube is to be performed on the bottom of the Channel, within a cast-iron "bell," as it is termed, this "bell" or shield being 80ft. long, 18ft. in diameter, and 8in. thick. The tube is to be packed, water-tight, within this bell, and the bell itself is to be forced forward, 10ft. at a time, after that length of tube has been added to the portion already laid. For forcing forward the bell, four hydraulic presses, each of a maximum force of 1,000 tons, are to be employed. The details of the scheme are most ingenious; at the same time, perhaps, not too much so, for many a mechanical project has been ruined by too much ingenuity. It is evident that, from the very confined space, but a dozen men or so at most could be effectively employed at a time within the end of the tube, in putting the segments together, although a much larger number, were they required merely to work the hydraulic machinery, could find room in the forward portion of the "bell," and it is evident that the rate of progress of the tube would be measured by the rate of working of the dozen or so of men employed in putting the segments together, the segments being brought, when the tube was nearly completed, from a distance of say twenty miles through the tube itself. The segments and bolts once made ready on shore, the whole labour of putting the tube together, the whole task of maintaining its intended course, and the whole of the responsible duty of inspection as the work goes on, would be performed under water, in an artificial light, and with artificial ventilation, and where, upon the occurrence of of any accident, causing the sudden inroad of water, all within the tube most hopelessly perish. Should the tube crack and fill with water, during the process of laying, it is also hopelessly lost, since no moorings are or can be attached to it during the process of laying or afterwards. That the tube might crack at some point, while the shield was being advanced under a force, according to the depth and the nature of the bottom, of from 1,000 to 4,000 tons, would be nothing very improbable. And what might be the chances of leakage, with nearly 65,000 joints, made in the dark, or rather in a very feeble light, and under water must be left to the imagination, the joints themselves being upwards of 200 miles

in aggregate length, and, taking them as 8 in. wide each, presenting a total surface, for the two parts brought together, at each joint of 34 acres. There is, probably, nothing physically impossible in the scheme, although it would be one attended with many improbabilities of success. Nor could this plan of construction be adapted to the irregularities of the Channel bottom, upon which the gradient would occasionally require to change from level to 1 in 100, making a difference of $1\frac{1}{2}$ in. between the joints in the upper and lower sides of the tube, thus necessitating special castings, or involving the risk of leaking. The particular tube now under consideration would have a multitude of external flanges, and it is not improbable that it might suffer from dragging anchors. These flanges and ribs are not essential, however, to the general plan.

While it is fairly open to doubt whether any of us will ever live to see a practicable railway tube laid across the Channel—open to doubt, too, whether such a tube is even required at all—there is still a sort of bewitching interest in speculating upon the mere possibility of such a thing; and it is thus that this meeting may be supposed to have resolved itself into a committee of inquiry upon this very point. Can the tube be made at all? Can it be made before those now unmarried shall have lived to see their grandchildren? If it can be done, and done off hand, so much the better, always provided the tube is what is wanted. Here, as with *Mr. Midshipman Easy*, there is no help for it but to "argue the point." Assuming, then, for the sake of argument, that the particular tube now under consideration can be made, and safely laid, can it be done, as its proposers estimate, within a period of three years and a-half, or only within from six to ten times that space? The tube is to be made of something like half a million tons of cast-iron, and to believe it can be made at the rate of 100 feet forward a-day, as estimated, is to believe that nearly 500 tons of castings, all ready, or supposed to be ready, to go exactly together, each casting weighing about eight tons, can be loaded on horse-trucks, or hand-trucks, and carried through the tube itself for average distance of ten miles, unloaded, placed in position, the thousand or more connecting-bolts, for which the holes have been previously drilled, secured in their places, the joints made good with lead, and a great deal of other work carried on, all within a confined space, within which, partly from the machinery to be employed, hardly more than a dozen men, if as many, will have room to work at all. The British Association was lately occupied with a most able and most interesting description of this plan, and the Society of Arts may therefore be inclined to examine this, the very important point, which, at the recent meeting of the Association at Exeter, appears to have escaped all examination whatever. The "point" might be "argued" still further, but let argument be dropped now for individual consideration of the subject.

Another plan of making and laying the tube has been proposed—a plan based, like the others, upon a general estimation of what is possible and probable. It is to construct the tube, in long lengths, within a dry dock in shore, and to float out these lengths, successively joined together, until the opposite coast is reached. The tube would be floated, not, certainly, upon the surface, but by means of buoys, just clear of the bottom, the tube being again grounded as soon as it had been advanced a length.

Few propositions, perhaps, connected with engineering, upon which the writer has ever reflected, have, at the first view presented more apparent impracticabilities than this one. But the more he has examined it, the more have the means by which these difficulties may be overcome disclosed themselves. It was enough to know, from the first, that the plan was not in contravention of any law of nature, and, therefore, was not impossible. Like each of the other plans already noticed, its execution would necessarily be in the face of tremendous difficulties—difficulties which, perhaps, not one of the various projectors of Channel tubes have fully estimated, and which it is beyond doubt they have not, because they cannot have, fully provided for. But the whole progress of engineering has shown that what were once seeming impossibilities have long since become useful and familiar facts. The difficulties supposed to be once overcome, it is plain that a plan whereby, say, a thousand feet or more of the tube could be put together in a single day, in the open-air, as many men employed upon it at once as could find room to work with advantage upon that length, would have a manifest superiority over any other in which each length of a few feet, say ten, must be wholly completed before another length could be begun, and especially in which the whole work of making up the tube is to be carried on within the tube itself, the parts being brought to the front in trucks drawn by horses to a distance successively increasing to twenty miles.

In no way could the segments of a tube be so rapidly got into place and secured together as in a dry dock, the semi-circular bottom of which, of cast iron, would conform exactly to the tube itself. The segments would be lowered into place, those for the lower half of the tube centering themselves, while those for the upper half would be temporarily supported upon centres so made as to be readily taken down when the key segment was got in and secured. The seaward end of the tube, of great strength, would, of course, be closed, and it would be provided with suitable fittings for attaching the powerful hauling-out tackle, to be used when the successive lengths were floated. The dock gates would close around the tube so as to form a water-tight joint. The tube would be of such dimensions and thickness that, previous to putting in the brick lining, its own weight would be, as nearly as possible, exactly the same as that of the sea-water displaced, so that, of itself, it would, so to speak, neither sink nor swim. Approximately, a 14 ft. tube would displace about $4\frac{1}{2}$ tons of water for each foot of its length, and it would of itself weigh about $4\frac{1}{2}$ tons for each foot of its length when its thickness, allowing for all flanges and bolts, was 5 in., or say $4\frac{1}{2}$ in. between flanges, and this would be the proper thickness for strength, irrespective of any consideration of displacement. The weight of the tube would require to be very accurately adjusted, since a difference of thickness of 1 in. would cause a difference of weight of 900 tons in a 1,000 ft. length, hence a difference of but one-thousandth of an inch would represent very nearly a ton in weight. Each length would require to be brought to the exact limit of flotation by means of adjustable weights. As the tube would require to be adapted to the irregularities of the bed of the Channel, each length, of a thousand or more feet, would have a ball and socket joint, and it would be here, and here only, that the sinking weight would be applied, and the holdfasts for the lifting and sinking tackle attached. Probably one hundred tons might be necessary to prevent any movement of the tube, especially in shore, from the force of the sea, for at a depth of a few fathoms the force of storms would not be felt at all. The tube being made in segments, the construction of ball and socket joints would be attended with no difficulty. They would require to be made of great strength, not merely to provide sinking weight, for they would receive the whole strain of the hauling-out tackle when the tube was advanced seaward. A thickness, for the ball and socket, of 8 in., this thickness being continued a little more than 10 ft. each way, would give 100 tons of sinking weight. The motion at these joints would be but slight, yet this slight amount of motion is none the less necessary to enable the tube to adapt itself to varying gradients. It is at least remarkable that any strictly rigid tube should ever have been proposed, as more than one has been, for a line having gradients varying from nearly level to 1 in 100.

When a length of tube had been completed and was ready for launching, its in-shore end would be closed

water-tight, the buoys made fast in place, the dock gates opened, and the sea admitted, upon which the tube would be drawn up well clear of the bottom by means of the adjustable tackle connected with the buoys, and the whole of the tube, of whatever number of connected lengths of 1,000 ft., would be drawn out to sea for a distance corresponding to the length last added. It would then be lowered again upon the bottom, the in-shore end of the tube being left well within the dock gates, which would then be closed, and the water in the dock pumped out.

In buoying and advancing the tube, especially when extended nearly 20 miles, it contained nearly half a million tons of cast iron, the chief resistance in starting would be occasioned by, not its weight, for, except at the ball-joints, it would have no preponderating weight in the water, nor by its skin friction, for this, at a rate of motion of 1,000 feet in an hour, would be comparatively trifling—but the real resistance would be from inertia. It might be supposed that as much effect would be produced by the hauling-out tackle if made fast to the rock of Gibraltar as if to a great iron sea-serpent, twenty miles long, and weighing half a million tons. But let us see what this enormous resistance would be. Let the rate of onward motion of the tube be 3 in. per second, a rate at which 1,000 ft. would be gained in 400 seconds, or one hour, six minutes, and forty seconds—not so very long a time after all. To give this rate of motion would require the same force as would be necessary to lift the whole weight to a height of the $\frac{1}{85}$th part of an inch, a distance almost too insignificant to deserve consideration, until it is understood that 500,000 tons are to be lifted to that height. It is then that the $\frac{1}{85}$th part of an inch begins to look respectable, the work done being equal to that in lifting one ton to a height of nearly 500 ft., or, in other words, 500 foot-tons, which is about the energy contained in a 32 lb. cannon ball when it leaves the gun fired with a full-service charge. But these 500 foot-tons do not need to be exerted within one, two, or three minutes, and if a quarter of an hour be taken to get the sea-serpent under weigh, the mean rate of progress during that time being $1\frac{1}{2}$ in. only per second, the tube will have progressed $112\frac{1}{2}$ ft. before it is in full swing, and thus the pull will average less than 4 tons during that time, after which all further resistance from inertia ceases. Now, 4 tons is a little more than the breaking strength of the little Atlantic cable of 1858, and is well within the working strength of the steel wire ropes employed to haul Fowler's steam ploughs. Next, comes the resistance of skin friction. The surface of the tube, supposing it to be 14 ft. in diameter and 20 miles long, and having no outer flanges, would be nearly 107 acres, whereas a ship like the *Hercules* has but little more than three quarters of an acre of immersed surface when ready for sea. But the *Hercules* has run nearly 15 knots an hour with a net thrust upon her screw shaft of about 50 tons, the resistence being nearly all skin friction only. Skin friction is believed to increase as the square of the velocity, so that the 1,000 ft. an hour of the sea-serpent are to be compared to the 90,000 ft. an hour of the *Hercules*, not in the proportion of 1 to 90, but in that of the square of 1 to the square of 90, or as 1 to 8,100. Thus the *Hercules*, weighing 8,600 tons, requires 50 tons pressure at the stern to drive her at her full pace, while the serpent, with a skin nearly 150 times more expansive, and a weight nearly 60 times greater, would, nevertheless, upon the law of the square, require a pull of less than one ton to tow it by the nose, if serpents have noses, all the way across the Channel, its inertia having been already overcome. And yet this mass of iron, if thrown into the form of a cube, would measure about 136 ft. on a side.

That the tube would follow its nose, in a straight line, and not in the zig-zag outline of a Vandyke border, known in America as the Virginia fence pattern, may be safely concluded, not only from a consideration of the reasons which would compel it of necessity to follow a straight course, but from the analogy afforded by Mr. Macsweeny's jointed steam-boat, the *Connector*, which plied a few years ago between Newcastle and London, and by Mr. John Bourne's trains of connected boats on the Indus. Although neither of these systems proved commercially successful, both demonstrated that a long train of boats connected together will follow as true a course upon water as will a long train of wagons on a railway.

The tube would be hauled forward, as each fresh length was added, by tackle worked from a vessel steered well ahead, on the true course, and there moored fore and aft, to prevent swinging out of her position, although the whole work of advancing the tube would or should be performed at slack high water. In such a great work, so important to the commercial interests of the whole world, it is not unreasonable to suppose that a convention would be entered into by all, or nearly all, commercial nations sanctioning the authority of a marine police to guard the hauling chain from dragging anchors.

But now come, perhaps, the principal questions of all. The maximum tidal current, at spring tides, in that part of the Channel where the various proposed tubes are intended to be laid, is, by Burwood's tables, 3·3 knots an hour, or 5·57 ft. per second. This is, however, the surface velocity, in mid-channel. The velocity at the bottom, in the deeper portions, is probably *nil.* In a communication recently made public by Mr. Cromwell Varley, the eminent telegraph engineer and electrician, occurs the following interesting and even amusing passage:—"It is well known to all nautical men that the action of the waves decreases very rapidly in descending. I believe I am correct in stating, in proof of this, that a diver, engaged upon the wreck of the *Royal George*, accidentally left his spectacles on the wreck off Spithead. The depth of water was about 16 fathoms. A violent storm prevented him from resuming operations for about nine days, and, on again descending, he found his spectacles in the place where he left them. It is also well known to all nautical men, that currents extend, as a rule, to only a small depth; and it is a common practice to moor a boat in deep water, by tying a kettle or some heavy object to a line, and dropping it overboard into the comparatively still water. This mode of anchoring has been frequently used by the surveyors in the Atlantic. As a further proof of the complete stillness at the bottom, I may mention the cable that was laid from Varna to Balaclava. This plain gutta-percha covered wire was wholly uninjured by those terrific storms which destroyed so many English vessels."

With 100 tons of anchoring weight at the shore end, and with the same weight at distances of every 1,000 feet, and with the immense inertia of a tube weighing 4,500 tons between each pair of sinking weights, there would appear to be but little danger from the action of storms —a conclusion borne out by the fact that iron sewer pipes are often extended well out to sea, as at Brighton, and remain there without disturbance. The waves come end on with the tube, and are harmlessly divided, whereas, did they strike it athwart, they would lift it upon the beach. Experiment, during a single winter, would determine whether even so much as 100 tons sinking weight would be required at each 1,000 feet. It might turn out that 50 or even 25 tons would suffice, in which case the work of lifting and grounding the tube, as about to be described, would be very greatly lessened. The most critical point in the whole scheme is, probably, that of lifting and lowering the tube at each advance. Before going into this, it will be as well to see what is to be done at each sinking weight or ball joint in deep water, say 33 fathoms at high tide. There are 100 tons of dead weight to be lifted, besides the inertia of 1,000 ft. of tube to be overcome, and there is also the weight of the lifting-chain itself, and its supporting buoy. Taking the weight and inertia to be overcome as 150 tons, and supposing the lifting chain never to be strained beyond 3 tons per square inch, the sectional area of the chain

would be 50 square inches, so that each 15 feet of its length would weigh a ton. As the chain would commence two fathoms and a-half from the bottom, we will allow that for slack, and its own weight would thus be between 13 and 14 tons. This it would be necessary to buoy with the utmost care, for, once lost, the chain could never be recovered in water of greater depth at most than 15 fathoms. The buoy, weighing probably 5 tons of itself, should have at least 20 tons of additional supporting power, and would thus require to be of a capacity of 875 cubic feet, corresponding to a cylinder 8 ft. in diameter and 18 ft. long. Were it not that the buoys must be kept out of the way when the lifting tackle is attached, they would be best secured by passing the chain through them in a central pipe with secure stoppers, top and bottom. As they would, in any case, continue to float, this might, after all, be the best way of attaching them, when the stoppers were taken off at each lifting and lowering.

In getting into deeper water, the chains would require to be lengthened, in 10 ft. lengths, at every few advances, and in shoaling they would have to be shortened in proportion. The lifting and lowering would be performed from a vessel alongside, and the lifting itself be effected by steam, acting directly upon the lifting chain, that is to say, a strong steam cylinder, 5 ft. in diameter, and permitting of a stroke of piston of 20 ft., would be supplied with steam from a small boiler worked at from 125 lb. to 150 lb. per square inch, giving a lifting force of from 150 to nearly 200 tons. It is only by a direct steam lift that the effects of pitching and scending in the lifting vessel, and the varying level of the sea as the tide ebbs or flows, can be provided against, and that the elasticity of strain necessary for the preservation of the chain, and thus of the tube itself, could be secured. There are many details which would require to be carefully worked out before such an undertaking could be safely begun, but, without entering at greater length upon them here, it may be said that the principles upon which safety at each step would be reasonably assured have been considered with some care, and that there are no difficulties in the way which appear really insurmountable. It is not to be forgotten that a lifting vessel would be required at each 1,000 ft. length, making no less than 110 in a length of 21 miles. There would be no difficulty in chartering the number, and the cost of the requisite fittings would not, in comparison with the whole cost of the work, be excessive.

The practicability of thus making and laying a tube could be approximately ascertained by making two 500 ft. lengths of tube half size, or 7 ft. diameter and $2\frac{1}{4}$ in. thick, closing their ends, and sinking and lifting them by means of three tug boats in different parts of the Channel. These lengths would weigh, including sinking weights, about 925 tons. If the experiment succeeded perfectly, as it should in calm weather and at slack high water, it might be continued in rough weather and under the influence of the tidal current. The exposure of one or both these lengths, for a single winter, lying end-on to the shore, would afford very valuable experience. It is always to be borne in mind that, after the tube is once laid, the brickwork lining and permanent way which will then be added will more than double its weight.

The tube, when laid for its whole length, would be bolted together at the hall joints by means of inner flanges, the whole then lined with brickwork and an inner iron casing, a permanent way laid, and would then be worked upon the atmospheric system.

The cost of the whole may be roughly estimated as follows:—

	£
500,000 tons of castings fitted ready for placing, at £6	3,000,000
Brickwork lining	250,000
Dry dock, fixed plant, &c.	500,000
Floating establishment	1,000,000
2,500 workmen for two years, at £100 per annum	500,000
Interest, during construction	500,000
Engineering and contingencies	250,000
Total, exclusive of approaches	£6,000,000

The plan suggested can claim no other advantages than these, viz , its practicability being assumed, it could be carried out in two or three years, including all the time expended in preparatory works. Almost any number of workmen might be effectively employed at the same time, and that in the open air, in full daylight, and out of the way of danger in case of accident. The tube would furthermore possess a flexibility which would ensure its following the irregularities, both vertical and lateral, which, with a careful survey in advance of the work, would naturally be found even on the comparatively smooth bed of the Channel.

It forms no part of the objects of the present paper, however, to put forward claims in favour of submerged railways. It is admitted, on all sides, that they cannot be made at a less cost than from £300,000 to £500,000 per mile. It is by no means certain that, even for the saving of half an hour and an immunity from sea-sickness, the majority of passengers would prefer a submarine journey of three-quarters of an hour, with the knowledge that but a few inches of iron were interposed between them and a second deluge. The fact that almost countless fleets of shipping were crossing fifty or sixty yards overhead, that a single ship, foundering then and there, and making its fatal plunge upon the tube, might work even greater destruction than its own; the reflection that scoundrels in the pursuit of mischief, or villains in the service of the devil, could at any time, and with almost perfect impunity, dispose of the tube for ever—all this would be anything but reassuring to the timid, and it would have its due weight with the strong.

In respect of economy merely, the interest upon a cost of £6,000,000, supposing the work to be carried out for that sum, and the money raised upon the guarantee of the English and French governments at £4 per cent., would be £665 per day, or £231 per mile per week. It is not, perhaps, necessary, however, to assume that the work is to be undertaken as an immediately paying speculation, since other considerations of importance are involved in the question.

It is not to be lost sight of, however remote the bearing of the question upon the present subject may appear to be, that a sudden demand, within a couple of years, for half a million tons of cast iron, not for export, and not for immediately productive employment at home, would most certainly inflate the iron trade, and indirectly affect nearly every branch of our industry. If the price of pig iron advanced, as it not unlikely might, to the extent of 20s. a ton, this means 25s. or 28s. on rails, 30s. to 35s. on bars, and from £2 to £3, or even £4, on the higher qualities and lighter sections of iron. The very home demand, whereby we would be literally throwing our iron, and with it our money, into the sea, to no immediate profit, would give to other nations an advantage of which they would not be slow to avail themselves. Half a million tons of pig iron, when converted into rails, bars, or plates, and allowing for loss in conversion, would suffice for 2,000 miles of double line railway, or it would construct 75 miles of heavy iron bridges, weighing a ton per foot, or it would serve the shipbuilder for 250 hulls, such as, when fitted, would register their 3,000 tons each. The sudden abstraction of such a quantity for a single work, having no immediate prospect of success, might be attended with consequences which the whole country would long have occasion to deplore.

It has been mainly the object of the present paper, however, to examine into the engineering merits of the various schemes proposed for crossing the Channel, and the writer cannot close without expressing the belief

that the balance of certainty, economy, and, all things considered, the safety and even the comfort of the travelling public remains with a large and suitably organised Channel ferry service.

DISCUSSION.

Mr. Lewis Olrick said there could be no doubt that it had long been a disgrace to the two greatest nations in the world, and more especially to England, as a great engineering country, that there was such a miserable system of conveyance across the English Channel. It had long been clear that something ought to be done; and also, to all competent authorities, that something might be done, to remedy this. The only question was, who should pay for it? A question of this kind ought not to be made simply a commercial speculation, but the necessary expense should be borne by the two countries interested, to whom an expenditure of even ten millions for such an object could not be a serious matter. Several schemes had been brought forward, which might be conveniently divided into two classes—those for a passage above water, and those for a communication below. The former included both the most practicable and the most impracticable schemes. M. Boutet's plan of a bridge was much spoken of at present, and no doubt it presented many advantages. It would be less costly than a tunnel, and would take less time in construction—if it could be constructed at all, and there would be no trouble in regard to ventilation—indeed, in a gale of wind it was possible there might be too much, and that the lateral strain would be too great for the strength of the structure. It was also said that it was free from the danger of inundation, and this was true so long as it remained *in situ*, but if, by any accident, it should break, and drop into the water, passengers would be no better off than if they were submerged in a tunnel. Assuming that it were supported, as he believed was now suggested, on piers a mile apart, he would ask any naval officer or captain of a merchant vessel, what he would say to having the Channel beset on a foggy night with even twenty additional sources of danger, any one of which might produce a collision. This consideration alone, he believed, was enough to cause the plan to be looked upon with suspicion in a country like England, so largely interested in the safety of vessels and their valuable cargoes. The next scheme which challenged attention was by far the most practicable. He referred to that for a Channel ferry, which had been carefully considered, and was strongly recommended by one of their most able engineers, Mr. Fowler. This plan, to his mind, presented many advantages. In the first place, it had already been carried out on a smaller scale in a lake in Switzerland, by Mr. Scott Russell, who, a short time ago, in that very room, before the Society of Naval Architects, had given a full description of the many difficulties he had had to contend with, and the modes by which, with the aid of indomitable English perseverance, he had been able to surmount them, and to provide for a permanent railway service, even in the midst of a tempest. It was said, however, that such a scheme was not sufficient, and that even with vessels the size of the *Great Eastern*, sea-sickness could not be altogether prevented. That was true, doubtless, but still it would only occur perhaps once in a hundred times; but now, the accommodation was so defective, and the terrors of the passage so vivid in the minds of nervous passengers, that many persons became sick at the first sight of the sea, even in calm weather. A good service, by means of a steam ferry, could easily be completed in a couple of years, at a moderate outlay, and there would then be ample time for considering other and more ambitious schemes, which would cost ten or twelve millions at a minimum; and which might very likely end in an expenditure of fifty per cent. more. With regard to the figures which had been given by Mr. Colburn, he could not at all agree that £250,000 would be sufficient to cover eventualities and emergencies in an enterprise presenting so many new features and contingencies. On the whole, therefore, the scheme of Mr. Fowler appeared to him by far the most promising, for present purposes at any rate. Of the below-water methods, that which had been described in so much detail by Mr. Colburn certainly seemed to hold out the greatest prospect of success. As he had already said, he did not think enough margin had been left for contingencies in the estimates, but, even with a large addition in that respect, it compared favourably with other schemes of a like nature. With regard to tunnelling through the chalk, there was this fact always to be borne in mind, that after spending many millions, and almost completing the work, the whole might be irrecoverably lost by a very slight fault or fissure in the material through which the tunnel was driven, and which, under such an enormous pressure, it would be practically impossible to repair. There was no reason, however, why all these plans should not be discussed, and if approved of carried out, even after an improved ferry communication had been established.

Mr. William Low, being called upon by the Chairman, said he should not have presented himself in the character of a speaker spontaneously, but being invited, he would say a word or two on the subject of tunnelling through the chalk. For his own part, he saw no difficulty whatever in such a work, and it had been proved satisfactorily that it could be accomplished. It would take a long time to thoroughly examine the geological strata, but they were tolerably certain that, at the point where the tunnel was proposed, there was a bed of chalk 200 feet in thickness, through which it was as easy to drive two driftways as it was to do the same thing in an ordinary coal field. The proposed plan was, to sink first two shafts on the English side, and then two on the French, and then to drive two driftways until they met. It had been said, however, that they might meet with a fissure, and that, however small this might be, the pressure would be so great that there would be no possibility of continuing the work. But the same thing might be said with regard to our coal-fields, many of which were underneath the sea or under rivers; and, therefore, it might be supposed that the miners would be in constant danger of an inundation, to say nothing of the accumulation of water in the superincumbent strata from the rain-fall. This matter had been very carefully investigated, although the results had not been all made public; everything connected either with sinking the shafts or driving the tunnels had been carefully worked out, and the results had been placed before practical men for their examination, all of whom agreed that, if a tunnel were made across the Channel, that was the proper method of constructing it. The promoters of this scheme had laid their plans before the Emperor of the French, who appointed a commission of the highest scientific men in France to examine it, and this commission had come to the conclusion that the scheme was practicable. The promoters asked the French government to join with the English government in a guarantee of two millions, and on this point the commissions were divided, but the minority, who were the dissentients, opposed it simply on economic grounds. However, the work was proceeding slowly but surely, and progress was being made daily in their experiments, as Mr. Zerah Colburn had said in the admirable paper, which he (Mr. Low) had travelled 200 miles to hear, and he was quite satisfied with his journey. Once the two drift ways were driven through, all difficulties would vanish. He believed in the spring of next year the works would actually be commenced. It was calculated that, with manual labour alone, the tunnel could be completed in five years, or in three years by machinery; but, allowing for contingencies, five years had been fixed by the engineer as the maximum; and he believed that, before the expiration of that period, passengers would be able to pass from one country to the other dry-shod.

Mr. Rochussen said he had listened with much

pleasure to the paper of Mr. Colburn, especially as that gentleman seemed to have acted on the principle of first setting up a scheme, which had more or less the appearance of an idol, which he afterwards demolished. On the question of communication between England and the Continent, he knew of no more valuable data than were contained in the report of the Chairman, Capt. Tyler, to the Board of Trade, which stated that the whole traffic between England and the Continent, so far as it was likely to be influenced by a rapid and easy communication, from some point near Dover to some point on the French coast opposite, was limited to some 250,000 passengers per annum. He believed that the traffic between Newhaven and Dieppe, and between Havre and Southampton, would not be materially lessened by any short cut which might be devised, either on or under the water, inasmuch as the bulk of the travellers were those to whom economy was an object. Another point not to be forgotten was, that the traffic between Dover and Calais was to a large extent affected by that which came from Belgium and Central Europe, and especially from the north of Germany, and that was liable, to a great extent, to be taken away by another route, which was rapidly approaching completion, from some point in England to Flushing, which was unquestionably, with the exception of Vigo, in Spain, the best port on the Continent. It wonld accommodate any nnmber of vessels; was never frozen; there was a depth of water of eighty feet, even at the lowest tides; and there was railway communication on a dead level, which would deliver passengers, at Boulogne or Dusseldorf, in five or six hours by express. It was probable, therefore, that a large portion of the north French and German traffic would be turned in this direction. But there was again another point to be urged in favour of a ferry scheme, viz., that the construction of the harbours necessary for the accommodation of an improved class of steamers would be of immense benefit to the general commerce of both countries, not only as harbours of refuge, but for the purposes of general trade. Moreover, he must say, he did not think there was such an opening for an increase of traffic between England and France as some people seemed to suppose, by the construction of a tunnel, particularly when it was considered that, in all probability, the fares would be nearly prohibitive. England was no longer the only high road to extra oceanic traffic. Formerly, a man who wished to cross to America had, as a matter of course, to find his way either to Liverpool or Southampton, but there were now excellent lines of steamers from Hamburg, Bremen, and Havre to that country. With regard to the carriage of goods by a Channel railway, the rates would probably be so high as to exclude almost everything but expensive French silks and early fruit, the traffic in which would be but very partial; and this important point must not be forgotten, that, directly you crossed the Channel, the great feature of the English railway goods system, its rapidity, was lost. You might send goods from Basle to Dieppe, a distance not greater than from Glasgow to London, and they would arrive in about seventeen days. He boldly asserted that, as a fact, because during the last 25 years he had had to put up with the inconvenience. At every junction the French railway authorities had the right, which they exercised, of detaining your goods 24 hours; and at every main station where they were shifted from one train to another, they had the right, which they exercised, of detaining them for three days. Consequently it would be of no use to have a through railway communication from London to Paris, unless English modes of working the traffic were also introduced.

Mr. Thomas Page said he had had this subject under his consideration ever since 1864, and had advised a plan for crossing the Channel, which was now under the consideration of one of the ministers of the French Emperor. The hour being rather late, he thought it would be better, instead of going into the details of that plan, to present it on a future occasion in the form of a paper, illustrated by drawings, when it might be thoroughly considered; but he would mention the main features of the plan, which he thought would commend themselves to the attention of the audience. His idea was, to divide the Channel into some ten parts, by nine shafts of wrought-iron, and of conical form, each shaft consisting of two cylinders or cones of wrought-iron, with a distance of ten feet between them, which would be filled with concrete. These shafts would be so arranged and constructed that they could be sunk one in a tide, rapidity being, in his opinion, highly important in such an undertaking; and it was evident that if you could accomplish a communication between two of these shafts, you could with the same ease accomplish the whole distance from shore to shore. The shafts, would not only divide the channel into ten sections, but they would also act as lighthouses and ventilators. He proposed, then, not to connect the shafts by means of a tunnel, because he believed that rapidity was essential to such a work, but by tubes lowered down into places previously prepared for them on the bed of the Channel, each piece of tube being a quarter of a mile in length. A length would be lowered down in one tide, and it would be necessary that it should be done in calm weather. It might be asked how divers could work at so great a depth, but he had had under his consideration, some years ago, a mode for enabling divers to work in deep water, which he believed would be perfectly successful, and the deepest soundings between England and France were, he believed, only from 33 to 35 fathoms. It was quite evident that if a man could go out from a temporary shaft, which could be hoisted and lowered into the sea at a depth of 33 fathoms, he went out with only the ordinary pressure of the atmosphere, not under that of the water, as regarded his breathing; and if he had such a dress as he had devised, which was something like a suit of armour, all the pressure of the water upon his body was prevented. He would then be able to work with a pressure of about 1 lb. per inch extra on his lungs, and with no absolute pressure of water on his body. When he laid the details of this plan before the Society (if he felt justified in doing so), he believed it would be generally acknowledged that all the main difficulties of crossing the Channel were removed, because, practically, the length of the passage would be reduced to one-tenth. The estimate which he had made, including covering over what he might call the tubular bridges with concrete to a considerable depth, amounted, on a very liberal calculation, to about nine millions for a double line; of course, if a single line only were taken, the cost would be considerably reduced. In conclusion, he must say, in justice to Mr. Newman, of the firm of Freshfield and Newman, that it was he who first suggested the idea, saying that if he (Mr. Page) could devise any plan for a railway across the Channel, on the success of which he would stake his professional reputation, there would be no difficulty in finding funds for carrying it out. He hoped to be able, before long, to lay before the Society such particulars as would not only be interesting to the public, but would satisfy them that there was an absolute practicability of completing this communication between England and France, the want of which was a discredit to the science of Europe.

Mr. Perry F. Nursey having congratulated the Society on the character of the paper which had been read, said there was no question that, given capital, which all engineers required, and given a clear way across the Channel without interruption, by currents or otherwise, such a tubular tunnel as had been described might be laid. This question was no new one; it had been before the public for the last seventy years; and, if time permitted, he could run through a list of about twenty-five schemes of various kinds, which had been proposed for the purpose of connecting the two countries. To narrow

the question, however, and bring it down to the present time, it was pretty well known that the schemes proposed might be divided into four classes, those for a tunnel beneath the bottom of the Channel; for a tubular tunnel lying on the bottom; for a bridge above; or for a steam ferry on the surface. Of the schemes before the public for tunnelling underground, two claimed special notice by their pre-eminence, that of Mr. Hawkshaw and that of Mr. Remington. Mr. Hawkshaw had gone to great expense in making experiments to determine the character of the soil through which he proposed to cut, which was the chalk, as had been stated by Mr. Low. Mr. Hawkshaw and his coadjutors, however, in the report which they had laid before the French Emperor, especially guarded themselves by saying that there were unquestionably elements of uncertainty and danger, and this, in his (Mr. Nursey's) opinion, ought to weigh very seriously with all who entered into the proposition. Mr. Remington, on the other hand, proposed to cut through the Wealden formation, as being a much safer material to work in, and, therefore, *primâ facie* the balance seemed to lean in favour of this plan. However, as Mr. Low had told them that operations would soon be commenced for the chalk cutting, the matter would be tested in the only safe way, that of experience, and, whatever the result, the knowledge gained could not fail to be useful to geologists. The main point was, whether or no there was a fault in the formation. If there was not, there was no doubt of Mr. Hawkshaw being able to carry out this plan, for his abilities as a mining engineer were well known. Schemes for laying a tube on the bed of the Channel were very numerous; but the only one which appeared to him to contain even the germ of success, was that of Mr. Bateman, which, in the manner described by Mr. Colburn, might, with capital, fair weather, and tolerably good fortune, be carried out with a reasonable prospect of success. With regard to the bridge schemes, they would inevitably involve a large expenditure of time; and there were many other strong objections made to any such plan; but this might be expected, because different minds never saw the same thing in the same light. He had not had an opportunity of examining M. Boutet's scheme in detail, and would not, therefore, give any opinion upon it, but it had been tried successfully in Paris, on a scale of sixty feet span; this, however, was very different to a span of three-quarters of a mile, which, he believed, was the distance proposed by Mr. Boutet. Whether or not this bridge could be carried out, he would not say, but he might call attention to the fact that there had been patented by Mr. Ordish a principle of rigid suspension, which had been already carried out in Prussia in two instances, and he hoped shortly to see it carried out in England. It had been certified to, some seven or eight years ago, by Mr. William Henry Barlow, as being capable of carrying a bridge, with a span of very nearly half a mile, with perfect safety, and it was not unreasonable to suppose that, since that time, improvements had been made. All these schemes, however, would take a large amount of money and a considerable length of time, and, in the meantime, the public were demanding some relief from the discomforts which inevitably attached to a passage in the present disgraceful boats. It was admitted that they were disgraceful, but there was no help for it, because the harbour accommodation did not admit of larger and better vessels. He had lately been reading Captain Tyler's carefully drawn report, in which it was stated that, by the expenditure of about £500,000 on the west pier at Boulogne, and of about £1,000 on the pier at Dover, these two ports would be rendered serviceable for a much superior class of vessels. This seemed to him the only reasonable plan for meeting the emergency in the present, while the other more elaborate and costly schemes were being discussed. In connection with this point, he could not but congratulate the Society of Arts on the spirited part they had taken in ventilating this question, and in offering prizes for designs of steam vessels suited to the Channel passage which had, he presumed, resulted in the numerous models which were on the table. Whatever scheme was ultimately adopted, it was evident that an improved means of crossing by steamers was urgently required for present necessities.

Mr. Page said it was only due to Mr. Ayrton, the present First Commissioner of Works, to say that he had many years ago proposed a scheme for carrying railway trucks across on large steamers, in the same way as was now advocated by Mr. Fowler. With regard to tunnelling, he might say, having been acting engineer of the Thames Tunnel, 563 ft. of which were constructed under his own immediate superintendence, he very much doubted whether any tunnel could be constructed between England and France in anything like the time stated. He calculated it at about fifty years.

Mr. Hyde Clarke said Mr. Nursey had anticipated the announcement which would have been made by the Society, with regard to the models on the table, but it was gratifying to the Society to find that their exertions were so well appreciated. He hoped that, on some future occasion, Mr. Page would give them some further details, which would be very interesting, relating to the progress of the Thames Tunnel, in which he had been associated with Sir I. Brunel. He (Mr. Clarke) happened to be the authority for the instalment made by Mr. Colburn with regard to Trevithick, and he had every reason to believe that it was correct, and that the water came into the tunnel entirely through his own wilfulness, when it was with difficulty that he himself escaped with his life. With regard to the fissures in the chalk, he had expected that some reference would have been made to the attempt which, he had heard from the contemporaries of Dodd, was made by him at an earlier period than Trevithick, to make a tunnel from Tilbury to Gravesend, which was to be made through the chalk. The notion was, that the chalk excavated would have paid the expenses of the tunnel, but the work was stopped by a fissure, and, with the appliances then at their disposal, they were unable to carry the matter through, although, as they knew, Dodd was a man of very great ability, and they were indebted to him for several large bridges, and other engineering works.

The Chairman said he feared it would be impossible to finish the discussion on so large a subject that evening, especially as he saw present several engineers who were connected with one or other of the schemes proposed. He hoped, however, that the matter might be more fully discussed on some evening after Christmas, when Mr. Page would give them the paper he had promised. There was not time for him to go at length into any of the matters which had been touched upon; but, in asking the meeting to pass a vote of thanks to Mr. Colburn, he could not omit a tribute of praise to that gentleman for the very excellent and practical character of his paper. This was a subject which required ventilation as much beforehand as the tunnel or tube itself would require it in a more literal sense when finished, and he was hardly so sanguine as Mr. Low, as to the time when that would take place. They were all agreed, however, upon one point, viz., that the 300,000 passengers who yearly crossed the Channel, and whose numbers were rapidly increasing to 400,000, required better accommotion. Hardly anything could be more uncomfortable than crossing the Channel in the mail boat on what was called a "dirty night." If you went below, it was enough to make one ill, if not previously inclined to be so, and if you remained on deck you could find no shelter from the seas, which broke constantly over the bows or stern. It was evident, therefore, that some prompt remedy was required, and the scheme of Mr. Fowler certainly had many merits. If they could only get the two governments to agree, nothing could be better than to have fine ferry steamers crossing regularly, at all times of the tide, and

in all weathers; but, unfortunately, there was at the present moment, in France, a perfect *furore* on the subject. He had in his hand a pamphlet, issued at Boulogne, which recited various objections to any harbour being made on the French coast, and it appeared that a committee had been organised for what was called the defence of the French coast. They went so far as to say, that now military invasions on the part of England were no longer to be apprehended, perfidious Albion was about to commence a series of commercial invasions, which must be guarded against. Attempts were being made to get a concession for a harbour at Audresselles, and it was feared that if once the subject got a footing in such a way, they would go on, until, in fact, they monopolised the whole commerce of France. He feared, therefore, that at present there was little chance of the French government either granting a concession or building a harbour themselves. He had, therefore, as Mr. Nursey had said, turned his attention to the best means of improving the present harbour accommodation, and this, he was of opinion, could be done by extending the west pier at Boulogne. He had examined the localities very carefully, keeping in view that Calais and Boulogne were the two important points, one being on the high road to Paris, and the other to the north of Europe. He was sanguine enough to think that there would be traffic enough for both ports, as well as for a tunnel when it was made. As far as Calais was concerned, he was unable to see his way to anything being done to prevent obstructions by sand, but at Boulogne he thought an important improvement might be made by extending the west pier. This would lead to no obstruction by sand, and there would be a very nice roadstead, protected on the north-east by Cape Grisnez, and on the south and west by the pier. On this side of the Channel Dover was undoubtedly the best starting place, being the terminus of the two great railways leading to the Continent, and there was already a pier there which only required a little extension to make it everything that was wanted. Mr. Rochussen had also alluded to Flushing; he had no doubt that there was a great future before that port, and he hoped to see some better steamers plying there before long.

The vote of thanks having been carried unanimously, Mr. Colburn briefly acknowledged the compliment.

The Paris correspondent of the *Times*, under date 30th November, writes:—"On Friday, Sir Edwin Watkin, chairman, Mr. Eborall, general manager, and Mr. Bingley, representative in Paris of the South-Eastern Railway Company, had an interview with Lord Lyons on the subject of the proposed change of the landing-place at Boulogne from the right to the left hand side of the harbour. The Northern Railway Company is quite ready to lay down its rails parallel to those already in use for the landing of coals, &c., and to do all that depends upon it to enable the public to enjoy the full advantage of the change. I also hear that the department of the *Ponts et Chaussées* at Boulogne has reported favourably upon it, so we may hope that, in spite of some petty local opposition, the improvement will soon be realised. It will be of considerable comfort and advantage to passengers between London and Paris, and may enable us to wait patiently for the success of the plan concerning which Messrs. Hunt, Fowler, and Stanhope were lately in Paris. The fact is, that we are shamefully behindhand as regards the communications between France and England. The Americans laugh at us Old World people when they see how badly they are managed. They calculate that if they had a little gully like the Channel, cutting off 30 millions of people from the Continent, they would long ago have found means to make it easier to get across. And no doubt they are perfectly right and would have done so. One can breakfast, it is said, in London and dine in Paris, and so one can by getting up very early and dining rather late, and this is cited as a wonderful progress; but that is no reason why a greater should not be accomplished, or why one's luncheon should be spoilt by uncomfortable little boats which cannot be larger because of sand-banks off Calais. Ten hours, it is said, is the present time of travel between the two capitals, but this is by no means invariably the case. The passengers who left London on Sunday night last by the mail train at 8.45 went on board at Dover before 11 p.m., and lay there till 1.30 a.m. It was of no use starting, they were told, because the water would be too low to land. They got away from Calais a few minutes past four, and did not reach Paris till 9.35, having been thirteen hours on the journey. It ought to be impossible for such a thing ever to occur, and so it will be if once we get the huge ferry-ships plying between the new port to be made at Dover and a new or greatly improved port on the French coast. This may be done in a couple of years or so. Goodwill is manifested towards the scheme in the highest quarters here, and it is to be hoped and may be expected, that no time will be lost in effecting this great and most desirable improvement in our international communication."

Proceedings of Institutions.

Chatham (St. Mary's Science and Art School).—A public distribution of the certificates awarded at the Society of Arts Examinations in April last, and of Queen's prizes, &c., gained by the students of the above school, together with those of St. Mark's, New Brompton, took place on Friday, the 19th November, at St. Mary's Schools, Chatham. The ceremony began by the students and friends, in all about one hundred persons, taking part in a tea, given by the teacher, after which Colonel Lovell, commanding Royal Engineers, took the chair; and amongst those on the platform were the Rev. H. B. Stevens, Rector of Chatham; Mr. Thornton, master shipwright; and Messrs. T. Wilkins, and J. Bridger, secretaries. After a short opening address, the Colonel proceeded, with very appropriate and pleasing remarks, to give away the prizes and certificates in the following order:—1. Queen's prizes for art, first to male and then to female students. 2. Art certificates in the same order. 3. Gold medal for science. 4. Queen's prizes for science. 5. Society of Arts' certificates. 6. Teacher's prizes to students. The next feature in the evening's proceedings was that of two presentations to the teacher, Mr. Horace Byatt, consisting of an alabaster time-piece, elaborately mounted, and a silver plate, with the following inscription:—"Presented to Mr. Horace Byatt, Science and Art Teacher, by the students of St. Mary's Science Classes, Chatham, October, 1869." The Chairman next spoke in the name of the female students, and presented the teacher with a beautiful Bible.

INSTRUCTION IN SCIENCE AND ART FOR WOMEN.

The following are the notes of Professor Huxley's sixth and seventh lectures:—

Lecture VI.

1. Protoplasm is found in plants and animals. These convert fluid and gaseous matters into dense solids, which, under favourable circumstances, accumulate in strata of vast thickness.

2. Peat-bogs are examples of the accumulation of solid matter upon the earth's surface, by the action of plants.

3. Many thousand square miles of the bottom of the Atlantic Ocean, 10,000 to 15,000 feet beneath the surface of the sea, are at present being covered with a chalky and silicious substance, by the action of plants and animals (*diatomaceæ*, *foraminifera*, *radiolaria*, *spongidæ*).

4. Great areas of the bottom of the Pacific and other

oceans are at present being covered by beds of limestone, which are the product of certain animals (*actinozoa*).

5. A considerable portion of that part of North America, which is now called Florida, has been made by animals (*actinozoa*), and is now being extended by the same means.

Lecture VII.

1. Protoplasm is a complex body, consisting almost entirely of carbon, hydrogen, oxygen, and nitrogen.

2. Ordinary plants consist of masses of protoplasm, each provided with a wooden case, associated together. The plant feeds, grows, multiplies, dies, and is resolved into simple compounds, which are chiefly carbonic acid, water, and ammonia.

3. Ordinary animals consist of masses of protoplasm, not inclosed in wooden cases, but imbedded in other matter, which result from the modification of protoplasm. The animal feeds, grows, multiplies, dies, and is resolved into simpler compounds, which are chiefly carbonic acid, water, and ammonia.

4. Ordinary animals cannot make protoplasm, but must be supplied with it; ordinary plants can make it from carbonic acid, water, and ammonia.

5. The matter contained in living bodies is continually undergoing a circulation from the not-living world, through the living world, back to the not-living world.

ECONOMICAL PENALTIES OF IGNORANCE AND REWARDS OF CULTIVATION.

At the opening of the session of the Social Science Association, on the 18th of November, 1869, Mr. Chadwick, C.B., in his address, exemplified the waste occasioned by neglected or perverted culture. He said:—

"The common average expense of any child from infancy for food and clothing, cannot in any district be put down at less than 2s. a week. At fourteen years of age he will have cost £70.; but at the ordinary expenses of well-managed unions, he will really have cost more than double that, or 4s. 6d. per week; and, at fifteen years of age he may be considered as an investment of £180 of capital economised for production. If from that period he remain a pauper, there will be thenceforward a loss of the return of wages necessary to replace the cost of his subsistence, and also a loss of the profit or payment to the capitalist, his employer. If the boy turns mendicant, he will thenceforth not cost less, but generally more, to the community, though the cost will be differently levied. If he turn thief, he will be maintained by the community far more expensively, for he will be maintained by spoil or in gaol. In whichsoever condition he may live, in prison or out of prison, the loss to the community for the remainder of his life, which from the adolescent stage, would according to the insurance tables, be about forty years, would not be less than about £400, in addition to the original outlay during the infantile and juvenile stages. In the educational conditions which prevailed formerly with the pauper children under parochial management, and which still prevail extensively under the ill-regulated union administration, only one out of three orphans becomes productive members of society, and the loss of capital to the public is not less than £800 upon every three orphan and destitute children thus reared. These educational failures, or the creation of those future objects of penal administration, correctly characterised in old English as 'wastrils," still go on, from the default of legislative principle, at the rate of many thousands per annum. There are upwards of 20,000 always in prison, and regularly to keep up that prison population, we found that there must be more than 100,000 at large."

. . . .

"Let me expatiate somewhat on the economical gains specially derivable from such culture. At present, by rude and accidental circumstances of physical domestic conditions, a large proportion of our population do obtain a valuable, though rude and imperfect, physical training, which ought not to be interfered with, but rather accommodated and promoted. It begins with errand going, parcel carrying, dinner carrying, water fetching, pumping, the use of the broom, the shovel, and the like—all of which I regard with respect, and consider that the scholiast ought to be taught to do so too; for work, negatively by the exclusion of the vices of idleness, is to be regarded as morality. Howsoever it may arise, the fact is that, with all his defaults, the British labourer may be set as the foremost in the world, except some North American or New England labourers who keep pace with him. Two English labourers are equal in efficiency to three Norman labourers, or to three Danes, or to three Norwegians, or to three Swedes, or three Germans. Therefore, though his wages may be a third higher, the result to the capitalist is the same, and he saves in time, moreover, and in labour of superintendence and certainty of result. Mr. Brassey, who has made railways in France, in Italy, in Germany, in Russia, and in India, tells me that, with the exception of about 10 per cent. in one part of Germany, and about 40 per cent. in earthwork in India, he found the higher priced labour of England as cheap as any in the world. And other engineers have told me the like.

"Now, what is the economical result of two having the efficiency of three? It is that you save the food, the clothing, and the house-room of the third—in fact, that you save a third capital, or create a fund, which may be divided as extra wages between the other two, as in point of fact it is to a great extent, leaving some extra profit to the capitalist. In the generality of this condition, a third population is saved, and the same economical strength maintained. I believe it is owing to this superiority of its labour that England is economically equal, if not superior, to France with her larger population. But of these extra wages, our labouring population spend some £60,000,000 per annum in stimulants, three-fourths of which they would be better without. What may not be expected from a population to whom an improved education imparts temperance and frugality, and, indeed, more of self-estimation. Whatsoever moral or other worth a labouring man may have, the agricultural labourer may be told, for his self-estimation and care, that he has invested in him the capital of a first-rate team of horses, or of two hunters, and the artisan may be admonished that he has in him the capital of a twenty horse-power steam engine."

PAUPER CHILDREN.

COTTAGE FARMING *versus* INDUSTRIAL SCHOOL TRAINING.

By George C. T. Bartley.

The advocates for the plan of farming out pauper children in the cottages of the agricultural poor adopt the following chief arguments in support of their views:—

1. The advantages which accrue to a child in being one of a family, with home influences and ties, and not being, as in a large industrial school, but a unit, independent of all others, receiving little or no domestic sympathies, and scarcely mixing with the opposite sex.

2. The avoiding of the spread of diseases, both those which are so frequently imported into an industrial school, by the diseased state of pauper children when admitted, and those which appear to burst out spontaneously when large numbers, particularly in an emaciated state, are congregated together.

3. The reduced responsibility and labour to the unions or district, and its officers, by thus, as is imagined, permanently disposing of the children.

4. The advantage of children, particularly those from large towns, having the fresh air and healthful exercises of the country.

5. The danger of a few black sheep in a large school polluting the others, and acting as a fatal leaven to the whole lump.

6. The great harm to the boys permanently in an industrial school from contamination derived from the constant inflowing and outgoing of casual pauper children, who are in the schools but a few days or weeks, and then leave with their parents for a course of villany, to return, probably, only again to leave, and so on; and the further damage thus caused to the order, organisation, and progress of the school.

7. That where the experiment has been tried, it has been successful.

8. The greatly reduced cost of substituting a low, fixed, and absolute charge per week for the fluctuating and ever-increasing outlay on a district school.

Each of these arguments will be considered in the following remarks :—

1. In weighing the value of the first argument, two things must be considered :—

Firstly, the homes which are supposed to have this good influence; and,

Secondly, the feelings which the cottagers are likely to entertain for their charges.

It is well known that the homes of the agricultural poor are overcrowded to a frightful extent. In many cases they consist of but one or, at best, two rooms, in which the family of father, mother, children, and often grandchildren and even grandparents, eat and sleep, huddled together without any regard to outward decency. In such homes as these, it is hardly likely that much benefit can follow by the introduction of a strange child or two. It is true that many cottagers are in a superior position; but were child farming carried on to any great extent, it is doubtful whether an over abundant supply of cottages would be found, as the better class of the people would not receive such unpromising companions for their children. Again, in most cottages the supply of the necessaries of life is not over-abundant, and it is evident that the labourer will receive the child chiefly for the amount he hopes to save for his own uses out of the parish payment. By this means he has every inducement to stint his charge, and to make him work as the drudge or slave of the family; the poor child having no possible appeal against any injustice that might be inflicted on him. This is nothing more than encouraging the formation of innumerable small Druet's establishments.

Mr. Hill, the late Recorder of Birmingham, in advocating the farming system, and forestalling the argument of the probable cases of cruelty, states that the omnipresent press, and in rural districts the village gossips, may be depended on for the detection of cases of cruelty to children, should it so happen that any were placed with improper persons, and the inspector failed in his duty of discovering such cases. How would the poor children fare with such protection from cruelty and oppression?

In a report of a committee appointed in March, 1869, to inquire into the boarding-out system, by the Bath Board of Guardians, of which Col. C. W. Grant, R.E., was chairman, it is stated by various authorities on the system, and endorsed by the committee, "that the cottagers are not wished to make any profit by their charges, and that they are expected to bring them up religiously, and in habits of industry and cleanliness, and to give them proper notions of economy." Is not this expecting rather too much, and might not the proverb, "Physician, heal thyself," be said to far the greater number of cottagers in the country? Could any system depend on such conditions for its success? Surely if such qualities were common among our labouring classes, they would soon of themselves eradicate pauperism.

A good deal is said about the cottage-farming system of Scotland, Ireland, Belgium, America, and France, though, at the present time, little or no reliable information is known of the success of the plan as carried out in those countries. The prevalent poetic idea of the affection displayed between the *enfants trouvés* and their guardians in the latter country is known, to a very great extent, to arise from the fact that they are often the illegitimate children of their guardians, and, by a system of trickery, they get boarded with their parents at the expense of the State. What is there to prevent such a system being carried on in England under the cottage-farming plan?

2. The diseased state of the children on admission to industrial schools, and the danger of the rapid spread of contagion in the schools, so far from being a reason in favour of the farming system appears to show its absolute infeasibility. It would be impossible to send pauper children, just as they are received into the workhouses, to the cottages of the labouring classes; their diseased and emaciated state would create an epidemic in the already over-crowded houses of the agricultural poor. However great the danger of spread of the disease in the industrial schools may be, where every sanitary arrangement and precaution is taken, and where all that knowledge and skilful watching can do is done to prevent it, surely the danger in the cottages, away from medical aid, and frequently with improper or stinted food, would be magnified a hundred-fold. The cottage-farming plan, therefore, could not be looked upon, even by its promoters, as a means of at once getting rid of the children as soon as they come on the parish, but could only be applied after the children had been passed through some sort of sanitary institution.

3. No doubt, on the face of it, the trouble to the parish is less by the cottage-farming system; though for this to be really an advantage to the State, it must be shown that no hurtful effect is produced by the want of superintendence which the saving of trouble may cause. It is also a question, which experience alone can prove, whether children residing in all parts of the country would not require very careful, frequent, and, consequently, troublesome and expensive inspection, to prevent serious cases of cruelty and neglect.

4. The advantage of fresh country air to the children is no doubt great, but, to all intents and purposes, they have it under the industrial school system. In no case would a district school be placed anywhere but in the suburbs of a large town, where land was cheap, and, consequently, not occupied with buildings. The frequent argument, that hardy Scotchmen are brought up in huts, on very little meat, and without costly food, cannot apply to the pauper children of towns, as, in the first place, the expense of sending children to the Highlands would be so enormous as to preclude the idea; and if they could be sent, the probability is, that the climate and diet, which is so good for the natives, would, in most cases, be fatal to their unaccustomed frames and feeble constitutions.

5. The evil effected in a large school by a few very bad boys, is a point which is apt, at first sight, to appear favourable to the farming system, but experience with the schools themselves alone can give a true impression. In the first place, the mere fact of the success of the district schools already established, in which over ninety per cent. of the children do well in after-life, would seem to indicate strongly that, instead of the evil element leavening the good, the reverse is the case. This is borne witness to by the intelligent superintendent of the Clifton workhouse and schools, Bristol. Here the experiment is being tried of farming out some of the best boys, and he considers that the school is being damaged thereby to very great extent, the loss of their influence bad boys, he considers that they keep these latter in check, being strongly felt; so far from their being damaged by the and prevent their evil influence pervading the school. Another consideration arises concerning these dangerous children. Is it right to send them to pollute the homes of the poor? It may be said that they would not be sent to cottages, but that those who were found to be very bad would be sent to certified industrial or reformatory schools. But it must be remembered that, even i

a school, the black sheep are not always easy to detect; and the farming system would give no means of finding them out before they were sent to do their worst in some poor man's family.

6. There can be no doubt but that the casual children in a school are a very serious point of objection, but it is one which is easily remedied in the industrial school. These casual children, under the farming system, would necessarily remain in the union, practically unimproved, companions of all the depraved "union birds." It could not be intended to farm them out during their flying visits to the parish. On the other hand, by an extended system of schools, the orphans and those who are likely to be permanently on the parish might go to one industrial school, whilst those of the casual nature might form a sort of casual ward school, situated, perhaps, in a wing of the workhouse. By this means, every effort would be made to reclaim them, though, at the same time, the other children would not be contaminated.

7. The neighbourhoods of Eton, Swindon, and other places are pointed to, as showing that the farming system has been tried with success. Here a few pauper children have been placed out, and great interest taken in them by ladies, and other influential persons in the district. No doubt this may answer, but it is no specimen for the whole country. In small country places with local interest, individual cases can be no guide, for, indeed, the poor of the agricultural districts are not those for whom the farming plan is so much required; they are generally fairly attended to by the clergy and other benevolent persons. No one will deny but that the farming system, when thus looked after, is better than leaving the children in the unions, or even in most of the union schools. Who would be interested in the tens of thousands of miserable, diseased, and deformed children, who will have to be farmed from London and the large towns? The very idea of their importation into a quiet country village would be regarded as a nuisance by every respectable inhabitant.

Scotland is, in all cases, held up as the model example of the farming system, in consequence of its having been in successful operation there for over 20 years. Separate buildings for the workhouse children are said, by the Governor of the Edinburgh Union, to be unknown in Scotland, and the children are sent out to cottages, where "they are depauperised," or, as the Assistant-Inspector of the Aberdeen Union states, "they merge into the rural population, and give us no further trouble."

If this system of depauperisation has been thus going on for a generation, as is asserted, surely, its effects would be sensibly to reduce the number of paupers, and to diminish the outlay required for the relief of the poor. What is really the case will be seen from the following table:—

Year.	Population of Scotland.	Number of persons relieved.	Amount spent in relief.	Rate per head on the population	Average price of wheat per quarter.
			£	s. d.	s. d.
1851..	2,888,742	141,870	534,943	3 8½	39 11
1856..	2,975,518*	137,383	629,348	4 4¼	75 4
1861..	3,062,294	140,188	683,901	4 5½	56 10
1866..	3,149,070*	141,259	783,127	5 1¼	43 6
1868..	3,183,784*	158,372	863,202	5 7½	67 9

These facts show that the cost of the poor in Scotland has increased enormously—no less than 50 per cent. during the last twenty years, and this, too, in spite of the average price of wheat having fallen considerably since 1856; and although the number of paupers has happily not increased in the same ratio, yet it has been steadily advancing since 1856, and that, too, in spite of the increased prosperity of the country, and its recovery from the blow caused by the famine of 1847 and the following years. Could these effects follow, if, for a generation, nearly all the pauper children were depauperised by the farming system?

* Estimated.

8. The immediate cost to individual unions is, no doubt, in all such matters apt to be the main consideration, and the cottage farming plan looks economical; but is it not short-sighted policy if, in order to save 1s. or 2s. a-week on each child, a great risk is run of saddling the community with keeping that child an unproductive consumer till the end of his days, instead of converting him into a useful and productive citizen. Under the old farming system, for three shillings to four and sixpence a-week, Druet starved hundreds of these children, and the parishes thought they were saving thousands; but those who had the misfortune to survive, as soon as they were too old to entitle him to payment, were at once dismissed, and, being utterly unfit for work, flocked forthwith to the unions and prisons, to end their days in misery to themselves, and at a heavy cost to the community. What better could a child do when sent away from a cottage in a village, where the regular inhabitant can scarcely find a living, and obtains work but for a few months in the year. He will have had no training, and must be quite ignorant of anything but what he has picked up as a drudge to an agricultural labourer's family, consequently, his only hope of a livelihood will be to undersell his guardian, and, so to speak, foster-brethren, in order to obtain work which they might fairly consider theirs. This would further tend to make his existence even worse than the Druet family. For six shillings a-week, with proper management, he may be brought up at a district school, with the *certainty* that it is nine to one in his favour that he will turn out a productive citizen. Surely the latter course is absolutely cheaper in pounds, shillings, and pence.

Looking, however, into the exact figures of the cost of the farming system in Scotland, it will be found that the plan is not so economical as supposed by many persons. Sir J. McNeil, head of the Scottish Poor-law, reports to the Home Secretary, that "the cost of the board and lodging, and of the clothing, &c., provided by the parish, exceeds what it would be if they (the children) were collected together in the poor-house, or other such establishment." At Eton, 3s. 6d. a-week, and 6d. a-week for clothes is allowed for each child, as also the outlay on school fees. To this should be added the large cost of inspection, which the advocates for the system allow must be very careful, and consequently expensive. These items bring the charge to within a very little of the amount, that is six shillings a-week, for which they may be trained, under proper management, at an industrial school.

In conclusion, it may be stated that the farming system would no doubt answer extremely well, and far better than the industrial school plan, *if* the cottages of the poor were what they should be; *if* a universal system of education pervaded the land; *if* the cottagers could be depended on to do their duty; and, in short, if things existed in such a perfect state as to render it doubtful whether any pauper children would be found in the country. Until this happy state of things comes to pass, knowing as we do that, in the established schools, the health of the children is so improved as to be raised above the average; that the spread of disease is reduced almost to a minimum; that the education and training is excellent; that the cost per head may be reduced to from 5s. to 6s. per week; and, above all, *that ninety per cent. are absolutely depauperised*—knowing all this, would it not be desirable to avoid trying any doubtful experiments, and to throw every energy into extending a system which, in its comparative infancy, has achieved such remarkable results?

CONSUMPTION OF FOOD IN PARIS.

If certain accounts are to be trusted, the following is the present annual consumption of the chief articles of food in Paris:—

	Tons.
Bread ordinary	218,113
„ fancy	130,943
„ brown	8,230
„ rye	678
„ fine *(Pain gruau)*	2,000
Total	359,964

The quantity of flour required to produce this amount of bread is nearly two millions of sacks. According to the above account, the daily consumption of the city is nearly one thousand tons of bread, and five tons of flour per diem.

The quantity of butchers' meat consumed daily is, on an average, 226 grammes; or rather less than half-a-pound per head of the population, which approaches two millions of souls. The quantity of animals slaughtered is said to be:—

Bullocks	175,132
Cows	45,678
Calves	143,428
Sheep	1,068,082

The amount of pork consumed is said to be about 56 grammes, or nearly two ounces per head per day.—Total expenditure for meat, £6,506,492.

The quantity of game and poultry consumed per annum is stated at 20,730 tons, and the total cost at £1,606,588.

Fish comes next in importance, and the consumption is given as follows:—

	Tons.
Salt-water fish, fresh or pickled	19,875
Oysters	1,010
Fresh-water fish	4,380
Salt fish	3,004
Pickled	622
Total consumption	28,891

and cost equal to £1,179,722.

The consumption of vegetables is large:—

	Tons.
Potatoes	52,603
Cabbages	40,981
Carrots	41,102
Turnips	7,744
Parsnips	2,402
Leeks	25,200
Salad	12,060
Melons	624
Cucumbers and gherkins	7,080

Paris consumes also:—

	Tons.
Cheese	5,104
Butter	over 20,000
Foie gras and truffled poultry	149
Pâtés of Amiens, Chartres, and Pethiviers	30
Other pâtés	539
Gingerbread	600
Macaroni, &c.	30
Sugar-plums, &c.	416
Sweet biscuits	110
Preserves	68
Preserved fruits	80

The amount spent for condiments is said to be:—

Mustard	£18,460
Pepper	22,354
Truffles	43,843
Saur kraut	10,080
Coffee	660,000
Chocolate	24,000

Tea, nearly the same as chocolate.

The following table, drawn up by the director of the "Assistance Publique," shows the increase which took place in prices, or, more correctly, in the average expenditure of families, between the years 1788 and 1859:—

	1788.	1859.
Bread	34·33	62·05
Meat	67·50	77·22
Wine	34·17	78·63
Beer and cider	2·20	4·35
Spirits	4·00	14·28
Fish	10·17	14·00
Butter	8·83	25·53
Cheese	4·00	6·95
Eggs	5·83	8·61
Fruit and vegetables	20·83	86·71
Vinegar	0·67	0·63

Commerce.

The Trade of Ceylon.—The following is from the *Overland Ceylon Observer* of the 2nd October:—The table which appears below shows the quantities of our staple exports, sent out of the island in the commercial and planting year which closed on 30th September. The result shows a marked increase in our great staples:—

Value of Ceylon Produce (included in Staple Exports Return) Exported from October 1st., 1868, *to September 30th*, 1869.

			£	s.
777,569	cwts.	Plantation coffee at 54s.	2,099,490	16
223,053	„	Native „ 40s.	446,106	0
1,372,680	lbs.	bales Cinnamon at 1s.	68,634	0
1,445,616	lbs.	chips „ at 1s.	77,280	0
110,097	cwts.	Cocoanut oil at 25s.	137,621	0
199,929	„	Plumbago, at 20s.	199,929	0
4,625	„	Rope coir, at 25s.	5,756	0
53,936	„	Yarn, at 12s.	32,361	12
6,912	„	Fibre, at 15s.	5,229	0
17,361	„	Ebony, at 5s.	4,340	0
1,433	„	Deer-horns, at 40s.	2,866	0
		Total	£3,079,613	8

From this return, it must be remembered, are excluded exports of considerable importance, such as tobacco; the produce of the areka and palmyra palms; timber (other than ebony), &c., in which English merchants have no direct interest. Adding, for excluded articles, and taking Customs' valuations, the figure for Ceylon produce cannot be under $3\frac{1}{2}$ millions. But, in truth, the valuations, even for the island, are too low; and if we take the value in the markets whither our produce has gone, we believe that $4\frac{1}{2}$ millions will not be above the mark. The million cwts. of coffee alone, which has been at last attained, and which the Customs valuation places at £2,545,596, ought certainly to be given at a figure exceeding 3 millions. The vast bulk of this product (888,858 cwts. out of a total of 1,000,622 cwts.) continues to go to Britain, mainly for distribution to the coffee-drinking nations of the Continent. A moderate quantity, ranging from 10,000 to 33,000 cwts. has gone to France. The demands of Australia are affected by the near neighbourhood of Java, and the annual exports from Ceylon to the lands of the South have ranged from 9,000 to 20,000 cwts. The figures for America have risen from 9,000 cwts. to 29,000 cwts.

Colonies.

Free Library at Sydney.—The Governor of New South Wales, in his speech at the opening of the Parliament, on the 28th September, refers to the establishment of a free library. It appears that the failure of the old

Australian library afforded the government a chance of possessing themselves of 15,000 volumes for £1,500. These books, for the present, remain in their old quarters, a great room built for the purpose, but will shortly be removed to the museum, a building that is in progress, and which, when completed, will give spacious and noble accommodation to literature, art, and science, with all their instructive collections. The portion of the building appropriated to literature would contain 160,000 books, and seat 1,000 readers at a time. There will be a sculpture gallery 80 ft. long by 50 ft. wide, and a picture gallery 235 ft. long by 45 ft. wide. Space is also intended to be allotted for an economic museum, a school of design, and a lecture-room in connexion with the museum. With respect to money, £25,000 is already voted for the library, but £50,000 will be required to complete the erection of the front. The *Times* correspondent observes that "there is now an opportunity for returned colonists in England to distinguish themselves. While they are enjoying the lavish measure of interest New South Wales has given them for the capital invested here, they will be able to mark their sense of this benefit by presenting works of art, such as shall ennoble the feelings and refine the tastes of the community they have withdrawn from."

Colonial Preserved Meat.—The *Times* correspondent at Melbourne, under date of October 12, says that the Melbourne Meat-Preserving Company, having extended their works, are now slaughtering 8,000 sheep a week, principally for exportation to England. Unless, however, they have a distinctive trade mark, and carefully appointed agents at home, this company will suffer severely from fraudulent imitations. The Sydney correspondent of the same journal says:—"I observe that some necessity appears to exist for the inspection of meat imported from these shores, and the branding of it with an official brand. The rogues are beforehand with us in your market, endeavouring to do, and with some success, what I feared would be done from this point. They are, according to some of our English correspondents, tinning second and third rate meats, and selling it as 'Australian preserved meat!' The dodge is likely to damage the reputation of our supplies, and we must look to it, to preserve ourselves as well as our meat."

Notes.

Music in Day Schools.—The recent decision of the Committee of Council on Education, admitting the tonic sol-fa system and notation on equal terms with others, appearing to make a fitting opportunity for calling the attention of the teachers of government schools to the many advantages offered by the system, the Tonic Sol-fa Association convened a meeting of certificated school teachers, at the "London Tavern," on Saturday, November 20th. Mr. Godfrey Lushington occupied the chair. Mr. Curwen, the promoter of the tonic sol-fa method, opened the discussion by an explanatory lecture, and a class of pupils illustrated the various uses of the method by singing at sight, by composing and arranging for four parts psalm tunes, the first few notes of which were suggested in the room, by performances on the violin and pianoforte, and by copying by ear. After some discussion, the following resolution was unanimously carried:—"That this meeting having heard Mr. Curwen's explanation of the tonic sol-fa method, and believing it to be especially adapted to what is one of the highest necessities of our elementary schools, the teaching of vocal music to the young, recommend it to the teachers of the day schools of the metropolis as worthy of a fair and impartial trial."

The Education Question.—The *Manchester Guardian* says:—"Mr. Forster is anxious that a measure should be submitted to Parliament without delay, but there is said to be a strong party in the Cabinet who are desirous of deferring the question for another year. Mr. Lowe is reported to be one of the most strenuous advocates of postponement. The Chancellor of the Exchequer, and those who concur with him in the view that immediate legislation is not expedient, are understood to be on the whole favourable to the scheme of the National Education League; and we are informed that one of the considerations by which they are influenced is the probability that, if further time is allowed for discussion, it will be made evident that the preponderance of public opinion is in the direction of the Birmingham plan."

The Tower Subway, constructed on the designs of Mr. P. W. Barlow, will shortly be opened for traffic. The permanent way is laid, and, according to recent experiments, the journey of the carriage from shaft to shaft will not exceed one minute. Working only 12 hours a-day, the line, it is stated, will be able to convey with facility 2,000,000 persons per annum.

Co-operation in Lancashire.—Few co-operative stores in Lancashire have had such a large share of success as the Rawtenstall Industrial Co-operative Society, near Bacup. On Saturday, the 27th ult., it held a *soirée*, which was attended by 1,500 persons, to inaugurate the opening of new stores, recently erected at a cost of £7,000. The society was started rather short of twenty years ago, by a few men whose capital was only a guinea, and has gone on increasing year by year, other businesses than that of grocery and provision dealing, such as drapery, tailoring, boot, shoe, and clog making, and butchering have been added. At present the society has 960 members, with a subscribed capital of £11,020 9s. 5d., and the loan capital of £1,846 19s. 9d., transacting a business of over £30,000 per annum, and realising profits of over £1,000 per quarter, which, after paying interest upon the capital, is divided on members' purchases, no less than 2s. 5¾d. per pound being the average on the latter. The society's assets amount to £14,544 8s. 7d. In the new building which has been erected there is a large news-room and a library, well stocked with standard and recent works; also a large assembly-room, capable of accommodating between 1,400 and 1,500 persons.

Southwark and City Subway.—This scheme, for which notices have been given, appears to be to construct a double tunnel capable of conveying eight millions of passengers annually, to commence near St. George's Church in the Borough, passing under the centre of that thoroughfare, diverging under Hibernia Wharf, to avoid London-bridge, and terminating in Arthur-street, near Cannon-street, City.

Street Tramways for London.—The plans of six distinct schemes have been put forward, though they do not all appear to have duly deposited plans. The projects of which notice have been given are—(1), the London Street Tramways; (2), the Pimlico, Peckham, and Greenwich Street Tramways (Extensions); (3), the Metropolitan Street Tramways; (4), the North Metropolitan Tramway Company; (5), the North London Tramways Company; and (6), the East London Tramways Company. Under the London Street Tramwass scheme no less than twenty-five lines of tramways are comprehended, and the object is to provide this means of transit to the City to the population in the northern district, of which Islington is the centre. From Holloway-road several lines diverge, two going direct to the City, one by the City-road and the other by Aldersgate-steet, while another line branches off direct to St. Giles-in-the-Fields and Marylebone, turning down Hampstead-road, through Tottenham-court-road to Oxford-street. Other ramifications of this scheme extend to Kentish-town, through the Caledonian-road, and to Edgware-road. There is also a proposed line from the Marble Arch through Oxford-street and Holborn direct to Farringdon-street, down Blackfriars-road to St. George's-circus, whence it turns up Westminster-bridge-road, terminating at the junction of the Belvedere-road and Stangate. The Pimlico, Peckham, and

Greenwich project is a comprehensive plan for covering South London with a net-work of these street lines. The Elephant and Castle is taken as the centre, to which shall converge tramways from Vauxhall and Victoria Station, and the streets abutting on the main thoroughfares from Westminster and Blackfriars bridges; and from Camberwell, taking in the large traffic along the Walworth-road, the New Kent-road, and Newington. There are extensions to Greenwich and Woolwich, which, with the new tramway by New-cross to Deptford, would connect this company's tramway system on the Surrey side of the Thames. The Metropolitan Street Tramway crosses Westminster Bridge to take up the traffic from the Metropolitan Railway. This line, it is proposed, shall take up the suburbs of Brixton and Clapham, passing down Kennington-road and along the Clapham-road; Brixton-rise and Lower Tulse-hill being the extreme points for the tramways, which meet at Water-lane. Distinct from all these plans is the proposed East London Tramways Company. Commencing at the junction of Salmon's-lane, this tramway extends along Commercial-road East to Mile-end Old Town, and will pass through High-street, Whitechapel, into Aldgate High-street, the Minories, and Little Tower-hill, terminating in Trinity-square; but its plans have not been deposited. There are two other projects, both referring to the Middlesex side of the Thames. The North London Tramways Company desires to run a line almost parallel with the underground railway from Paddington to Farringdon-street, with a tramway from Baker-street to the Swiss Cottage. This company proposes to go over some of the ground marked out by the London Street Tramways Company, viz., through Hampstead-road and Tottenham-court-road to Oxford-street. The North Metropolitan Tramways Company also seeks power to construct a line from Highgate to Moorgate-street, and proposes to go through Stratford and Bow to Aldgate.

Working Men's Club.—The rooms of the Society of Arts were lent to this club on Thursday evening, the 25th ult., when a social tea meeting was held. The meeting was specially promoted by the Hon. Auberon Herbert, and the party numbered upwards of a hundred.

Correspondence.

Army Education.—Sir,—In a letter published in last number, some remarks were made on the report of the Commissioners. The Commissioners have not attempted to modify the present system of education in public schools, but they have made the examination of candidates suit the public school teachings, without any due regard to the future profession of soldiering. Hence 5,000 marks for classics, 4,000 for mathematics, and 1,500 for English, allotted to the competitors for Sandhurst and Woolwich. For direct commissions, English is at a lower ebb still, only 1,000 marks, against 7,000 marks for classics, and 4,000 for mathematics. The author of the remarks proposes to oppose the adoption of the report, but not on grounds, I believe, which could be sustained. Scientific education is not to be had in our public schools, and, until this is altered, there is no choice for the Commissioners. What should be blamed is the total absence of provisions made for encouraging military education. Although the Commissioners have admitted the necessity of beginning professional education early in life, and have lowered the age of admission to Sandhurst to sixteen, yet they have not encouraged the numerous class of candidates for direct commissions to acquire any useful knowledge. Field sketching and field fortification are absent from the list of optional subjects. There is no inducement for the candidates but to qualify. It is true that they will be gazetted in rotation, as their names stand on the list, but what is it? A few weeks saved. If the Society, true to its calling, will make an effort to promote professional education, even in the army, it is on that ground that it should act. A thorough reform cannot be made suddenly. Let the two subjects alluded to above be placed among the optional ones, and see how it will work. Encourage the candidates by giving a few commissions to the top of the list. As for public schools, the committee of the British Association should insist upon the introduction of natural history, geology, chemistry, and natural philosophy into the curriculum. It is their province.—I am, &c., Z.

The French Treaty.—Sir,—In your last number you mention the agitation in France for an increase in the protective duties, and the counter-movement in Bordeaux and other places. Having lately returned from the Viticultural Congress at Beaune, where all the wine-growers of Burgundy, with delegates from other parts of France, were assembled, I ask space to state a few facts, elicited during the proceedings, which bear strongly on the question. M. Drouyn de l'Huys, the president, in his opening address, stated that the wine-producing interests in France give employment, directly and indirectly, to seven and a-half millions, or about one-fifth of the population. Moreover, all with whom I conversed declared that the production could be doubled, or even trebled, if there were sufficient demand. Now, France has not a superabundant population. I heard certain systems of vineyard plantation and management recommended by men from all parts of France, mainly because of the scarcity of labour. In the agricultural districts this is a chronic complaint. In some parts a sort of agricultural co-operation is proposed to secure to the soil the labour necessary to its cultivation. On this account loud complaints are heard of the conscription. Yet the manufacturers practically exercise another conscription, in seducing from the land the labour it so much needs, in order to maintain manufacturers which require, as a condition of existence, a protection of thirty per cent., the existing protection of fifteen per cent. being declared to be only half enough. It is clear that they can only be maintained at the cost of the best interests of France, which require a rigid application of the true principles of free trade, to stimulate the natural productions of the country, instead of delusive attempts to foster manufactures which can only be kept alive in a hot-bed of protection. I may add that an addition, however small, to the existing protection is found in the operation of the French patent laws, which require that all articles sold under a French patent shall be completely manufactured in France; it may be said, in answer, that a foreigner cannot take out a patent in his own name in England; but this is only a legal fiction, and practically he can obtain a monopoly in England for goods manufactured in France.—I am, &c., Charles Farrow.

78, Great Tower-street, London, and 13, Rue du Pont Neuf, Paris, Nov. 19, 1869.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Mr. J. Norman Lockyer, "On the Spectroscope and its Applications."
Social Science Assoc., 8. Mr. A. H. Safford, "On a Sanitary Police."
Royal Inst , 2. General Monthly Meeting.
Society of Engineers, 7½. 1. Discussion upon Mr. Light's paper, "On the Need for further Experiments on Strength of Materials." 2. Mr. Vaughan Pendred, "On Apparatus for Measuring the Velocity of Ships."
Entomological, 7.
Medical, 8.
Victoria Inst., 8. Adjourned discussion on Mr. Greig's paper, "De Providentiâ Divinâ; or, the respective Spheres of Providence and of Nature's Laws."
London Inst., 4.

Tues ...Civil Engineers, 8. 1. Mr. Edward Dobson, "On Public Works in the Province of Canterbury, New Zealand." 2. Mr. John Grantham, "On Ocean Steam Navigation, with a View to its further Development."
Pathological, 8.

Ethnological, 8. 1. Lieut. S. P. Oliver, "Report on the Prehistoric Remains in the Channel Islands." 2. Rev. W. C. Lukis, "On the Megalithic Monuments of Brittany."
Syro-Egyptian, 7½. Mr. Bonomi, "On the Obliteration of the Name and Figure of Amun, and the Restoration of both in the time of Rameses the Second."

WED ...Society of Arts, 8. Mr. S. T. Davenport, "On Prints and their Production." Being a sequel to a former paper, entitled "Engraving and other Reproductive Art Processes."
Geological, 8. 1. Mr. T. Davidson, "Notes on the Brachiopoda hitherto obtained from the Pebble-bed at Budleigh Salterton, near Exmouth." 2. Mr Searles V. Wood, jun., "On the Relation of the Boulder-clay without Chalk of the North of England to the Great Chalky Boulder-clay of the South." 3. Messrs. Ralph Tate and J. S. Holden, "On the Iron-ores associated with the Basalts of the North-east of Ireland."
Graphic, 8.
Microscopical, 8. Professor Rymer Jones, "On Deep-sea Dredgings from the Vicinity of China and Japan."
R. Literary Fund, 3.
R. Society of Literature, 4½.
Archæological Assoc., 8.

THUR ...London Inst., 7½.
Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Royal Society Club, 6.
Mathematical, 8.

FRI ......Society of Arts, 8. India Conference. Mr. Andrew Cassels, "On a Gold Currency for India."
Astronomical, 8.
Quekett Club, 8.

SAT ......R. Botanic, 3¾.

Patents.

From Commissioners of Patents' Journal, November 26.

Grants of Provisional Protection.

Bar iron for manufacturing shoes for horses, &c.—3199—S. Busk.
Boilers for supplying baths, &c.—3310—C. Ching.
Boring tools—3211—A. M. Clark.
Boxes for matches, &c.—3288—W. E. Gedge.
Buffers—3306—J. G. Garrard.
Button-hole sewing machines—3249—I. Nasch.
Carding engines—3277—R. and G. Hardman.
Cartridge shells—3303—M. Sautter.
Chimney cowls—3328—H. A. Hammond.
Coal, apparatus for breaking down—3298—J. G. Jones.
Coal mines, rendering less injurious to those employed therein—3091—P. Walker.
Coffee pots, &c.—3203—E. Edmonds.
Colouring matters, suitable for dyeing and printing—3318—W. H. Perkin.
Columns for exhibiting notices at railway stations, &c.—3268—T. Snow.
Cotton, &c., preparing for carding—3326—G. H. Kenworthy and T. Knowles.
Despatch boxes, &c.—3293—J. Tribe and J. Mallett.
Floating vessels, constructing and propelling—3312—S. J. Mackie.
Furnaces, obtaining blast in smelting and other—3276—C. H. Holt.
Furnaces, &c.—3264—S. Chatwood and R. Kenyon.
Galvanic batteries—3324—C. Faure.
Gas meters, &c.—3322—J. Woodward.
Gloves—3294—A. Jugla.
Grain, machinery for hulling—3259—G. A. Buchholz.
Horses, apparatus for clipping—3221—S. Heath.
Inking or stamping pad—3286—R. Ganthony.
Invisible bodies, apparatus for ascertaining the presence of certain—3280—C. Sutton.
Iron and steel—3267—W. Gorman.
Lace machinery—3243—A. Mosley.
Land, apparatus for ploughing—3217—T. Perkins.
Lead, refining and desilvering—3292—C. D. Abel.
Letter pillar posts—3271—H. R. Minns.
Liquids, regulating the flow of—3311—P. Negrin.
Locks—3290—F. Brampton.
Locks—3300—W. H. Tucker.
Locks, &c.—3257—P. Wilson.
Looms—3239—H. Lee.
Looms, constructing healds for—3299—G. Cherpit.
Lubricators—3205—J. Maiden.
Metal, rolling—3195—J. Booth.
Metallic manometers—3309—F. Delacroix.
Metallic tubes and rods, manufacturing and coating—3315—T. and H. Weston.
Metallic pens—3255—J. Mason.
Metals, tinning—3222—R. Aders.
Mining lamps—3289—F. Clarbour and W. E. Teale.
Motive-power, obtaining—2753—W. J. Cunningham and A. P. McCarthy.
Motive-power, obtaining and applying—3263—C. Brakell.
Ores, treating certain—3284—J. Henderson.
Paper, card, or form holders—3223—R. Jones.
Paper-hangings, manufacturing—3279—R. Smith and J. Higginbottom.
Pipes, &c., core barrels for making—3235—G. Knighton.
Pistons—3265—O. Rose.
Pneumatic apparatus—3229—A. M. Clark.
Printing surfaces, photographic process for preparing—3151—J. C. Mewburn.
Pyrites, treating—3167—J. Hargreaves and T. Robinson.
Railway chairs—3262—S. Martin.
Railway switches, &c., apparatus for working, &c.—3272—G. H. Hannaford.
Railway trains, signalling on—3245—T. Herbert and J. C. Fowler.
Rudders, machinery for working—3225—G. D. Davis.
Safety lamps—3281—T. A. Dillon.
Sewing and embroidering machines—3213—F. Taylor.
Sewing machines—3201—F. Armstrong.
Shawls, manufacturing—3269—W. E. and F. Dobson.
Sheep shears, manufacturing—3278—C. Burgon and J. Ball.
Soap, machinery for cutting—3261—B. Shaw.
Spindles and flyers—3227—T. Hattersley.
Spinning looms—3317—E. Bazin, A. Ruiz, and E. Le Pelletier.
Stair rods, securing—3215—W. R. Lake.
Steam boilers—3305—C. Asbury.
Steam engine cylinders, valves for—3282—W. Richardson.
Steam engines and boilers—3253—J. M. Rowan and T. R. Horton.
Steam engines, cut-off gears for—3207—J. Turnbull.
Steam engines, slide valves for—3237—J. W. Hackworth.
Steam hammers, &c.—3266—G. D. Edmeston.
Stone, machinery for dressing—3283—H. H. Grierson & J. M. Rigby.
Sulphur, &c., obtaining—3295—W. Gossage.
Telegraph posts, fixing and staying—3308—J. Oppenheimer.
Tubes, machinery for welding and finishing—3209—J. K. Northall.
Umbrellas, manufacturing—3316—J. Willis.
Velocipedes—3210—F. Pash.
Weighing, balances for—3233—W. Donbavand.
Wood-cutting apparatus—3297—G. R. Mather.
Wood-cutting apparatus—3330—T. Llewellyn.
Wool, &c., apparatus for combing—3313—J. Crofts, R. Dawson, and J. King.
Wool, &c., machinery for combing—3241—I. and G. Battinson and T. and H. W. Whitehead.

Inventions with Complete Specifications Filed.

Electric batteries—3378—H. A. Bonneville.
Ladies' stays, &c., fastenings for—3374—J. Brookes.
Mowing machines, cutters for—3383—H. F. Shaw.
Railways, &c., hydraulic traction on—3382—W. E. Gedge.
Type, machinery for distributing—3358—W. R. Lake.
Wooden pavements, constructing—3342—I. Hayford and J. F. Paul.

Patents Sealed.

1644. J. Ingham and I. Butterfield.	1698. J. Urbain.
1652. A. T. Fairgrieve.	1733. R. B. Plum and R. George.
1656. A. Hemingway.	1736. J. Blomfield.
1664. J. Smith.	1753. G. A. Frebault.
1665. J. F. Nicholls.	1788. R. Harrison.
1676. R. Mathers.	1796. W. Cook.
1687. A. Rushworth.	1841. T. Knowles.
1688. C. H. Gardner.	1916. J. H. Johnson.
1693. C. F. Waldo.	1958. G. C. Haswell.
1696. R. B. Cooley.	2569. W. E. Newton.
	2917. W. P. Gregg.

From Commissioners of Patents' Journal, November 30.

Patents Sealed.

1689. O. Barrett & G. P. Wheeler.	1829. M. Benson.
1690. J. Warhurst.	1830. M. Benson.
1699. A. Watt and T. Knowles.	1876. G. Molland.
1700. G. V. Turnbull, C. Salvesen, and R. Irvine.	1893. M. Olsson.
1705. F. R. A. Glover.	1898. P. G. B. Westmacott.
1716. J. Stewart and T. Charlton.	2011. A. Angell.
1718. J. and R. Tatham.	2133. B. J. B. Mills.
1719. W. V. Morgan.	2458. J. H. Johnson.
1726. E. T. Hughes.	2483. W. Jones.
1740. E. G. Brewer.	2705. J. H. Johnson.
1744. F. H. Holmes.	2888. H. Howard-Keeling.
1752. W. R. Lake.	2902. H. and A. Holmes.
1779. W. Madders and J. Wood.	2908. W. H. Horsley.
1828. M. Benson.	2914. J. C. Ramsden.
	2924. T. Rice.

Patents on which the Stamp Duty of £50 has been Paid.

3076. M. Marks.	3143. J. Field.
3084. J. Coulson.	3186. G. Haseltine.
3095. W. Bass.	3136. L. A. Fargon.
3123. A. V. Newton.	3157. W. Crighton.
3099. C. H. Southall, R. Heap, and J. Tasker.	3137. J. Wadsworth.

Patents on which the Stamp Duty of £100 has been Paid.

3174. J. R. Danks and B. P. and R. P. Walker.	3165. A. V. Newton.

Journal of the Society of Arts.

FRIDAY, DECEMBER 10, 1869.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at eight o'clock :—

December 15.—"On India-rubber, its History, Commerce, and Supply." By J. Collins, Esq.

December 22.*—"On Wines, their Origin, Nature Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea." By J. L. W. Thudichum, Esq., M.D.

Cantor Lectures.

The first lecture of the course "On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., was delivered on Monday evening last, the 6th inst. The second and third lectures will be delivered on Monday Evenings, the 13th, and 20th inst., at Eight o'clock. The whole course of lectures will be published in the *Journal*.

India Committee.

The next Conference will be held this evening (Friday) December 10th, when a paper "On a Gold Currency for India" will be read by Andrew Cassels, Esq. The chair will be taken at Eight o'clock, by W. S. Fitzwilliam, Esq.

Local Science Colleges.

The Council have issued the following circular to members of the Society residing in the locality, calling a meeting in the Mayor's parlour, Manchester, on Friday the 17th inst. :—

Sir,—The Council of this Society have under their consideration the national importance of promoting Scientific Instruction in the United Kingdom, and they desire to draw attention to the great need which exists for the establishment of colleges and science schools in the principal centres of industry for this purpose, under a system which shall combine local action with State aid. With this object in view, the Council recommend the formation of local committees extensively, and they confidently trust that the members of the Society of Arts residing in the localities will give their aid to this movement by helping to form such committees, and serving on them. The Council have received with gratification a communication from Owens College on the subject, and a Committee is now in the course of formation for Lancashire, which will hold its meetings at Manchester. The Council hope that you, as a member of the Society, will allow your name to be placed on this Committee. A meeting will take place at Manchester, in the Mayor's Parlour in the Town Hall, on Friday, the 17th of December, at twelve o'clock, under the presidency of the Mayor, when your attendance is particularly requested.

I am, Sir, your obedient Servant,

P. Le Neve Foster, *Secretary*.

* Captain O'Hea's paper on "Recent Improvements in Small Arms" is postponed till after Christmas.

The Council earnestly hope that any members of the Society, whether residing in the locality or not, who may feel interested in this movement for the promotion of scientific instruction, will endeavour to attend the meeting.

Donations to the Library.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors :—

Ten Pamphlets, published by La Ligue Internationale et Permanente de la Paix, Paris; presented by the League.

Harmony of the Bible, with Experimental physical Science, by the Rev. Arthur Rigg; presented by the author.

Notes on Letters Patent for Inventions and the Registration of Designs, by Francis Lloyd Wise; presented by the author.

Channel Steamers.

The Committee to report on the seventeen models sent in competition for the prizes offered by the Society, held their first meeting on Monday, the 29th of November. Present—Lord Henry G. Lennox, M.P., Mr. E. J. Reed, C.B., Capt. Boxer, R.N., Mr. S. Teulon, Mr. C. W. Merrifield, F.R.S., and Admiral Ommanney, F.R.S.

Collection of Engravings and Prints.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, "On Prints and their Production," read on Wednesday evening last, will be open for the inspection of members and their friends up to Saturday, the 18th inst., inclusive.

Institution.

The following Institution has been received into Union since the last announcement :—

Birmingham, Society of Artisans.

Subscriptions.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

Food Committee.

This Committee resumed its meetings on Wednesday, the 8th inst. Present, Seymour Teulon, Esq., in the chair; Mr. B. Shaw, Mr. J. T. Ware, Mr. Holland, Mr. W. H. Michael, Rev. J. E. Hall, Mr. Hyde Clarke.

The Committee had before them four tins of preserved meat, from the Melbourne Meat Preserving Company,

sent by the Colonial Office for the consideration of the Committee. (See correspondence already printed in the *Journal*, Vol. XVIII., p. 2). The specimens consisted of boiled mutton, boiled beef, and spiced beef. The mutton can be supplied wholesale at 6d., the boiled beef at 7d. per lb., cooked, and without bone. It is preserved in air-tight tins, upon the same principle as that adopted by the meat preserving firms in this country.

The Committee had also before them a tin of meat preserved raw in Australia, by "Manning's" process. This process may be shortly described as one of the many methods in which sulphurous acid is made available for preventing decomposition. This was cooked for the Committee in two ways, one fried, the other as an Irish stew.

The Committee had also before them a specimen of meat preserved by the process of Baron Fabrice. These specimens are stated to have undergone the treatment in Paris, on the 14th and 15th of September last. They were, with others, brought to the Society on the 16th of October, and have been in its custody ever since. Some portion was cooked for the Committee, and tasted this day. The specimens were dressed under the superintendence of the Baron's own French cook, and were served in the form of soup, bouilli, bœuf à-la-mode, and biftek. The actual process is a secret, but it is known that the meat is dipped in a vegetable decoction of an aromatic nature, which evidently contains tannin. The meat remains in the bath and is gradually heated to a temperature of about 100° F. It is then taken out, dried, and hung up.

The Committee had also before them a specimen of meat received from Paris, about a month since, prepared, the latter end of October, by the process of M. Thibierge, which consists in dipping the joints for five minutes into dilute sulphuric acid, of the strength of about 10 water to 1 acid. The meat, on being taken out, is carefully wiped and dried, and is then hung up for keeping. This joint (a sirloin) was roasted.

The Committee had also before them a communication from Dr. Estor, descriptive of a proposed process for the preservation of meat, the details of which will be given in a future number of the *Journal*.

Fourth Ordinary Meeting.

Wednesday, December 8th, 1869; Henry Cole, Esq., C.B., Vice-President of the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Bennett, Charles Fox, 55, Queen-square, Bristol.
Brand, Henry R., M.P., 70, Princes-gate, W.
Carter, C. R., 17, Carleton-road, Tufnell-park, N.
Farrant, R. E., The Limes, Lower Tulse-hill, S.W.
Greener, John Henry, 2, New London-street, E.C.
Hayne, C. Searle, 3, Eaton-square, S.W.
Hollebone, Frederick, Ravensbourne-park, Catford-bridge, Lewisham, S.E.
Langford, J. A., LL.D., Birmingham.

The following candidates were balloted for, and duly elected members of the Society:—

Beamish, William, 5, Elgin-road, St. Peter's-park, Paddington, W.
Berthon, Charles Septimus, 20, Margaret-street, Cavendish-square, W.
Dashwood, Captain F. L., 6, Park-street, Westminster, S.W.
Foord, John Ross, Mayor of Rochester.
Lesingham, Henry, Victoria College, Bayswater, W.
Ludlam, Thomas Edward, Marlborough Lodge, Brentford-end, Isleworth, W.
Thomson, Robert, L.D.S., Denmark-hill, Camberwell, S.E.

The Paper read was—

ON PRINTS AND THEIR PRODUCTION.

By S. T. Davenport, Esq.

This Society has ever taken an active interest in the improvement of industrial reproductive art processes, and the present has appeared to me not an inappropriate time for reviewing the course which has been followed, during the past century, by artists and others, for the purpose of creating a taste for, and an appreciation of art, and also of supplying the demand for art on the part of the public. The means resorted to in the production of prints have been of an ever-varying nature, and the object of the processes used in more recent times has been the production of impressions in larger numbers, with greater facility, less wear and depreciation of the surface from which the prints were obtained, and at less cost to the publisher, and, therefore, to the public. These conditions have especial reference to what may be termed commercial illustrative art; and I cannot but regret that, as the public have increased in their appreciation of art, the processes which have been resorted to to supply the public demand, have, of late years, been, many of them, deficient in those high qualities of art which the processes in general use 50 or 60 years ago possessed.

It will be my endeavour this evening to place before you examples illustrative of some of the various processes which have been employed or proposed for adoption, with the results obtained; and, before concluding, I shall direct your attention to two or three of the processes more recently discovered, by means of which some of the warmth, richness of effect, and artistic qualities of the past are now sought to be secured, and combined with economy and facility of production.

Into the history of the art of printing, in all its breadth, I cannot attempt to enter. Printing has been described as the means employed to impress on one substance the idea produced on another. The earliest examples of it are probably to be found in the bricks which were used by the founders of the cities on the banks of the Euphrates and Tigris; and bricks from Babylon, impressed with the cuneiform characters, may be seen in the British Museum.

"The Egyptians appear to have made a close approximation to printing; some of their wood stamps yet remain, and are capable of giving impressions in the same manner as the wood blocks of our own times. The use made of these blocks by the Egyptians was, doubtless, that of stamping clay, and bricks so impressed are frequently found. One of these stamps was found in a tomb at Thebes, and was brought to this country by Edward William Lane, Esq.; it is 5in. long and 2½in. broad.

"The ancient Romans marked their cattle and horses with a metal stamp containing letters. The stamp was dipped into fluid pitch, and was used to print on the bodies of animals; but, in the case of runaway slaves, the stamp was made hot and printed into the captive's cheek or forehead. The Roman law required that bread should be printed or stamped with what may be called a trade-mark, indicating its composition.

"Examples of this practice have been found in excavating the buried city of Herculaneum, and, in one case, the loaves thus wonderfully preserved during 1800 years were marked in the following manner:—

SILIGO E GRANIS
ET CICERE,

meaning that the finest wheat flower was mixed with the meal of peas or lentils. Marking manufactured products was a common practice among the ancient Romans, as is evidenced by the examples of pigs of lead which have been found; and, in England, by the '1st James VI., cap. 3,' by the '1st James I., cap. 7,' and the '39th Elizabeth, cap. 4,' beggars were to be branded

with a hot iron, so that the mark should remain during life." *

Thus, from the earliest ages, and in all countries, the principle of stamping or printing has been known and used; but, says John Fary, "during the dark ages of ignorance and superstition which followed the decline of the Roman Empire, all the arts and sciences were neglected in Europe. A small remnant of the writings of ancient philosophers was preserved by monks, who read and copied them without comprehending their meaning, and this they frequently perverted to suit their own reveries of magic, astrology, alchemy, and logic. . . . . . . After a long lapse of barbarous ignorance, the useful arts and trades which were practised by vulgar artisans were improved, and many discoveries were imported into Europe from Arabia, where science was first cultivated. By degrees the useless learning and philosophy of the schoolmen began to fall into disrepute, and the progress of civilisation was promoted by several important inventions which were made by those who were unlearned. Such was the origin of the mariner's compass, firearms, and the art of navigation, building, painting in oil, engraving, printing, &c. These inventions have produced a great and general revolution in the state of Europe, and have wonderfully improved the condition of mankind in all parts of the world."

From the reign of Charles I. to that of George II. it is well known that, in England, the arts of painting and engraving did not receive much encouragement. It is from the latter period that we have to date our history of the progress of art in this country, at which time the chief occupation of artists was painting portraits and sign-boards. To the arts of engraving and printing we are indebted for much of our knowledge of the works of artists of the past; by their aid, also, the manufactures of the country have been improved, and commerce extended. In the early part of the reign of George II., though art was little encouraged, a regular trade with the Continent existed in works of art, and it is stated that the picture-jobbers imported by shiploads "Dead Christs," "Holy Families," and "Madonnas," &c., on which they scrawled the names of Italian masters.

At the same period, literature was far in advance of the fine arts in England. Foreign engravers were employed to produce the illustrations required for the works issued to the public; even the paper on which they were printed was chiefly of foreign manufacture.

Engraving, as then practised in this country, was, like painting, almost entirely confined to portraits, the process being mezzotinto. In 1732-3, George Virtue engraved a series of portraits for an edition of "Rapin's History of England," which was, probably, the first illustrated work published in weekly numbers in London, and it is stated that thousands of copies were sold. It was upon this newly-discovered predilection of the million for illustrated works, that Hogarth, in 1733, founded his hopes of patronage for his talents as an artist, and was led to paint and engrave a series of pictures of moral subjects, treating them as a dramatic writer would, but making the picture the stage for the players, and, by certain actions and gestures, exhibiting dumb show.

Hogarth's prints of "The Harlot's Progress" were the first of the series which he published, and they were highly successful. 1,200 copies were immediately subscribed for. The subjects were copied for different articles of fashion. A piece was brought out at one of the theatres, founded upon them; and copies of them were engraved, of various sizes, and impressions spread throughout the country, and sold by means of hawkers. Hogarth, rendered sensible, by these acts of piracy, that published engravings were the common property of all adventurers, and feeling the danger to which his enterprise was consequently exposed, called a meeting of his professional brethren, and an application to Parliament for a Bill to secure to artists exclusive enjoyment of the copyright of their own works was the result.*

Up to the time of these publications, there were but two print shops in London; their trade consisted in foreign prints and in English engraved portraits, and was of very limited and unimportant extent. But the introduction to the town, from time to time, of Hogarth's visible forms of virtue and vice, by constituting framed and glazed prints fashionable decorations for rooms among the middle classes of society, the making collections for folios, and the awakening among dealers a general spirit of enterprise in engraved works, imparted to that trade an entirely new character; and the Copyright Act, obtained by Hogarth in 1734-5 (8th George II.), having given security and confidence to the various interests growing out of the new state of things, print shops were opened in various parts of the town; and whilst the works they exposed to view, by drawing the attention of the public, aided in making artists known, and in diffusing taste for art, they constituted an entirely new characteristic of the metropolis of Great Britain.

PROCESSES OF ENGRAVING.

It is not necessary that I should repeat here what I have already given in the Society's *Journal*,† viz., a detailed account of the various processes employed in the production of engravings; it will be sufficient, for my present purpose, that I should enumerate them. The processes chiefly used at the close of the last and commencement of the present century consisted of:—

Wood engraving, of which the earliest-known print bears date 1423.

Line engraving on metal plates, which appears to have been practised in England as early as 1284; and the art of etching, which is now combined with it, is attributed to Albert Dürer, and dates from the beginning of the 16th century.

Chalk, or stippled engraving, a process which seems to have been first introduced in France.

Mezzotinto, a process which is attributed to Prince Rupert; but the credit of the invention appears more properly to belong to Louis von Siegen, and dates from about 1643; and

Aquatinta, a process which was soon extensively used.

The chalk, mezzotinto, and aquatinta processes, but more especially the two last-mentioned, afforded great facilities for the production of broad effects spread over large surfaces; but the refinement, gradation of light and shadow, and force of artistic effect produced by the mezzotinto process led to its general adoption in the production of portraits; while the aquatinta process was more generally made available in landscape scenery on a large scale; but neither of the processes were used, to any great extent, as a means of illustrating books, as, in the first instance, the surface of the engraved plate rapidly wore away in the process of printing, and, in the latter case, in addition to wearing readily, there was a want of fitness for the production of minute detail on small surfaces.

Many other processes were subsequently invented and used, and are fully described in the paper before referred to, and prints obtained from such plates are exhibited, but time will not permit of my now dwelling upon them.

Hogarth employed the process known as line engraving, which, at that time, was executed on copper plates, and the success of his publications led to his employing, between 1733 and 1750, a large number of engravers, and the development of much native talent; and portrait painters soon began to exhibit in print-shop windows portraits of distinguished persons engraved after their own pictures.

In 1741, Boydell began to publish a series of views in and about London, drawn and engraved by himself. The success of this work led him to extend his plans, and to

* See "The Invention of Printing," a lecture, by Charles Tomlinson, F.R.S.

* See John Pye's "Patronage of British Art."

† See *Journal*, vol. xiii., p. 131.

his employing Bartolozzi, Basire, Walker, Erlam, and other engravers, on plates from pictures by celebrated masters. From 1750, the works of Rooker, Strange, and Woollett, as engravers, began to command attention; and, in 1752, Dalton commenced his career as draughtsman, engraver, print-seller, publisher, librarian, &c., to George III.; and, in the production of his work on Greece and Egypt, he employed the talents of Basire, Mason, Chatelain, Vivares, and others.

The engravings thus issued to the public, the action taken by artists themselves, who had now established an academy in St. Martin's-lane, the establishment of the Society of Arts, and other circumstances, ultimately led to a more general recognition of art and artists, and to the establishment of exhibitions of pictures in London, and the creation of the present Royal Academy. After the creation of the Royal Academy, the Society of Arts, which had previously paid considerable attention to painting and sculpture, directed especial attention, through its Committee of Polite Arts, to improving the arts of engraving, and the materials on which, and the ink in which, the prints were produced.

A taste for art had been developed in the minds of the people; the knowledge of and love for art continued steadily to grow, and was greatly extended by the productions of West, Reynolds, Gainsborough, Wilson, Barry, and others. So great was the success of some of those who had entered on the dissemination of prints by means of engraving, that the sanction of Parliament was obtained by Alderman Boydell, in 1804, for the disposal of his property by lottery, "he having, at that time, expended in promoting the commerce of the fine arts in this country above £350,000." *

It was soon found, however, that the cost of producing engraved works on a large scale, and of a high class, not only involved a large expenditure of time and capital, but that the expense of printing was a serious charge upon the production of largely illustrated works. It was also impossible to obtain from copper plates perfect impressions in large numbers, owing to the wear of the work in the process of printing. An enormous trade had now been created by the issue of illustrated editions of celebrated English works, and it was sought to raise magazines in public favour by embellishing them with engraved portraits, views, maps, &c.

To overcome the difficulty in the way of obtaining an increased number of perfect impressions, engraving on steel was introduced. Previous to the introduction of engraving on steel, the designs executed for the embellishment of our literature, as also many of the portraits then published, were of a decorative character; but, with the introduction of steel-plates, the ornament was given up, and a diminution in the extent of surface covered by the engraving became, in the first instance, a necessity, as steel was not only more difficult to work than copper, but the best method of acting upon it with acids had not been found out. Some of the finest examples of prints from engraved steel-plates will be found among the works of Warren, Heath, Pye, the Findens, Rolls, Lekeux, and others, and were published in the annals and other gift-books issued at the beginning of the present century. It is to be regretted that many of the best works produced and executed by a generation of artists and engravers now passed away are shut up in books which, in the present day, are all but unknown, except to collectors.

Wood Engraving.

Where a large number of illustrations were sought to be introduced into a work, the time occupied in printing tended greatly to retard publication, and we therefore find that attention was soon directed to the improvement of the art of wood-engraving, as a means of simplifying and cheapening production. This art is supposed to have been known and practised in Europe prior to 1285, having been introduced from China. Soon after engravings had become a necessary part of every book that was presented to the public, an increased amount of attention was directed to improving this art, but it did not make much progress in England until the time of Thomas Bewick, notwithstanding that the practice of lowering portions of the surface of the block, so as to graduate the tints in printing, was known.

Thomas Bewick, in 1775, received from this Society a premium of £7 7s. for his specimen of engraving on wood, and he settled in London for a short period in 1776. In 1777, he left London and returned to Newcastle, where he entered into partnership with his former master. Bewick may be considered as the introducer of the art, and he was the first to apply it with success in the delineation of animals and landscapes. The blocks cut by him, in illustration of his "History of British Birds," are some of them looked upon as his masterpieces. He was assisted in the production of many of his works by his brother John, by Luke Clennell, and others of his pupils; but though the production of the blocks had been perfected, the art of printing from their surfaces had not yet been sufficiently attended to. Several years, however, before Bewick's death, he had conceived an improvement, which consisted in printing a subject from two or more blocks, not in the manner of chiaro-scuro, but in order to obtain a greater variety of tints and a better effect than could be obtained without great labour, in a cut printed in black ink from a single block. This improvement, which had been suggested by Papillon, in 1768, Bewick proceeded to carry into effect, but before he had completed his work he had himself ceased to live. He had, however, so far proceeded with his blocks as to admit of four impressions being taken from them about a week before his death. The subject he selected for his experimental blocks was an old horse waiting for death. Bewick died in 1828, and the blocks were finished by other hands, and published in 1832.*

Many artists of ability soon rose up, and followed in the path which Bewick had so ably opened; among them were William Harvey, Robert Branston, Henry White, John Thompson, and others, whose works have become universally known in the literature of our own times.

Coloured Printing.

From the earliest times, prints from wood blocks or engraved plates have been taken in black ink, and various are the means which have been resorted to, to get rid of the coldness of effect and want of transparency due to the use of such pigments alone. In 1393, soon after cards had been first printed or stencilled, in the account-book of Charles Poupart, treasurer to Charles VI. of France, there is an entry of sixty-six sols of Paris, given to Jaquemin Grinnoneur, printer, for three packs of cards, gilt and coloured, and of different sorts, for the diversion of his Majesty. That the same desire existed in this country, as soon as engraving began to take its hold on the public mind, is evidenced by the examples exhibited. Tints and colours were sought to be employed in the preparation of prints from engraved plates, whatever the process of art might be by which they were produced, and Bartolozzi early introduced the practice of printing in warm tints from the plates engraved by him, and Boydell, in some of the plates he published, printed a mezzotinto ground in warm inks over the etching. Examples of plates engraved by Erlam, and so printed, will be found in the second volume of Boydell's plates, after pictures by celebrated masters.

In 1777, the Society of Arts rewarded Mr. Robert Laurie for disclosing his method of printing mezzotinto prints in colours, and an example of the results he obtained is before the meeting. Colour printing was soon afterwards practised both at home and abroad, and the example of mezzotinto engraving by C. H. Hodges, after a picture by P. P. Rubens, and published at Amsterdam,

* See "Annual Register," Vol. xlvi, page 366.

* See Jackson's "History of Wood Engraving."

in 1807, shows what the art had attained to at that date. The examples of fruits and flowers engraved by the chalk process show the perfection to which coloured prints and printing attained in connection with that art in France; and a further illustration is afforded by the portrait of Dr. Young, printed on satin, in this country. Of all the systems of engraving, that known as line engraving was least suited to yield satisfactory results by colour printing, but a few examples are occasionally to be met with. They appear to have been published by E. Harding, of Fleet-street.

Any process of engraving which afforded a large amount of detail within a limited surface, or which failed to yield an unbroken tint when printed from, must have proved far too costly or ineffective to admit of extensive application, as inking in the plate must have been a tedious and costly operation, and much too slow for commercial adoption. The only process of engraving which, so far as I know, ever came into general use as a source of coloured prints, previous to the discovery of lithography, was the aquatinta process, and the prints so obtained were printed in various colours, by making portions of the works, and filling in the separate colours as through a stencil-plate. This was effected by small inking-rubbers, known as thumbs and fingers, and the printing was called thumb-printing. Wiping off the surplus ink required much care, and the prints so obtained were then finished by hand-colouring, after the paper on which they were printed had dried. The "View of the Rock of Gibraltar," taken from the Devil's Tongue Battery, is a fine example of this description of coloured print; it was published in 1808.

Colour-printing has now been brought to great perfection, owing to the practice followed of printing tints from flat surfaces which are free from grain, such as lithographic stones, wood blocks, &c.; and to these I must now refer.

Lithographic Printing.

The successful production of a lithographic print depends upon a combination of circumstances, viz., the quality and surface of the stone; the skill with which the drawing is made by the artist; the nicety with which the etching process is performed; the care with which the printing ink is prepared and applied; and, in the case of colour-printing, the degree of refinement and approximation of the print to the coloured work of the artist will also depend, in a great measure, upon the number of stones employed to produce the gradations of colour required in a highly-finished chromo-lithograph.

In Germany, in which country the art was discovered by Senefelder, lithography was soon regarded as a valuable ally to engraving, and it was early practised and carried to a considerable degree of perfection; but, in England, our accomplished engravers regarded it as almost too insignificant to be heeded. It was accordingly passed by almost unnoticed in England, till the success of Hulmandel's efforts called attention to the art; and the subsequent publication of Senefelder's work in London, in 1819, drew public attention to it, and from that date the art made rapid progress, and is still daily becoming more generally used in connection with both commerce and art.

To Mr Hulmandel is due the credit of having developed in this country, not merely the capabilities of lithography proper, but also colour-printing by its means. He first applied it in copying an Egyptian painting, in which the colours were flat, and without gradation, and the outlines were printed in black ink. Mr. Owen Jones also early carried the same art to much perfection in his work on the Palace of the Alhambra, the brilliancy of colouring in which rivalled, in some instances, the painted missals of the Middle Ages; and he carried the art to a still higher point of perfection in the production of his work entitled, "Flowers, and their Kindred Thoughts;" but to Messrs. Leighton Brothers belongs the credit of having produced the first of that series of prints now known as chromatic prints, the peculiarity in the production of which consisted in the entire abandonment of black ink. The first prints so produced were published by Messrs. Rowney, in 1849, and were entitled "The Dovecot," and "A Sketch near Claines, Worcestershire." In 1850 Messrs. Hanharts produced their first chromo-lithograph. Of the large number of works so produced since, and the great improvements which have been introduced into the manipulation of the stones and colour, by Messrs. Rowney, M. and N. Hanhart, Vincent Brooks, and Dalziel Brothers, it is impossible to speak too highly; and I am enabled, by the kindness of those gentlemen, to exhibit a few specimens of their most recent productions.

The influence of the improvements effected in the art of wood-engraving and printing from wood blocks, and of lithography and litho-chromatic printing upon the older arts of engraving upon metal plates, has been such that the processes in common use fifty years ago can scarcely be said to exist now.

But while engraving has been superseded by the processes I have referred to, several new arts have been developing, the results of which, by the combined skill of men of science—artists, chemists, photographers, and mechanics, are opening to commerce new, simple, cheap, and permanent printing processes.

Surface Blocks.

I have said that commerce in art demanded in past times a higher productive power at a reduced cost; the same demand still exists. Much as the processes of production have been simplified by means of lithography and wood-engraving, still much time, labour, and cost, to say nothing of loss of artistic character and effect, too often attend the translation of the artist's design into a surface from which to print. This has led to a desire for the introduction of some process by which the artist's own sketch may be made the base from which the printing surface may be produced. In aid of this object, there are one or two processes which appear to me to be waiting a fuller development of their powers, and to be deserving of more attention than they have hitherto received in this country.

Such is the process of M. Dulos, a process almost unknown in England. It affords much force, as well as great gradation and softness of effect in the print obtained. The blocks themselves are absolute reproductions of the artist's own work, obtained by means of an amalgam of metal formed upon the drawing itself. Upon the process itself a report was issued by the Société d'Encouragement of Paris, which is published in vol. xi. of the Bulletin of that society.

The graphotype process also appears to me to be capable of much refinement in the hands of competent artists, and affords a ready means of obtaining surface blocks, from which a large amount of commercial work might be printed, in the ordinary printing machines.

Split Prints. — I may here mention, incidentally, that, as wood-block printing superseded the copper and steel-plate prints used in illustration of our literature, the practice which had been followed, in many cases, of issuing separate proof impressions, was not followed in wood-block printing, and, as a result, collectors were deprived of the facility which they had possessed for forming collections of portraits, plans, views, &c., or were reduced for a time to the necessity of introducing into such collections impressions cut from the body of the work in which the block had been published. This was but seldom done, owing to the fact that the prints so obtained were, in the majority of cases, unsatisfactory, as the type impression at the back of the wood-block generally destroyed much of the artistic effect. This has led, of late years, to the introduction of a process for splitting prints, and split prints are now mounted for collectors' folios. The specimens exhibited

illustrate the utility and advantage of the process, which is simple, certain in its action, and free from risk of injury to the print itself. The same system is now commonly applied in splitting hard papers, upon both the back and front of which drawings or etchings by eminent artists have been made.

Photography.

Photography, the process by which landscape scenery and natural objects have of late years been so beautifully rendered, has hitherto been wanting in the one important element of permanence. In speaking of photography, as I am about to do, I must not be supposed to overlook the fact that it has been, and still is, in the main, a copying process; but I believe that at the present time a new class of artistic studies is being created by its means, and new paths for the development of its powers are opening up.

It is just thirty years since the discovery by M. Daguerre of a means of fixing upon the surface of a silver plate the image obtained in the camera was given to the world by the French government. Though the results obtained by M. Daguerre were permanent in their nature, they were destined soon to be superseded by the discovery which Mr. Fox Talbot made of a means of fixing a like image upon paper. All attempts to obtain a number of prints from the daguerreotype plates failed commercially, and the power of obtaining prints by the partial transmission of light through a sheet of paper which had had an image impressed upon it by the agency of light was hailed as a great advance. Mr. Fox Talbot was not, however, satisfied with the results he then obtained. He sought a means of fixing the image upon a metal plate, so as to admit of prints being taken by the ordinary printing process. Though Mr. Fox Talbot accomplished much, and succeeded in obtaining prints from engraved plates, still, in the main, he failed to effect his object, and it was not till 1852 that the public became aware of the importance photography was likely to assume in reference to the future progress of industrial art.

In December, 1852, the Society of Arts brought together and exhibited the first collection of photographic prints, the result of French, German, and English skill; and, though but little progress had then been made in the art, it had, even at that date, been proposed to transfer the image obtained to the surface of wood blocks; "But," said Mr. Roger Fenton, in his address at the opening of the exhibition, "before sun-pictures can be extensively used in the production of letter-press, some method of copying them must be discovered which will produce as good, or better, results than the present ones, which shall be so simple in its manipulation that a workman of ordinary intelligence may be trusted to perform it, and which shall not depend upon the state of the weather for its success."

To promote a more systematic inquiry into the capabilities of the photographic art, and to aid its application to commerce and industry, the Photographic Society of London was then founded. How far the art has been advanced, and the requirements set forth by Mr. Roger Fenton fulfilled, it will now be my object to point out.

In 1853, a discussion took place at the Paris Academy, between MM. Arago, Biot, and Chevreul, as to the respective rights of Mr. Talbot, of London, and M. Niepce de St. Victor to be considered the inventors of the art of photographic engraving on plates of steel. To attain that object, Mr. Talbot had used a mixture of gelatine and bichromate of potash, which, it is stated, was modified and browned on the immediate contact of light, and only where the light acted, whilst the part covered by the object to be copied remained unchanged, and could always be removed by water. M. Niepce had aimed at perfecting the process his uncle, the inventor of heliography, described in 1827. The sensitive substance used by him was a solution of bitumen of Judea in oil of lavender. Applied as a layer, this varnish changed its properties while under the action of light. "The parts exposed to the sun became insoluble in a mixture of essence of lavender and oil of petroleum, so that they could be easily separated from the soluble part not impressed, and which represented the image to be reproduced." The liquid used by Mr. Talbot for biting in on steel was bichloride of platinum; that employed by M. Niepce was a mixture made of one part of nitric acid, eight parts of distilled water, and two parts of alcohol.

In 1851, Mr. Archer discovered the use of collodion in connection with photography. Collodion is a solution of gun-cotton in ether and alcohol. Poitevin was the first to use albumen and gelatine, mixed with the bichromate of potash, for the purpose of fixing a pigment upon paper, and thereby producing a print. Mr. Pouncy, of Dorchester, next introduced his carbon-printing process, which, although a modification of Poitevin's, was an independent discovery. He used gum arabic instead of albumen, and a porous paper into which he brushed the soluble pigmented compound. For the results he obtained, he received, in 1859, the prize offered by the Duc de Luynes, and awarded by the French Photographic Society. Since that time Mr. Pouncy has substituted oil and bitumen of Judea for the gum previously used, and he now, after exposure, dissolves out the surplus oil and bitumen by means of naphtha, and in this process of solution he is able to modify at will the force of the print. He has also produced prints on various substances, such as wood and canvas. It is owing to the combined results of carbon-printing, the collodion image of Archer, and the bichromate of potash and gelatine of Fox Talbot, with nature-printing (to which I shall hereafter refer), that the art has attained to its present position.

Gun-cotton was first introduced to the notice of scientific men in England by Professor Schönbein, of Basle, in 1849, and its solubility in ether was then alluded to. Soon afterwards, M. Le Gray, of Paris, suggested the possibility of its use photographically; but to Mr. F. Scott Archer belongs the merit of having first combined with the collodion the iodide of potassium, by dissolving it in it, thus removing the difficulties which had previously stood in the way of its use photographically. He thus became the inventor of the collodion process, an account of which he published in the pages of the *Chemist*, in March, 1851, and in 1852 he issued a small manual of his mode of operating. So important was the discovery made by Mr. Archer considered that, upon his death in 1857, a sum of money, as a testimonial fund, was subscribed by photographers on behalf of his widow and children; and upon the death of Mrs. Archer, the year following (1858), a pension of £50 per annum from the civil list to the children of the late Mr. F. Scott Archer, in consideration of the scientific discoveries of their father, was approved by Her Majesty. This was the more readily granted, as the government had become aware of the value of Mr. Archer's discoveries by the use which it was able to make of them during the Crimean War, and subsequently in connection with a series of drawings and plans executed by the Royal Engineers, in reduction of the various ordnance maps, which reductions, it was stated, had been made at an estimated saving to the country of £30,000. The prints obtained by means of the collodion negative were free from the objections which attached to printing obtained through a paper negative, as the collodion film was entirely free from grain, and much more transparent than paper; but the print obtained by its means was still of a fugitive nature.

Photo-Galvanography.—Previous to the invention of the photo-galvanographic process by Herr Paul Pretsch, no satisfactory permanent prints in carbon from plates had been obtained by means of photography, nearly all, with the exception of the daguerreotype image, being prints consisting of the salts of silver, and especially the nitrate

of silver, which had been decomposed in the body or upon the surface of the material upon which the image was produced by means of the camera; and as the visible image was developed by the combined action of several agents and reagents, it was difficult to entirely neutralise or remove them from the print, and a destructive action was constantly ready to be set up within the print itself, by the absorption of moisture by the salts of silver, or by the presence of sulphurous gases in the atmosphere, which attacked and decomposed them. To obviate this fugitive character, and to give permanence to the photographic print, was the object of many inquiries. Carbon was known to be indestructible, but how to incorporate carbon with any known substance used by the photographer, and obtain by its means the brilliancy of light and shadow seen in the silver print, was not known. The first step in the solution of this problem had, however, been taken by Mr. Fox Talbot, in the use of bichromate of potash and gelatine as an etching-ground; and the second was taken by Herr Paul Pretsch, who availed himself of the established fact that bichromate of potash and gelatine in combination, when acted upon by light, changed its nature to a greater or less degree in proportion to the intensity of the light's action; and he developed a means by which the collodion image, either positive or negative, could be impressed in the gelatine, and then converted into an image in relief. By the electrotype process he then obtained a copper plate, from which the first satisfactory impressions from carbon or printer's ink were produced. He says, in a paper read before this Society*:—"My invention consists in adapting the photographic process to the purpose of obtaining a raised or sunk design, on a glass or other suitable plate, covered with glutinous substances mixed with photographic materials, which design can then be copied by the electrotype process." The plates thus obtained by Herr Pretsch possessed many of the qualities so much desired. The image was truthfully reproduced, with all its gradations of light and shadow, and the print was permanent; but the printing surface was far from durable, and the cost of printing was a heavy charge on the product obtained. Moreover, there were many difficulties and much uncertainty involved in the production of the copper plates, and, doubtless, the want of certainty and facility of production, added to the ready wear of the surface when obtained, caused this process soon to be given up. I may add, that Herr Pretsch endeavoured to avoid the coldness of effect due to printing with black ink, not merely by using a pigment of a more agreeable tone, but he also obtained a certain amount of artistic effect, where black ink was used, by taking the impression upon prepared paper, which I may describe as a Creswick's tint, thus securing light and warmth in the foreground, a tint for the middle distance, and a sky, the want of which, in landscape photography, till recently, has been one of the deficiencies of that art.

Woodbury Type.—Nature-printing, on which the invention of Mr. Walter Woodbury is based, was discovered in this country, in 1849, by Dr. Ferguson Branson, and it became known in Austria about the same date. In Austria its great powers were first and most fully developed. It is a method of copying natural objects by embedding them in metal plates, gutta-percha, or other substances, by pressure, by casting moulds from the objects themselves, or, in some instances, partially decomposing, by means of acids, the object to be copied. Thus, a metal plate is obtained either directly or by electro-deposition, from which plate impressions can be obtained by the ordinary process of copper-plate printing. Mr. Woodbury, like Herr Pretsch, avails himself of the fact established by Mr. Fox Talbot, and employs gelatine in combination with bichromate of potash. Having obtained the photographic image in relief, by dissolving out the soluble portion of the gelatine, he imbeds the insoluble portion by pressure in a metal plate, but instead of using the plate to print from in the usual manner, he employs it as a die or seal to distribute a mixture of gelatine and carbon, the colour and amount of the carbon being regulated according to the nature of the object, and the effect sought to be obtained. Thus, after the first gelatine image has been obtained by the action of light, all subsequent prints are procured without the aid of light, by a mechanical process, and in a material indestructible under ordinary atmospheric conditions. The process has been introduced into France by Messrs. Goupil and Co. Mr. Woodbury's original communication to the Photographic Society of London, in 1865, as also a second paper on the same subject read, during the present year, will be found in the pages of the Photographic Society's *Journal*. In England, the process has been carried out under the superintendence of Mr. Woodbury himself. The prints obtained by this process are full of vigour and rich in colour, the gradations from light to shadow are delicate, and the texture and surfaces of objects are rendered with all the truth and precision observable in an ordinary photograph. This process has rendered photography an available and permanent commercial product, the impressions being obtainable in our climate, and as readily printed, during the fogs of November, as prints from an ordinary type.

Autotype.—Mr. J. W. Swan, of Newcastle, simultaneously with Mr. Woodbury, was engaged in working out a method of printing in gelatine and carbon. Mr. Swan's investigations were, however, chiefly directed to the preparation of the gelatine film, for the purpose of producing each impression in it by printing from the ordinary collodion negative by the action of light, dissolving out with warm water those portions which had remained unchanged after exposure of the gelatine under the negative image. The perfection to which Mr. Swan has carried his process is evidenced by the extensive series of works which have been produced, both in England and France, by its means. The French specimens are, many of them, *fac-similes*, in every conceivable colour and style, of drawings by celebrated masters, and are known and published in this country by the Autotype Company as autotype drawings. In carbon printing, by Mr. Swan's process, the film of gelatine and carbon is prepared of sufficient thickness and density to be practically opaque when placed upon white paper. The greatest depths of shadow in the picture result from the greatest thickness of the film remaining after the printing process has been performed; and so relatively with every succeeding gradation of tint, as, the thinner the film remaining after the excess of gelatine and carbon has been dissolved out, the brighter will the lights appear, and the white paper will become more and more apparent till it approximates to pure white light. The pigment employed may be of any desired colour or tint, as is illustrated by the examples referred to. Prints of any desired dimensions are readily produced. The preparation of the gelatine and carbon film has been the subject of many interesting experiments; and Mr. J. R. Johnson, of the Autotype Company, has now rendered the manufacture so uniform, and its action so reliable, as to justify the expectation of its being shortly supplied to the public in sheets, for the general use of photographers, in place of the paper hitherto employed. Mr. Johnson has found that, in order to fix a pigment print upon its permanent or temporary support, it is only necessary that the support should be impervious to air or water.

Thus, it will be seen that gelatine, since 1840, when Mr. Fox Talbot used it in combination with bichromate of potash as an etching ground, has played an important part in most of the recent processes which have had for their object the obtaining of permanent prints, but in the cases enumerated, secondary processes have been employed. Both Mr. Swan and Mr. Woodbury substitute gelatine and carbon in combination for the paper used by Mr.

* See *Journal*, vol. iv., p. 385.

Fox Talbot, and thus secure prints in a permanent material, but the prints so obtained have to be cut and attached to the paper mount on which they are issued to the public; and, simple as this process may appear, it was for a time a source of much difficulty and cost.

More recent investigations have led to a further development of the powers of this wonderful compound substance, and, at the present time, the tendency of investigation seems to point to the early rejection of all secondary processes, and the possibility of printing in carbon direct from the gelatine image itself; indeed, prints so produced are before the meeting.

Photo-lithography.—Many attempts have been made to obtain carbon prints by means of photographs transferred to the lithographic stone, and printed in ordinary printer's ink. Such attempts have not hitherto yielded thoroughly satisfactory results.

It must be borne in mind that a photograph is the result of the action of light upon the entire surface of whatever object is sought to be copied by its agency, and that the resulting picture is an ever-varying gradation from light to shadow. If, therefore, we attempt to transfer the image to the lithographic stone, we can only do so by giving the stone an affinity for greasy matter wherever light has acted in the production of the photograph, which is over every part of its surface, and this is at once inimical to the production of a picture, as the stone, having an affinity for the oil of the ink, will not take it up in the same variable proportions in which light has acted in the decomposition of the silver salts. To overcome this difficulty, many methods of breaking up the masses of light and shadow have been resorted to, some by giving an artificial grain or surface to the stone, others by interposing an artificial surface between the photograph to be printed and the stone itself, thereby printing upon the stone only portions of the photographic image. The necessary result of such processes has been to destroy much of the natural drawing and character of the object represented, and, at the same time, to reduce the force of the shadow and middle tints, rendering the print grey and flat in effect.

It must, at the same time, be admitted that much has been done by photography to aid the production with facility of photo-lithographs, rendering a comparatively small amount of hand-labour requisite to their finish, as will be seen by reference to the early examples of French photo-lithography, and the more recent productions by M. Lemercier, of Paris, whose fine examples will be found exhibited in that section of the collection on the walls. I am also able to show some English examples produced by Messrs. Bullock and others.

Though photo-lithography has hitherto proved its inability to produce satisfactory artistic examples, it by no means follows that, in other directions, it has not been more successfully applied. Much has been done in Australia, by Mr. J. W. Osborne, and in England, by Sir Henry James, by means of photo-lithography and photo-zincography; and where flat objects have been copied, and the texture of fabrics sought to be rendered, the most perfect success has been attained, as will be seen by examining the photo-lithographs of Indian shawls and other fabrics, prepared by Mr. Griggs, in illustration of Dr. Forbes Watson's work on "The Fabrics of India."

Mr. Griggs has also applied photo-lithography successfully to the production of photo-chromo-lithographs. In the production of the example exhibited eleven printings were involved, and the character of the fabric copied is most faithfully and minutely rendered. Photo-lithography and photo-zincography have also been, and are still, extensively used in the production of maps, plans, &c., and with highly satisfactory results; but it is of the artistic aspect of photography that we have this evening more especially to speak.

I must now return to the subject of prints from gelatine, as allied to photo-lithography. They result from two of the most important, as well as the most recent, discoveries which have been made in reference to the reproduction of prints from photographs, and that in a permanent form, viz., M. Tessier du Motay's process—an account of which was first published about eighteen months since—and Herr Albert's process, known as the Albert-type process, for the first account of which, as well as the first examples of the process published in this country, we are indebted to Mr. G. Wharton Simpson.

The Phototype.—M. Tessier du Motay's process is said to consist in the use of a thin film of gelatine and bichromate of potash spread upon a bed or plate of copper or zinc. The film, when dry, is exposed to the partial action of light under a negative photographic image, which renders those portions acted upon by light insoluble. The negative photograph is next removed, and the gelatine is placed for two or three hours under a fine stream of cold water, after which it is dried, and is ready to print from. The surface of the gelatine, before each print is taken, is sponged with a wet sponge, as in the ordinary lithographic process, and the soluble portion of the gelatine takes up the water, while the insoluble repels it. The film is then inked as in lithographic printing, and the print is pulled in the usual way. In some cases the impression is transferred from the gelatine film to a lithographic stone, or to a plate of zinc, which is then used to produce any number of impressions, but these are not so fine as the impressions taken direct from the gelatine. Blocks which may be printed with type may also be obtained by this process. Through the kindness of M. Arosa, of Paris, by whom the process is being worked on a considerable scale, I am enabled to place before you a large number of examples of the results obtained. The process appears to be especially suited for the reproduction of architectural subjects and of sculpture, and for rendering in fine detail porcelain bodies, and no better studies of ornament could be desired to be placed before the student in art than the examples, prints of which are exhibited. The prints from the sculptured decoration of the column of Trajan, the altar of the twelve gods, and others of the examples exhibited, have not yet been published, nor, I believe, have they ever been seen by the public in this country till this evening. It is a source of much gratification to me to be able to lay before the meeting specimens produced by a process which will no doubt excite considerable interest among all lovers of reproductive art in this country.

The Albert Type.—Herr Albert's process is said to be similar in many respects to that last described, but differs in respect of the bed upon which the film is placed, and which is stated in this case to be glass. It is also asserted that two films of gelatine are now used instead of one only, the first film being combined with albumen, in addition to the gelatine and bichromate of potash, and rendered insoluble by the action of light. After drying and exposure, a second bichromatised film is poured upon the first, and, after drying, it is exposed under the negative photographic image, and the negative having been removed from the gelatine block or surface thus obtained, it is inked, and used to impress the image on to paper, not in a lithographic press, as in the former case, but after the manner of block printing, the surface of the gelatine being turned down on to the paper, and pressure applied as in an ordinary copying-press. The entire absence of grain in the impressions obtained by means of this process, the perfect gradation from light to shadow, the force of the shadows, and the fact that the prints are rendered in permanent pigments, give to this process considerable importance and value. But, in order to obtain satisfactory impressions by it, it is necessary that the surface of the paper should be as fine and free from grain as possible, and the character of the ink employed must be varied with the nature of the print desired to be obtained. Here I may add that the question of lithographic inks and their preparation is

too frequently disregarded when speaking of the lithographer's art. Much of the variety of tone and artistic effect is due to the inks used.

Mr. G. Wharton Simpson states that the specimen portrait presented by him to the subscribers to the *Photographic News*, is one of a series of eight copies of the same photograph printed at one operation; and further, that the twelve presses employed by Herr Albert are equal to the production of 12,000 copies daily. I must not, however, conclude this reference to the Albert-type process without calling attention to the examples which were recently exhibited at the exhibition of the Photographic Society, just closed, and which, through the kindness of Mr. John Spiller, the Secretary of that Society, I am permitted to place before you. The specimens were expressly forwarded to this country from Munich, by Herr Albert, for that exhibition, and show the extent of surface to which the process has already been applied, as well as the degree of force obtainable, and the gradation from light to shadow yielded by the process.

Such are some of the processes which have been introduced and are at present used in copying natural objects, the drawings of artists, and in the production of original works of art.

Photographic Surface Blocks.—At present I have said little as to the photographic processes which have from time to time been proposed to supply us with illustrations for our literature in the form of surface printing blocks. Many processes have been proposed, though but few have been successfully applied. Here, again, photography appears to come in, in aid of the object sought to be attained, with what success I am able to point out by the illustrations which are exhibited, but with the details of the processes I am not personally acquainted. The most successful processes appear to be those produced by Mr. W. J. Linton, and described as a new process for engraving for surface-printing and electro-photography, or etching on glass, both which processes are claimed to be based upon Mr. Charles Hancock's system of copying drawings, engravings, or printed matter, and of enlarging or diminishing them. In reference to the blocks produced by these processes, it is stated "that the drawings may be made in two ways, either directly upon a prepared surface of glass, or with black ink upon white paper, in which case the drawing must be reversed. When the drawing is made upon the glass with an etching needle, the glass is specially prepared with collodion, but when made upon paper it has to be copied, that is, photographed on to glass in the usual manner. The drawing is next photographically printed upon a prepared surface, and from this photographic impression an electro-plate is made, which preserves, in the most minute particulars, the lines of the original drawing. From the electro-block so obtained, any number of impressions can be printed with letter-press in the same manner as wood engravings now are." The cost of preparing electro blocks by these processes is stated to vary from 1s. 6d. to 3s. per square inch.

Composition Photographs.

Let us return for a moment to the subject of photography proper. It may be urged by some, that it is, after all, only a copyist's art, and, as such, has many limits placed upon its powers which the skill of the artistic draughtsman overcomes, but which the photographer cannot overcome. To this I would reply, by admitting that there is much in nature and in art which photography cannot be expected to copy. Mind acting on matter may change the condition under which natural objects are represented, but the camera cannot alter the condition under which nature is seen. Nevertheless, we must not come to conclusions too hastily as to the unfitness for, and inability of, the photographic artist to create by means of photography as the artist does with his pencil and brush. Composition pictures have already been executed by some able artists, both from natural objects and human models, as well as copies of drawings executed by artists for the express purpose of reproduction photographically. The earliest composition photograph was produced by Mr. O. G. Rejlander, being a picture entitled "The Two Ways of Life." It was produced in 1857, for exhibition at Manchester, and the means employed in its production and the picture are fully described by its author in the pages of the Photographic Society's *Journal*, April 21, 1859. The picture consists of thirty figures and a back-ground, and was conceived and executed in six weeks. Each portion of the picture was separately photographed, and then the whole of the parts were printed in their respective positions, and were harmonised at the various points of junction by acting upon the sensitive paper by means of pencils of light.

Such was the first attempt at photographic composition; and I am able, through the kindness of Mr. Rejlander, and his friend Mr. Greenwood, of Liverpool, to whom the print belongs, to exhibit one of the original prints of that work.

Since Mr. Rejlander's picture was produced, we have had several works of a similar nature, and of great merit, presented to the public, among which, those from the studio of Messrs. Robinson and Cherrill claim priority, both as to date of production, and number and variety of subjects. Mr. Robinson's first picture was issued in 1858, and was entitled "Fading Away." The subject was selected as being eminently unsuited to rendering by any ordinary photographic treatment, and was intended to illustrate the fact that other conditions than those of actual life could be illustrated by its means. This picture was soon succeeded by others, and much adverse criticism followed, based upon ignorance of the means of their production. To correct mistaken notions, and inform the public as to their mode of production, Mr. Cherrill, in January last, read a paper before the Photographic Society, on the "Production of Composition Pictures," which paper will be found in No. 201 of that Society's *Journal*.

Messrs. Robinson and Cherrill have produced several most artistic works, some of which I am enabled, through their kindness, to exhibit this evening. The three pictures entitled "Returning Home," "The Sleepers," and "Over the Sea," show to what perfection they have now brought the art.

But fresh competitors are daily coming forward to claim the patronage of the public in this direction. Mr. J. Hubbard has issued two or three pictures, one entitled "Blighted Hopes," another, "Stolen Moments." Of the artist's skill in the treatment and lighting of his subjects it is impossible to speak too highly; they are bright and full of colour, at tho same time that they are quiet, and the tale they are intended to tell is easily read and full of interest. The pictures, by the kindness of Mr. Hubbard, are exhibited.

The last work of this class to which I have to refer is full of interest from many other points of view. It is not only the last of the class produced, but it is also one of the largest. It also possesses an historical interest, and its interest is enhanced by the fact that the principal actor in the scene represented has recently passed away. Mr. McLachlan has just presented to the public a large picture, which includes portraits of all the members of the late Famine Committee which held its meetings at Manchester; of that committee the late Earl of Derby was chairman.

I have thus endeavoured to show that the artist photographers not only have the will but the power of creating for the public works which possess the richness of colour, and pictorial and artistic effects which have hitherto alone resulted from a laborious study, and translation of nature on to canvas by the artist painter.

Conclusion.

From what I have said, it will be seen that we have

now attained to a knowledge and use of the following modes of producing prints :—

1. By means of incised or indented surfaces, the design is produced in relief by pressure, and without colour of any kind.

2. By means of incised surfaces, a series of white lines upon a dark or coloured background are obtained by inking uniformly the entire surface of the block, and then removing the ink on to paper by pressure.

3. By means of raised surfaces, as in printing types and most wood-blocks, in which the design alone is capable of being inked, such surfaces yielding impressions in black or coloured inks, by means of pressure.

4. By means of incised metal plates, the incisions in which are charged by rubbing into them one or more black or coloured inks, and then carefully removing all the superfluous ink from the surface of the plate, after which it is covered with paper, and pressure applied.

5. By using the lithographic stone, and giving one portion of the surface of the stone an affinity for greasy matter, while other portions of the same surface are made to repel it; thus, when ink is applied and afterwards removed by pressure, flat tints or prints from simple lines are procured on the paper.

6. By using a series of surface blocks or lithographic stones, either separately or in combination, from which surfaces various tinted inks or gradations of colour are printed either separately or in combination, as exhibited in illuminated printing and chromo-lithographs.

7. By the photographic process, in which light, by acting upon the salts of silver or other bodies, decomposes them, and the image obtained in the camera is then fixed by subsequent chemical treatment.

8. By a combination of the lithographic and photographic processes, as illustrated by Mr. Griggs' specimen prints of Indian fabrics.

9. By a mechanical distribution or sealing of a mixture of carbon and gelatine, as in Mr. Walter Woodbury's process.

10. By the preparation of a uniformly dense film of black or coloured carbon and gelatine, and then submitting the film to the partial action of light, thereby fixing and changing the condition of some portions of the film, while other portions remain unchanged, and are subsequently dissolved or melted out.

11. By using the gelatine after it has been chemically prepared and submitted to the partial action of light, as a matrix which is inked and printed from in a manner analogous to the lithographic process.

Let me now direct your attention for a few moments to the prints which are still produced by the processes in use a century since. Engraving for literary and commercial purposes, I have stated, has been superseded by newer and cheaper processes of production; but from the first introduction of the art of engraving to the present time, there have been examples of higher aspirations by both artists and engravers, and greater powers of production than were needed for book illustration. But illustrations of literature, though, in the main, of a lower type than the examples of art products I refer to, still served a useful purpose—they formed the training-ground on which young and fresh aspirants for fame tried their skill, and learned to manipulate their tools and materials. I regret that that school or training-ground no longer exists; and though I feel that the productions of the artist and engraver have, up to the present time, not been excelled or superseded by any of the new art-products hitherto produced, still, I cannot fail to observe that it is probable that, at no remote period, engraving, like miniature painting, will have been swept out by the advances which the art of photography is now making. Let us hope that the result may, in the end, be favourable to the advancement of public taste. But so long as the art of engraving does exist, it is to be regretted that unprincipled persons, skilled in the practice of modern arts, are to be found, who, by copying the works of the artist and engraver, which have been produced at great cost, and, following in the steps of the hawkers of Hogarth's time, undersell the original producer, and thereby rob him of his just reward.

Hogarth found his works, as soon as published, pirated on all hands, and the Copyright Bill of George the Second's reign was passed to secure to the artist an exclusive right in the work he had created, and, till a recent date, that right had not been materially jeopardised. But, within the last few years, piracy has become so common among us, by means of photography, that the patrons of art are likely to be deprived of works such as those now produced by Landseer, Cousins, Doo, and others, by the withdrawal of the capital and enterprise which has hitherto been invested in their production; and it is only just to such persons as Mr. Graves and others that their property should be protected by an improved copyright law—a law such as the Society of Arts has been for the last two years endeavouring to introduce to the notice of the legislature, and under which the artist and photographer separately, or in connection with the capitalist, would have their rights defined and protected, and we might then look for a fresh and extended development of commercial enterprise and art-patronage.

I feel that I owe you some apology for having detained you so long. I may perhaps be open to the charge of being an enthusiast, and of attaching more importance to reproductive art than the subject merits. But, if so, the fact is easily accounted for. My boyhood and early youth were spent amidst engravings—for many of you are probably familiar with the works of my late father, who was a contemporary of Finden, Heath, Lekeux, and other eminent engravers. Many of his productions are before the meeting. I was myself educated for the same profession, and before I became an officer of this Society (now more than twenty-five years ago) I practised the art for some time. Indeed, I may mention that I was one of the first to produce, by electro-deposition, copper-plates from engraved steel-plates.

These facts must plead my justification for what I have said; and it will appear not unnatural that I should continue to take a warm interest in every new process that may promise to give greater facilities to reproductive art and thus to increase the means of affording one of the purest and best sources of gratification, not only to the rich, but to the people at large.

The Chairman said the usual custom was, that after a paper had been read it should be discussed, but on the present occasion he was inclined to think that there was a great deal more to see than to talk about, and, therefore, instead of the meeting resolving itself into a committee, to consider the many different printing processes of which Mr. Davenport had spoken, and the numerous points he had raised, he thought it would be a wiser employment of time if they confined their attention to examining the numerous interesting specimens which were displayed around the room, as well as in the library below. During the time Mr. Davenport had been speaking he had made a few notes, with a view to comment upon the paper, but he felt that any one point contained matter enough for a whole evening's discussion, and he had no doubt that, in the course of a fortnight, there would be several pages of *Notes and Queries* devoted to calling Mr. Davenport's attention to matters which he had omitted to mention, and doubtless a sufficient reply would be given. They must all agree that they owed great thanks to Mr. Davenport for the patience and industry he had displayed in collecting his materials, which were really so voluminous that almost a whole session might be taken up in this discussion. With regard to wood-cuts, having known something about them for the last forty years, he could not help thinking that Mr. Davenport was wrong in some of his conclusions with respect to them, as, for instance, when he said that the art was in the same state now as when Bewick left it. His opinion was, that it was quite the reverse. But if

he were once to begin the discussion, he should not know where to stop. He thought, therefore, they could not do better than confine their attention to the interesting specimens Mr. Davenport had collected.

Mr. S. J. Mackie suggested that, if the arrangements of the Society would permit, the valuable collection of engravings and prints might, with great advantage, be left open for a day or two, in order that persons interested in the subject might study the different specimens more completely than was possible at that hour, and in so crowded a room. The great value of such a collection was, that it displayed the history of the art in its various phases; and this could only be studied at leisure, so as to compare the results obtained by different processes.

Mr. Seymour Teulon said he cordially agreed with the suggestion which had just been made, that the collection of prints, engravings, and photographs should remain open for inspection for such a time as would allow the members to examine them at their leisure; particularly as it must be remembered that the room on the ground-floor contained many specimens equally worthy of attention. He would conclude by moving a cordial vote of thanks to Mr. Davenport for the great labour he had taken in bringing together so large a collection of art-specimens, and for the information and instruction he had given in his paper.

Lord Henry G. Lennox, M.P., said it required no words from him to second the motion which had just been proposed by his colleague, Mr. Teulon, but before the meeting proceeded to examine the various interesting objects around them, he was happy to be able to inform them that, in accordance with the suggestion which had been made, the pictures would remain in their places for a few days, during which time they might be examined by the members and their friends.

The motion, being put by the Chairman, was carried unanimously.

Mr. Davenport thanked the meeting for the kind manner in which they had received his paper. He should be very happy to allow the collection to remain for a few days. But, before they separated, he must be permitted to suggest that a vote of thanks should be passed to the various gentlemen who had assisted him with the loan of pictures, and in the other ways which he had mentioned in the paper.

A vote of thanks was then passed to the following gentlemen, to whom the author of the paper was indebted for the loan of various interesting examples, and for other kind assistance:—J. Forbes Watson, Esq., M.D., Reporter on the Products of India to the Indian government; John Spiller, Esq., Hon. Secretary of the Photographic Society of London; G. Wharton Simpson, Esq., John T. Taylor, Esq., O. G. Rejlander, Esq., Henry Greenwood, Esq., John Pouncy, Esq., J. W. Swan, Esq., J. R. Johnson, Esq., Walter B. Woodbury, Esq., M. Arosa, of Paris; M. Lemercier, of Paris; G. W. Yapp, Esq., of Paris; W. Griggs, Esq.; Messrs. Rowney and Co., Messrs. M. and N. Hanhart; Vincent Brooks, Esq., Messrs. Robinson and Cherrill, John Hubbard, Esq., Valentine Blanchard, Esq., J. Dallas, Esq., and Messrs. Graves and Co.

In the course of the evening, Mr. Pouncy, jun., attended, and practically demonstrated his father's process; and the autotype process was also shown in operation by the kind permission of the directors of the Autotype Company. Mr. Griggs, by permission of the Indian Government, attended, and printed in gold and colours specimens of a photo-chromo-lithograph from ten stones.

Proceedings of Institutions.

Hertford Local Educational Board.—The annual distribution of prizes and certificates obtained at the last examination of the Society of Arts, in connexion with the Board, took place on Friday, December 3rd, at the Town Hall, Hertford. The Hon. Henry R. Brand, M.P., presided. The report, read by the secretary, showed that the number of candidates who this year had come up for examination was considerably in advance of former years, and that the efforts of the Board to promote education in the outlying and rural districts have been successful. Of the seventy candidates, five had come up for the final examination, four obtaining certificates. The meeting was addressed by the Chairman, on the general advantages of education; by Robert Dimsdale, Esq., M.P., Chairman of the Local Board, on the work the Board had been doing during the year; by W. G. Larkins, Esq., of the Society of Arts, who explained the scheme and object of the Society's examinations; by R. Baker, Esq.; and by the Rev. E. H. Bradby, of Haileybury College.

INSTRUCTION IN SCIENCE AND ART FOR WOMEN.

Professor Huxley's lectures on "Physiography" conclude on the 17th of this month. Numbers eight and nine were delivered at South Kensington last Friday and Tuesday. Following those upon "Protoplasm," these have been devoted to the explanation of the variations which occur in the weather, due to the effect of the sun's heat upon the atmosphere encircling the world. It is sincerely to be hoped that the whole course of lectures may be published at some early period. They will form not only a valuable addition to standard educational works, but will be a most interesting volume for general reading. Elucidation, given in the simplest form, of phenomena hitherto comprehensible only to the limited circle of interested philosophers, would be welcomed by all. The following are the notes for lectures eight and nine:—

Lecture VIII.

1. The ultimate conditions of the circulation of the watery and solid matters of the earth are heat and light. The great source of these, outside the earth, is the sun.

2. The sun is a globe, the surface of which consists of gaseous matters, by and through which it radiates its heat into space. Its diameter is more than a hundred times that of the earth, and its bulk more than a million times as great as that of the earth. The distance between the earth and the sun is about eleven thousand five hundred times the diameter of the earth; or a hundred and eleven times that of the sun. The sun turns round on its axis, the ends of which are its poles, once in twenty-five or twenty-eight days, and its surface is measured by imaginary meridians of longitude and parallels of longitude.

3. The earth is also a globe (rather less than 8,000 miles in diameter) the surface of which consists of gaseous matters, by and through which it radiates its heat into space. The earth turns round on its axis once in twenty-four hours. The terms poles, meridians, and parallels, have the same meaning as in the case of the sun.

4. The surface of the earth which faces the sun at any time gains more heat than it loses, and is illuminated. The opposite surface simply loses its heat and is dark.

5. If the earth and the sun had no motion relatively to one another, and if the earth were all solid, and did not rotate upon its axis, the hemisphere which happened to be turned towards the sun would be intensely hot in the middle, cooler towards the circumference, while the opposite hemisphere would be intensely cold. If there were no atmosphere, the contrast of climate would be less intense, and cold winds would blow, from all points of the compass, directly towards the middle of the hot hemisphere.

6. If the earth now began to rotate on its axis, wha

would happen would depend upon the direction of the axis.

(*a*) If the axis coincided with a prolonged radius of the sun, the only change would be in the direction of the winds.

(*b*) If the axis were perpendicular to a prolonged radius of the sun, all points of the surface at equal distances from the poles would be equally warmed and equally illuminated. The poles would be coldest, and the winds would be directed obliquely from the poles towards the equator.

(*c*) In any intermediate position, the parts of the surface at equal distances from the poles would be unequally warmed and illuminated; and one pole would be in everlasting darkness and cold.

As a matter of fact, the axis of the earth is in the position (*c*), but no part of the earth's surface is permanently dark and cold.

Lecture IX.

1. The earth moves round the sun once in three hundred and sixty-five days and a quarter; and its path, or orbit, is almost circular. The positions of the earth's axis, in all parts of its orbit, are parallel to one another; hence the pole which is at one time directed towards the sun is at another turned from it.

2. The climate of any place on the earth's surface is determined primarily by the lengths of the days and nights, and the relative duration of the seasons; and these, again, depend upon the latitude of the place.

3. Secondarily, climate is determined (*a*) by the nature of the surface, whether water or land, and if land, by the height of that land; (*b*) by currents of air; (*c*) by currents of water.

4. Land surfaces tend to have an extreme climate, water surfaces, a moderate climate. In all parts of the world, snow lies all the year round upon land elevated above a certain height. This height is the level of the perpetual snow line.

5. Currents in the air modify climate by transporting heat and water vapour from one place to another. Over a large part of the surface of the earth the winds are nearly constant in their direction.

6 Currents in the sea transport heat from one place to another. They are caused partly by the unequal heating of the sea, partly by winds. Over a large part of the surface of the earth the ocean currents are constant in their direction.

INTERNATIONAL CONFERENCE ON ART EDUCATION.

The conference held in the council room of the Palais de l'Industrie, and which has been already briefly referred to in the *Journal*, was, as already stated, organised by members of the Union Centrale, in conjunction with a certain number of representatives of other countries than France, present or absent.

The bureau was composed as follows:—President—M. Louvier de Lajolais. Vice-President—M. Paul Bénard, architect. Presidents of honour—M. Guichard, President of the Union Centrale; Henry Cole, Esq., C.B. (representing Great Britain). Vice-Presidents of honour—Baron de Schwarz (Austria); M. Canneel, Director of the Royal Academy of Ghent (Belgium); General Novitzki (Russia); M. Baümer, Professor of Architecture at the Polytechnic School of Stuttgard (Wurtemberg); M. Sajou, Vice-President of the Union Centrale. Secretaries—M. Ernest Lefebvre, lace manufacturer, secretary of the committee for the organisation of the exhibition of the Union Centrale; M. Camille Minoret, officer of the Academy of France, secretary of the consultative commission of the Union Centrale; M. J. Grangedor, professor of drawing, Paris. Secretaries-adjoints—M. Rousel, lace designer; M. Victor Lefebvre, professor of sculpture at Brussels. The above list will show that the basis of the conference was in every sense a broad one.

The attendance, during six or seven days, did not flag in the slightest degree, the largest room in the building being filled to the very last day, although the conference sat for several hours each day. Amongst the strangers present were M. de Schwarz, M. Canneel, General Novitzky, and Baümer, already named; M. V. Lefebvre; Mr. G. W. Yapp, of the English press; M. Engelhorn, editor of works on art, Stuttgard; MM. Brocard, Divigne, and Willems, Belgium; MM. Devers and Mazzuchelli, Italy. The adhesion of the following gentlemen was also officially announced:—M. de Lutzow, professor at the Ecole des Beaux Arts, Vienna; M. de Steinbeis, President of Commerce and Industry, Wurtemberg; M. de Kreling, Director of the Ecole des Beaux Arts Appliqués à l'Industrie, at Nuremberg; M. Essenwein, Director of the Musée Germauique, Nuremberg; M. Pecht, art critic, Munich; M. Grunow, Director of the Musée des Arts et Metiers, Berlin; Mr. Lubke, art critic, and M. Froschel, professor of drawing, of Berlin; M. Krombholz, professor of drawing at the Ecole des Arts-et-Metiers, Dresden.

The proceedings consisted in the discussion of four subjects, or rather divisions of the subject, of art instruction and industrial art, and the adoption of certain resolutions and memoranda, under each of these heads:—

1st. Of the character and conditions of modern productions in industrial art, the congress is of opinion:—1. That the dominant artistic character of contemporary production is essentially unsettled, on account of ill-advised over-production. 2. That the necessity for the production of large quantities of articles, in great variety, and at low prices (the introduction of machinery and division of labour) is, in general, in contradiction with the true sentiment of art in the objects produced. Also, 1. That an exaggerated value is attributed to organisation, to the detriment of individual action. 2. That apparent material perfection and the admiration for details are sought for, to the detriment of general harmony. 3. That the discoveries of science are often applied without sufficient comprehension.

2nd. Of public taste and its influence on production, and the means of developing and improving it, the congress considers that public taste is the reflection of the intellectual and moral condition of society, and that the principal causes of its insufficiency and fickleness are:—1. The tendency to make the sentiment of art subordinate to the material perfection of workmanship; and 2. The general tendency towards apparent rather than real qualities. These causes united necessarily exercise a deplorable influence on production, and the congress is of opinion that the only mode of remedying such a state of things is the introduction of a new, general, and complete system of education in matters of art, which shall propagate the soundest notions in all classes of society.

3rd. Of the actual organisation, and of the development to be given to the study of the arts of design; of the direction of such study; of professors, of methods, and of examples or copies; the congress is of opinion that the actual organisation of such instruction is not on a level with the wants of the age, because.—1. The examples which tradition furnishes are not sufficiently known, and generally badly interpreted—their spirit is misunderstood for want of education. 2. The study of nature is generally insufficient and ill-directed.

The congress declares:—1. That preparatory instruction in drawing should be introduced in primary education. 2. That the development of the sentiment of art should be commenced in early youth, by the beautiful in all its forms being daily presented to the child's eye. 3. That greater and entirely new importance should be given to museums of instruction in villages as well as in towns.

The congress is of opinion that instruction in drawing should form a part of the obligatory programme of

primary instruction. It desires to express its profound conviction that in art-education there should be no division; that the unity of art should be the only law and principle of instruction.

Primary Education.

The congress cannot recognise the present principle of primary instruction, which is limited to the servile and textual imitation of copies. It is of opinion that the pupils in the common schools should, from the very outset, have placed before them those elementary geometric models which constitute the alphabet of form, as well as the simplest common objects. The congress also recommends the oral explanations of the teacher as indispensable.

Secondary Education.

The congress finds the present system of secondary instruction objectionable, on account of the abuse which is made of drawing copies; and it declares it to be its opinion that intellectual interpretation (the reduction or amplification of the model or copy), reproduction from memory, and choice of the modes of execution, should take the place of literal and servile copying.

Professional Education.

With respect to professional instruction, the congress expresses a desire that in the schools general instruction in art should take the place of any industrial application to meet a special demand. It cannot but regard all premature workmanship as dangerous to art, and injurious to the pupil's future career.

General Questions—Professors, Methods, Models.

Professors.—The congress recommends the extension of instruction in drawing in the normal schools, under special professors, for primary teachers. It asks consequently for the formation of superior normal schools for the education of professors.

Methods.—The congress does not recommend nor prescribe any particular method; but it would guard against all those in which the employment of mechanical and abbreviated processes dispenses with the direct, personal, and attentive observation of the pupil.

Models and Copies.—As regards copies, the congress condemns the employment of printed copies, which possess the serious fault of substituting the study of picturesque effect, which is but an accidental character, for that of form, which is a permanent one.

4th. On comparative examination of the experiments tried in various countries to the present time, with the view of furthering the progress of industrial art, the development of public taste, and the improvement of instruction in the arts of design, the congress recognises with satisfaction:—1. That during the last few years there has been an awakening of public opinion, which has directed civilised nations towards the extension and progress of art industries, the improvement and generalisation of instruction in the arts of design, and the development of a taste inseparable from an action favourable to morality. 2. That, under the influence of this excellent spirit, efforts have been constantly made by governments, societies, and individuals, which have already given rise to the creation of important institutions—schools, societies, museums, &c.

The congress is of opinion:—1. That it is important to give effect to the proposition made at the time of the Universal Exhibition of 1867, and approved by all the honorary presidents of the international commissions, to the effect that each country should cause copies to be made of the artistic objects in its possession, and endeavour, by all possible means, to make them known and used in other countries. 2. That serious endeavours be made to improve the condition of professors devoted to instruction in the arts of design, because upon that condition depends essentially the quality of such education.

It is understood that the council of the Union Centrale is now occupied with the consideration of the means by which the measures above indicated may be carried into effect, and it is believed that the efforts of that society will not be in vain.

WHAT ART AND SCIENCE IS GIVING TO DEFENSIVE AS AGAINST OFFENSIVE WARFARE.

Mr. Edwin Chadwick, in his address, on opening the winter session of the Association for the Promotion of Social Science, in stating the subjects for the consideration of the Department of Economy and Trade, adverted to the means of economising the expenditure for war, and said:—

"I was recently at the International Statistical Congress at the Hague, and, with the kind assistance of the Dutch authorities, I was enabled to call the special attention of the governmental delegates, the economists and statists of Europe, to the need of examining the means of economising the oppressive expenditure of some hundred and eighty millions sterling of money for keeping some three millions of men under arms in camps and cantonments. The means of economising that expenditure, which I had to submit, were chiefly bringing men only for a short time under colours for military causes, allowing them to be occupied to the greatest extent in productive industry, and transferring as much as possible from the productive adult stages to the non-productive school stages of life, all military training and exercises. In the general principles propounded, and in the large position of the question, I had cordial support from the government delegates of the United States, Holland, Belgium, Switzerland, and Sweden. Prussia and France were conspicuous for their absence.

"But the question concerns the people of France more perhaps than any other in Europe. I was enabled to submit, on that occasion, one great question which has to be made known and publicly discussed as an economical question—namely, the gain from advancing science of the power of defence over the power of offence. Discussing this question with the late Captain Fowke, whose military as well as other science will be appreciated by those who knew him, he admitted that, whilst the new science gave one to offence, it gave more than two to defence. The advances made since his time in the increase of the range and of the power of arms, appeared to me to warrant the conclusion that science gives three to defence for one to offence. But I have since been told that I understated the extent of the change made. I will give it, as I have since been enabled to collect the military opinion now prevalent at the French camp at Chalons, and military opinion elsewhere in France. I submit some of the details for the information of our volunteers.

"At the sitting of the Legislative Assembly, in the discussion on army organisation, on the 20th December, 1867, Colonel Regius, a veteran of the wars of the First Empire, said—'When the range of the musket was 250 metres, and its discharge one ball a minute, and the time of a column of attack in traversing that distance was four or five minutes, although we lost men in doing it, we did it; but now, with the new arms, the range is 1,000 metres, and the rate of discharge is seven or eight a minute, and a column of attack will be exposed for fifteen or twenty minutes to the fire of the enemy in getting over that distance; the column must be annihilated before it could get to the enemy.' The common practice in France with the chassepot by the rank and file is that, at 1,000 metres, one out of five shots hits (which is a great advance upon the old musket), that at 400 metres nearly two out of five, and at 200 metres more than three out of five hit. As an example of a trial of that implement with cavalry, it is stated that in a simulated charge of the *cent guides* against eighty foot soldiers of the garde, armed with the chassepot, the distance of the target used and of the charge was 400 metres. The *cent guides* got over that distance in thirty-two seconds, during which

time the foot soldiers fired 326 balls, of which 150 hit the target, or one and a-half for each horse soldier; so that the cavalry would have been annihilated in thirty-two seconds, without having reached the enemy.

"But the Snider has a quicker fire, nearly twenty a minute, and a longer range than the chassepot; and the other day it was shown that an Adams' revolver had a discharge of more than twenty shots a minute, and an average of twenty-four shots within the space of a man's head, at sixty yards, or little less than the old firing distance. The smoke of a column, observes the Horse Guards, will obscure the aim after the first discharge. But smokeless cotton, or powder manufactured in small quantities, has yet to come, is the answer. As it is, however, the Horse Guards, which only recently condemned breech-loaders, appears to have failed to observe what was done with the chassepot at Mentana, where the advancing Garibaldian army was suddenly routed, and, before they could exchange shots, was obliged to fly before the defensive force of a simple advanced guard of three battalions of French troops, with the 'infernal fire' of their chassepots, which their commander exclaimed 'did wonders.' The poor misled Italian patriots fell before it, some with two and three bullets through their skulls. The Horse Guards have failed to observe what was done with the breech-loaders in Abyssinia, where our soldiers said Theodore's men had so little chance that, instead of its being a 'fair fight,' it was a horrible butchery, of which they felt in some degree ashamed.

"The French military opinion of the results of observations and exercises, as collected at Chalons, where the trials with the new arms have been intelligent and close, is, that the soldier who marches up to the enemy, who waits lying or behind a cover, or with only his head exposed, does so against odds of nine to one in favour of defence as against offence; that there is an end of all serious warfare with *l'arme blanche*; that swords and sword fence, bayonets and bayonet fence, are of the past, and, for the future, wicked military follies; that lancers and lances, and cuirassiers and cuirasses, will go down even before revolvers; that there is an end of all charges of cavalry, and still more completely of infantry.* The infantry soldier cannot walk to any attack, and, if he must run to it, the more he runs, the closer he gets to increasing danger. If he by miracle escaped the shots of a Snider emptied upon him, he might come upon the fire of a six-shooting Adams' breech-loader, giving all its shots upon him in almost as many seconds, and thus really offensive warfare is reduced to the extreme of difficulty against intelligent foes. *Dieu aime les gros bataillons* was a favourite saying of the French army. They now see that He has doomed them to destruction wheresoever they appear, or wheresoever men can be seen in open column. The offensive force must now, therefore, approach in some other manner, if they approach at all.

"Those two fine fellows of ours, with their cuirasses and their helmets, the 'Horse Guards,' are as monuments of the past. For the future, they can only be regarded as displays of the folly that prevails within there; or that of the representative assembly which votes for the maintenance of such dangerous folly and waste. If any soldiers are to appear there at all, it should be the Sappers, with their picks and shovels, their Sniders, and their revolvers.

"The exercises of the French army with the new arms are, as described, novel too. Speaking of the exercises at Saint Maur, a witness describes the army as being in position, on ground suited to cover it. Suddenly, at the sound of the bugle, the army disappears. It lies down behind such cover as it can get. Suddenly, on another sound of the bugle, there is discharged from the surface of the earth, an "infernal fire," before which no force can advance standing and live. But that is a defensive fire. How is the army to change position, or to get out of its cover? It can only do so with a reasonable degree of safety by crawling; and the French soldiers now say that the future of war must "be a war of serpents."*

"As it is with the new manual machinery given by science, although it requires more intelligence for its use, it is comparatively so quickly learned, as to reduce or to abolish the need of the long apprenticeships required of old—so it is with the new machinery of war. The intelligent volunteer, a citizen soldier, is more than a match with it against the common rank and file of standing armies. This new condition, in which intelligence gives the advantage to quick learning, is wholly different from the condition of the time in which Adam Smith wrote in favour of standing armies, and in depreciation of militia forces. The discipline to stand in line and move in line patiently under fire is no longer needed. What is required is the quick intelligence to get under cover and keep it. The only available mode of offensive warfare, according to the French army opinion at Chalons, is a sort of skirmishing by advances and surprises. But intelligent defenders, in a popular cause, and with superior knowledge of the country, are likely to have the advantages of surprises, from behind hedges, walls, and every sort of cover.

"In a work by Le Compte de Dreuille, 'Comment on

* The fact is beginning to dawn on military minds in England. Thus Captain Majendie, in his Report on Small Arms, at the International Exhibition, 1867, says, "It is impossible to shut one's eyes to the fact that each successive improvement in firearms has tended to reduce proportionally the military importance of the sword, and lance, and bayonet; and that the introduction of a system by which the rate of fire of soldiers is multiplied four or five times must prove a serious blow to the practical value of this class of weapon. The occasions must henceforth be comparatively rare in which hand-to-hand contests will be possible; rarer still in which whole regiments, whether of infantry or cavalry, can come to close quarters; and these considerations must inevitably influence, sooner or later, the destiny and importance of arms specially intended for close fighting. This opinion indeed finds practical expression in a bayonet exhibited among the English arms by Mr. Scott Tucker. This bayonet is scarcely half the length of the present bayonet, and Mr. Scott Tucker suggests its adoption on the distinct ground of 'the chance of crossing bayonets being materially lessened by the introduction of breechloaders.' He claims for it the advantages of being comparatively light, cheap, strong, handy to draw and return, less easily parried, quick for thrust and withdrawal, free from chance of locking, and out of the way when skirmishing However opinions may differ as to the desirability of modifying the existing bayonet, this deliberate recognition of a new order of things is not without its significance." The Italian military men, whilst they yet flourish the now silly sword, rely on the revolver. Captain Majendie also states in his Report that a noticeable novelty is exhibited by Lafaucheux, of which specimens are to be found in the cases of Le Page and Chanrot, and other Liège makers; and in the Italian collection is a sword with a pistol in the hilt. The pistol is so arranged that the trigger falls within the sword guard, and the fire is delivered parallel to the blade of the sword. These revolvers, which are said to be used by the officers of the Italian army *in large numbers*, are invariably adapted for copper cartridges, containing their own ignition, either pin or central fire.

* A military writer, in the *Cornhill Magazine* for March, who admits that hand-to-hand fighting will cease to be possible, and that the bayonet may now be dispensed with, observes:—"Other nations have not been idle; and the broad result will be the development of military small-arm fire to an extent exceeding all former experience. Ought we to stop here? Clearly not; and the next step—a step which should no longer be delayed—appears to be sufficiently obvious. We must strive to protect our troops from the deadly fire which will henceforth be brought to bear upon them. In its way, this is no less important than the adoption of an efficient arm; but, hitherto, this branch of the subject has been *strangely neglected*. Abroad it is not neglected; nearly all the great Continental armies are busy instructing their troops in the art of seeking and obtaining cover. This is to be done in two ways—by the improvement of the skirmishing drill, and by the adoption of an efficient and ready system of field entrenchment. Under the first head, we include the necessity of teaching our soldiers that a man who exposes his whole body, who neglects to take advantage of every stone, and tree, and sheltering undulation, who is not apt in shifts and devices which have hitherto been considered more characteristic of an 'Alabama duel' than of formal military operations, is a marked, and probably a lost man Under the second head we hope, ere long, to see a serious attempt made to organise a system of spade drill, and to teach battalions to improvise cover when nature does not afford it. If we neglect these precautions we may as well throw our breech-loaders aside, for, under the circumstances, the best breech-loader in the world will fail to avert disaster and defeat."

pouvait reduire l'armée tout en assurant la defense nationale,' he shows that, with the new small arms (not to speak of the new Whitworth small artillery) one-third, or even one-fourth, of the existing army, would render the invasion of France impracticable.

"As science does this—and it is not by any means the last word of science—it renders the other two-thirds, or three-fourths, of the army in France an army of simple offence and flagrant menace. But menace of what value, and against whom? Switzerland can no longer be overrun. It has 300,000 available trained men, to whom science give a defensive power of 900,000, and who, with the Snider, and perhaps a better weapon than that, would roll back the Emperor's columns as they, with the chassepot, rolled back the Garibaldian army at Mentana. It is only recently that the independence of Belgium was spoken of in France as due solely to moral influences; for it was asserted there that it was ridiculous to suppose that the Belgian army could seriously resist that of France if she chose to move. Science has changed all that. According to the military opinion collected at the French camp at Chalons, Belgium might, if the people were so minded, make a very serious resistance indeed, and quite an effectual one.*

"I have gone thus far into military detail, to sustain the general principle of the gain from science of defence against offence, and I might show that the rule is equally applicable to naval warfare. The outlay for plate-armouring ships is like returning to plate-armour for men, in the face of small arms which will now send a bolt through three men in armour. A single low lying gun-boat with one of Whitworth's largest guns, which sends a shell through twelve-inch plates, would send to the bottom any large four or six-inch iron-clad afloat. In establishing these gains of defence in warfare, we are establishing them as great gains in international economy. Five millions of worse than waste are now, therefore, at the doors of the War Office and of our Parliament, to be retrieved for productive application. A division of labour in the prosecution of the question may aid its advancement. I submit, as a suggestion, that the examination of the mechanics of the subject, of the efficiency and power of the new machinery and arts of war for defensive purposes may be commended to the Society of Arts, whilst this association might continue the pursuit of the purely economical question, with less of hindrance than it may receive in that Society. For the interests of this country, the question is one of a large relief. For our international interests, it behoves us to set an example to Europe of the means of removing a vast incumbrance to progress of all kinds—economical, social, and political. It may be submitted for consideration, whether we might not open some correspondence on the question with our friends on the Continent."

"It may be submitted, moreover, that the great and augmenting gifts of art and science, to *defence* against *offence*—to intelligence and capital, for internal security, against barbarism, and against external violence—cannot be too soon made known to our colonies and to our Indian Government."

FRENCH COMMERCIAL TREATIES.

The Emperor announced in his speech, at the re-opening of the Chambers, that a bill would shortly be presented to the Corps Legislatif, renewing such parts of the existing tariffs as had not given rise to any serious objections, but that no steps would be taken with respect to contested questions until a full examination of the facts had been made. The latter portion of the paragraph refers to an inquiry which is now being carried on by a commission and delegates of the Ministry of Commerce. The government added to this commission the names of several determined protectionists and manufacturers, but the former have declined to act. Their objection is supposed to be, that the commission is ministerial, instead of parliamentary or public.

The discussions connected with the tariff conventions spread all over the country, and Rouen, Roubaix, and some other manufacturing centres are loud in their demands for more protection; the advocates of free trade are, however, decidedly increasing in number, and the principles of commerce are being far more generally recognised in France than formerly. M. Jules Simon made a very effective speech on the subject the other day at Bordeaux, where free trade is naturally enough held in high honour. The protectionists disclaim any desire to return to a system of prohibition; they only, to quote the expression of M. Pouyer-Quertier, "ask for sufficient protection," which means prohibition. Against such views, as well as against the announcement of the government to consider a portion of the existing tariff as open to consideration, the Bordeaux free traders protest energetically.

The following facts, drawn from official documents, are put forth as forming a conclusive answer to the demands of the protectionists:—

In 1860, the exports of French products to England amounted to 598 millions of francs, and those from England to France, to 308 millions. In 1863, the former had grown to 800 millions, and the latter to 592 millions. In 1868, the former had increased to 862 millions, while the latter had fallen to 300 millions.

Taking in the dealings of France with all those countries with which she is allied by commercial treaties, we have the following results:—Since 1868, the exports of France have grown from 1,800 millions to 3,180 millions, and her imports from 1,600 millions to 2,793 millions.

The free-trade question, apropos to wool, is treated

* Though at the Hague we had not the support by speech of M Legoyt, the most eminent statistician of France, yet we have in the following passage his powerful support by writing, expository of his view of the international interest in this great question of the cost of warfare:—"In 1869, according to estimates which we consider under rather than over the fact, Europe keeps in times of peace an effective army of 3,815,847 men, and inscribes upon its budget a sum of three and a half milliards (£140,000,000), or 32 per cent. of the whole of her expenditure, to meet the cost of this colossal army. Now, let us suppose for a moment that, as the result of an understanding between the Powers concerned, a disarmament to the extent of one-half was carried into effect. Forthwith, 1,907,924 men, of from 20 to 35 years old, the very pick of the population of that age, are restored to peaceful labour, and a saving of 1,600,000,000f. (£64,000,000) in the budgets of Europe is realised. With this sum Europe might add annually to her present railway system (at the mean cost of 150,000f. (£6,000) per kilometre) 10,000 kilometres (6,214 miles) of railway; she might complete her system of road communication of every kind in a single year; she might endow in every country and in every parish a primary school. These great improvements once realised, she might, if she determines to maintain the existing amount of taxation, apply the surplus to a progressive reduction of her debt. The annual interest of this debt being now about two and a third milliards (£95,000,000), and being capitalised at an average interest of 4 per cent., representing a capital of 57½ milliards (2,300,000,000), might (without calculating compound interest) set her free from liabilities in about thirty-six years. If, on the other hand, the States in question choose to apply the 1,600,000,000f. (£64,000,000) thus saved to a reduction of the imposts which now press upon production or consumption, what a relief for the peoples! what a new impulse given to business of all kinds! We have said that 1,907,924 men in the prime of life would be restored to the arts of peace. There would be in this happy fact another efficacious cause of prosperity to Europe. In effect, putting the average daily earnings of these 2,000,000 of workmen at no more than 2f. each (1s. 10d.), and on the hypothesis that the wages represent a fifth part of the value produced, this pacific army, then enlisted under the flag of industry, would create a daily value of 20,000,000f. (£800,000), and an annual value of 7½ milliards (£300,000,000). This is not all—a considerable amount of capital now employed in the fabrication of articles necessary for the equipment and armament of these 2,000,000 men, would become disposable for, and might be applied to, other branches of national industry incomparably more useful. In a word, the keeping at their firesides of 2,000,000 of young people would have the certain effect of appreciably lowering (for a time at least) the price of manual labour, and so giving a lively impulse to production in all its forms. Setting aside for a moment considerations of economy, we call attention to the advantage which a country gains by cherishing the habit and taste for work in a considerable number of adults whom garrison life now condemns to idleness and to its deadly consequences. We point, moreover, to the love of order, to the public morality, to the maintenance of family ties, which the absence of five and six years from the domestic hearth, of these youthful recruits, more or less completely violates."

shortly in the *Journal de l'Agriculture*, conducted by M. J. A. Barral. The writer says:—" In France, an agitation is on foot to raise the customs' duties on wool, and it is hoped by so doing to render the nation a great service. Our neighbours take another view of the question." He then gives extracts from German and American sources. Dr. Tellkampf says:—" It has often been pretended that the present low price of wool is caused by the increased production in Australia, yet it is well known that the flocks in that country have suffered greatly from drought. Instead of attributing the present prices to Australian production, one of the causes is to be found in the increase of duties on the import of raw wool into the United States. America has committed the serious fault of laying high duties on a raw material, and thus has done great injury to her manufacturers, as well as producers, at home and abroad. Let us see what is the effect of a high duty on wool. It was pretended that the new duties would favour the sheep farmers, and that protection would soon enable manufacturerers to pay the high duties. The high duties have profited no one, but have injured all the world. Before the alteration of the tariff, the American manufacturers bought their wool at home or abroad; but now European, Australian, Cape, and South American wool is nearly excluded from North American markets, and cumbers those of Europe, and caused the low prices. This is why the German and French wool producers have suffered much of late.

" This mad protection has been fatal to all the world. There is nothing else to be done but to allow of the admission of wool duty free, as in Germany and England, except to reduce the duty on manufactured articles to a minimum.

" Some German wool producers talk of giving up, or, at any rate, of greatly reducing their flocks; they should not be in too great a hurry, but wait for better times. Similar experiments have already been made in England. The reduction of the import duties caused the prices both of wool and cereals to rise. High duties should never be levied, except upon articles considered as luxuries, such as tobacco, sugar, coffee, and spirits. The free admission of raw materials induces cheapness in consumption, by increasing competition and stimulating improvement. England finds it answers her purpose, and every country, North America especially, should adopt the same policy."

Fine Arts.

Results of the Munich Exhibition.—The material results of the Munich exhibition have been remarkable. Two hundred works of art exhibited there have been sold, the total received for them being £13,000 sterling. These were not royal purchases merely, for the king is said to have bought only a few pictures. The number of visitors, or rather visits to the exhibibition, is reported to have amounted to 100,000, and the catalogues sold to £30,000. A lottery was established for the purchase of works of art after the fashion in France, and the directors of it have disposed of no less than 50,000 tickets. The organisation, catalogues, &c., of the exhibition, were very far indeed from being perfect, so that the results recorded above are all the more surprising, and show that the Bavarians have a true love of art.

Commerce.

Cotton Supply.—A company has been formed under the title of "The East African Cotton Company," the object of which is the acquirement of land and cultivation of cotton in Zanzibar. The climate is stated to be specially suited for the cultivation of the superior qualities of cotton. The soil is rich, and labour is said to be plentiful.

Colonies.

Sheep in Queensland.—A Queensland paper says:—" The quantity of sheep now being boiled down for their fat, &c., is very large, partly for the sake of culling the flocks, now that it is found by experience that inferior animals do not pay to rear, and partly with the view of converting sheep stations into cattle stations. When it is taken into account that 1,600 sheep can be made into tallow per day, and that this has been going on for months, it is reasonable to look forward to an appreciable decline in the quantity of the wool produce of the colony. Either sheep must be very plentiful, or money very scarce, in a country where they are boiled down for the sake of 9½ lbs. of tallow. It is evident there is a large over-supply of sheep in the colony, and the sooner a large meat-preserving process is brought into action, with a view to exporting the surplus mutton to England, the better. The legislature of Queensland have offered to grant 5,000 acres of land for the first 750 tons of fresh meat exported from Queensland, and sold in a British market at not less than 4½d. per lb. During two months, there had been prepared, at the Red-bank Meat-preserving Establishment, by Manning's process, 14,816 tins, containing 103,826 lbs. of beef and mutton. There were about 1,500 tins still to be prepared, which would bring the quantity to over fifty tons."

Notes.

Great Exhibition at Turin.—It is announced that a great industrial and artistic exhibition is to be held in the year 1872, on the occasion of the completion of the piercement of Mont Cenis, but it is not stated whether it will be international, or confined to Italian productions only.

Salmon Breeding.—A Dundee paper says that operations have commenced at Almond Mouth Fishing Station, on the river Tay, for the purpose of obtaining ova to stock the Stormontfield ponds. During the preceding week fifteen shots had been made with a net at Almond Mouth, and 45 female and 55 male salmon were landed; ten of the females were in an unfit state for spawning, but 106,000 ova in all were got and safely placed in the boxes. A clean "new run" salmon, weighing about 30 lbs., was recently landed. It was returned to the river. In Glenisla, on the Ericht, in Glentilt, Glen Lyon, and Glendochart, large numbers of salmon are to seen on the spawning beds; and on the Earn, both at Crieff and Comrie, beautiful beds of gravel have already been thrown up by the salmon in the act of depositing their ova; and should the rivers keep at their present level for a few weeks, this will be a very good spawning season.

Correspondence.

Crossing the Channel.—Sir,—I was much gratified at hearing the paper read, on Wednesday evening last, by Mr. Zerah Colburn, on his proposition for laying a tunnel or iron tube on the bottom of the sea from England to France—assumed for a length of twenty miles from shore to shore—say, from Folkestone to Cape Grisnez, which is the shortest distance between the two countries. The tube is stated to be 14 ft. diameter outside, and in lengths of about 1,000 ft., with a thickness of metal rim of 4½ in. thickness, inside of which would be, say, two half-brick rings or arches, laid in hydraulic cement. This would reduce the clear inside diameter to 11 ft. 9 in., to carry the continental traffic to and from England, Europe, Asia, and Africa, which traffic of passengers, goods, coals, &c., will far exceed all calculations already made, when once the great commercial market is opened for a general interchange of produce,

&c. Now, assuming the possibility, and great probability, of establishing this national intercourse and interchange, I will simply ask a practical question. Is it any way likely that a single line of rails, either through a tube or tunnel, will be sufficient to carry on the great and continuous running traffic to and from England and continental nations, including India, Russia, China, and Japan, which would all be opened for railway traffic, by crossing over the Dardanelles or the Bosphorus by a railway bridge? As reasonable would it be to suppose that all the traffic to and from Fleet-street and the Strand could be passed through in single line by a lane similar to Holywell-street, in the Strand. The iron tubes, as proposed by Mr. Colburn, are to be jointed five times in the mile length—which gives above 1,000 ft. for each tubular length—so that 100 jointings must be made to cross the twenty miles of Channel bed, and, consequently, 100 serious risks or chances of terrible mishap, from rusting of the jointings laid in salt water. These tubes being circular will naturally have a tendency to roll over, which would cause a serious accident. An immense difficulty presents itself to my mind, as to how the straightforward and increased deepening of tube laying by haulage can be accomplished, down to a depth of 180 feet, or 30 fathoms, below the sea level, where no diver could work to adjust the tube over a constantly varying irregular sea bed or bottom, and give it a permanent bearing, to receive the concrete coating over it, which latter would have to be lowered down in bags or through pipes, to get the concrete in its proper place over the iron tube. Nothing has been said as to ventilation or lighting the tube, or getting rid of the waste slop of water, which will naturally accumulate in the tube from condensed steam. These points are important, and must not be over-looked or omitted; if iron tubes are to be decided on, three lines of which, at the least, should be used to ensure the uninterrupted traffic to and fro, that is, supposing tubes are chosen as the best practical mode of securing international communication. In conclusion, I beg to send you a printed extract of my proposition for a triple or three-arched tunnel under the bed of the Channel, which plans have now been before the public for the past thirteen years, awaiting a fair inspection, and (if deserving it) a recognition as worthy of competition with other proposals emanating from more powerful men, who have means and appliances at command which I do not possess. My wish is to avoid conflict with any other projectors, and in writing this plain statement, I wish to avoid offence to all, simply asking fair play. The *Engineer*, of the 19th November last, says:—"Towards the close of last year, Mr. W. Austin proposed a submarine three-way tunnel under the Channel. His plan is to cross at a line of route extending from the landing piers at Folkestone to the landing piers of Cape Grisnez, but the tunnel will range below the sea bed, at a safe depth for practical permanent masonry arches, which will be constructed of imperishable materials, on an improved principle of vertebraical bond. The tunnel is intended to pass under the submerged island called the Varne, lying near the mid-channel, and on which island Mr. Austin proposes to erect a central ventilating shaft or tower, which would be available as a permanent central lighthouse and naval signal shaft; also to afford a refuge or retreat for crews of ships wrecked in the Channel. As a fence or guard to this central tower or shaft, it is proposed to have two ranges of timber floating breakwaters, so as to act as floating retreats for ships, and protectors to the tower-shaft from hurricanes or gales. Two other masonry shafts will be permanently constructed for ventilation and pumping purposes at each shore. Seven or eight temporary shafts will also be constructed in iron, and sunk and bored down to the tunnel arching, so as to give ventilation to workers in the construction of the tunnels, and also to remove a portion of the excavated *débris*. These temporary shafts would be protected by moored floating booms or fences during the construction of the tunnel, and, on the completion of the tunnel, the temporary shafts and booms would all be removed, having done their work. The gradients or inclines of the proposed tunnels are so arranged that the steepest gradients of the two shore inclines, or connections with the main land railways in England and France, do not exceed 1 in 100, so that locomotives of moderate powers would accomplish the required work easily. Occasional openings are to be constructed in the masonry range of tunnel wall sides, so as to allow for a traverse of engines and carriages from one range of tunnel to another, in the event of any accident or emergency, when traverse frames would quickly shift the disabled carriages out of the way of an obstructed traffic. Arrangements of a distinct and peculiar character were to be made for the proper ventilation of the tunnels by air and water streams; also for the lighting the tunnels throughout by perfected modes of gas burning in specially constructed lamps, &c. Every facility will be provided for laying down a perfect system of telegraph conducting wires, which will be easily accessible for adjustment and repair; and the present great risks and accidents, now so often occurring, of tearing up telegraph cables by ships' anchors will then be avoided. Subways are to be constructed throughout the tunnel ranges, which will exhaust any accumulation of steam and waste waters, or temporary leakages, and which water will be passed through well-pits, and then ejected by pumps, connected with the great central shaft and two shore shafts. The advantages of three tunnel ranges will be to keep special, ordinary, and goods traffic trains separate and distinct, and thus obviate present causes of frequent accidents by clashing trains conveying passengers and goods on the same ranges."—I am, &c., William Austin, C.E.

8, Culmore-terrace, Carlton-road, Old Kent-road,
December 6th, 1869.

Crossing the Channel.—Sir,—In the otherwise able and correct report of my remarks in the discussion upon Mr. Zerah Colburn's paper, on the 1st inst., a slight inaccuracy occurs which I think it due, both to Mr. Hawkshaw and to Mr. Low, to ask you to correct. Commencing at line 27, column 1, page 52, of your last issue, I am reported to have said, in reference to Mr. Low's projected boring through the chalk:—"The main point was, whether or no there was a fault in the formation. If there was not, there was no doubt of Mr. Hawkshaw being able to carry out this plan, for his abilities as a mining engineer were well known." By substituting the name of Mr. Low for that of Mr. Hawkshaw in the foregoing passage, it will be rendered correct. —I am, &c., Perry F. Nursey.

166, Fleet-street, London, December 4th, 1869.

Patent Laws.—Sir,—The legislative body in Holland considered that their patent-law was prejudicial, and not required, and voted its abolition. There is, doubtless, some foundation for this opinion, for the law contains a clause by which a patentee in Holland forfeits his rights, if he takes out a patent in any other country subsequently. The small number of patents of invention (an average of ten per annum), was alleged as a reason for the abolition; there is fair ground for inquiry, however, whether the effect has not been taken for the cause; the character of the Dutch people for practical good sense lends weight to the conclusion. It is true, their reputation as an agricultural and mercantile people, and their peculiar temperament, are not favourable to a high development of inventive genius, as evidenced by some of their products, and direct them to a more immediate and less uncertain investment of their time and capital than that of patents; yet, for these reasons also, it may be urged that such a limitation as the one referred to would operate more forcibly, as it is both tyrannical and subversive of the inventor's interests. In all cases it would appear to have been advisable to have tried a law excluding this arbitrary enactment before carrying out an entire abolition. Countries like Holland and Switzerland may not suffer directly, or to the same

extent, as large manufacturing countries like England and France, from the absence of a stimulus to native invention. They may find it answer to benefit by their improvements without contributing to the premium by which they were acquired; but were such an example followed by any of the leading states of Europe, it would infallibly prove a losing game, degrading to the country who practised it, and, in the long run, a cause of retrogression in the arts of civilisation generally.—I am, &c.,

L. de Fontainemoreau.

4, South-street, Finsbury.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Mr. J. Norman Lockyer, F.R.S., "On the Spectroscope and its Applications."
Social Science Assoc., 8. Mr. E. W. Hollond, "On the Employment of Paupers."
Society of Engineers, 7½. Annual General Meeting.
R. Geographical, 8½. 1. Mr. G. S. Hayward, "Journey across the Kuen-lun to Yarkand and Kashgar." 2. Dr. Cayley and Messrs Douglas Forsyth and Shaw, "Reports on Trade Routes from India to Eastern Turkestan."
British Architects, 8.
Medical, 8.
London Inst., 4.

Tues ...East India Assoc., 3. Lieut.-Gen. Sir A. Cotton, "On the Proposed Expenditure of £100,000,000 additional on Railways."
R. Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. Grantham, "On Ocean Steam Navigation."
Photographic, 8.
Anthropological, 8.

Wed ...Society of Arts, 8. Mr. J. Collins, "On India-rubber, its History, Commerce, and Supply."

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. Daniel Hanbury, "On a Species of *Ipomœa* affording *Tampico Jalap*."
Zoological, 4.
London Inst., 7½.
Chemical, 8.
Numismatic, 7.
Philosophical Club, 6.

Fri ......Philological, 8¼.
Quekett Club, 8.

Patents.

From Commissioners of Patents' Journal, December 3.

Grants of Provisional Protection.

Advertising sheets or papers—3389—F. J. Granville and H. Gardner.
Banjoes, &c.—3352—W. Temlett.
Battery guns, revolving—3341—A. M. Clark.
Boilers—3359—J. H. Fraser.
Boilers for hot-water apparatus—3333—J. Hartley and Z. Sugden.
Boilers, &c., apparatus for feeding—3323—E. Körting.
Blacking, manufacturing—3410—A. McDougall.
Bricks, burning—3270—S. W. Shaw.
Cabs, &c., means of communication between passengers and drivers in—3334—T. E. Lundy and J. L. Dunham.
Calico-printing, machinery for engraving cylinders used in—3343—W., J., and F. W. Edmondson and R. Cunliffe.
Carding machines, &c., apparatus for feeding wool, &c., to—3402—P. C. Evans and H. J. H. King.
Cast-iron earth screws for the lower parts of fence, &c.—3340—W. and M. Bayliss.
Collars, cuffs, &c.—3414—G. M. Felton.
Cotton, &c., machinery for preparing, &c.—3353—T. R. Hetherington.
Cotton, &c., packing bales of—3331—S. Mendel.
Electro-magnetic machines, &c.—3363—J. Burroughs, jun.
Electro-metallurgy—3377—H. A. Bonneville.
Feet-warming apparatus—3362—J. Moseley.
Fibrous substances, spinning—3368—J. Bottomley and S. Emsley.
Fire escapes—3371—F. Hawkings.
Fluids and liquids, apparatus for forcing and drawing—3398—S. Chatwood and T. Sturgeon.
Furnaces—3301—W. Lancaster.
Furnaces—3349—J. Taylor.
Gas, lighting and extinguishing by electricity—3396—D. Miles.
Gas, apparatus used in manufacturing—3395—J. B. Paddon.
Hats—3401—W. C. Mann.
Hats, &c., apparatus for felting—3394—J. and B. Dunkerley.
Horses, &c., apparatus for clipping—3356—S. H. Salom.
Hydraulic presses—3400—J. Downs.
Hydraulic presses, &c., constructing—3364—R. Wilson.
Knitting machines—3121—H. B. Barlow.
Lubricating oil or grease, manufacturing—3354—D. Morgan.
Lubricators—3346—H. Wilson.
Manure, &c., preparing ashes for—3329—G. Petrie.
Match and fusee boxes—3361—J. Macneill.
Match splints, &c., apparatus for filling—3412—L. Mount.
Metal surfaces, &c., composition for coating—3274—W. E. Gedge.
Motive-power engines—3387—H. C. Löbnitz.
Motive-power, utilising streams, &c., as—3344—C. D. Abel.
Ores, &c., treating—2795—J. Stuart.
Pavements, constructing—3370—R. Hennell.
Pillar letter boxes, &c.—3365—S. W. Wilkinson and J. E. Dooley.
Pills, &c., machinery for making—3406—B. Goddard and W. Finley.
Pirns, winding thread or yarn upon—3325—J. P. Kerr and W. McGee.
Pneumatic tubes, &c.—3345—J. Cochrane.
Power, obtaining—3390—W. Thomas.
Pressure gauges—3385—F. Foster
Pumps—3337—R. K. Miller and A. B. Herbert.
Railway carriages—3339—W. N. MacCartney.
Railway carriages, &c., connecting and disconnecting—3397—J. Turnbull.
Railway carriages, &c., transporting—3399—M. Henry.
Railways, self-acting apparatus for placing fog signals upon—3393—J. Norris and E. Longworth.
Safes for ships carrying mails, specie, &c.—3388—A. McNeill.
Saws, machinery for grinding—3386—J. H. Johnson.
Saws, &c.—3379—S. G. Arnold.
School forms and desks—3404—T. Richardson.
Ships' bottoms, &c., composition for preventing fouling of—3314—T. Marshall.
Ships, machinery for propelling—3408—W. R. Lake.
Shuttles for weaving—3369—J., J., and H. Ingham and C. Smith.
Spinning machinery, washer cloth for—3351—T. Aitkin.
Steam boiler supply cocks—3376—H. A. Bonneville.
Steam boilers, preventing and removing incrustations in—3285—C. D. Saintgeot and C. Poucel.
Steam boilers, &c., water gauges for—3367—J. Bourne.
Steam carriages for common roads—3384—A. Nairn.
Stone, &c., machinery for breaking—3089—T. Bevington, S. Courtauld, and J. A. Norberg.
Stone, &c., machinery for dressing—3391—J. Fogg.
Tents, sunshades, and umbrellas—3372—G. and J. Ritchie.
Terriers or ground augers—3231—A. Bohlken.
Textile fabrics, geoffering and plaiting—3338—J. Orson.
Textile fabrics, weaving—3336—R. Clews.
Thread, &c., machinery for drying, dressing, and finishing—3332—J. Dockray.
Tramways, &c., constructing—3375—E. E. Allen.
Vent peg for preserving liquors of all kinds—3327—M. Shelley.
Washing machines, &c.—3416—W. Pollitt and W. J. Knowles.
Weighing machines or scales—3219—J. C. Heywood.
Wheat, &c., machine for cleaning cracked—3260—M. Benson.
Window sashes, apparatus for tightening and holding—3360—S. L. Loomis.
Wood, machinery for working—3320—G. R. Sweetser & G. Wadman.

Inventions with Complete Specifications Filed.

Sewing machines—3441—W. Brookes.
Railway carriages, journal bearings for—3456—W. R. Lake.

Patents Sealed.

1724. J. Edge.	1926. S. Joy.
1737. T. Wilkins and W. Fisk.	2007. J. Steward.
1750. W. B Leachman.	2024. W. R. Lake.
1758. F. Heckner.	2232. R. Boyd.
1759. W. Sellers.	2354. W. R. Lake.
1760. G Fenner.	2355. W. R. Lake.
1764. C. E. de Lorière.	2537. W. R. Lake.
1782. A. St. C. Radisson.	2625 S. F. and A. B. Ibbotson.
1802 E. T. Hughes.	2697. W. E. Newton.
1812. J H Brown.	2789. H. A. Bonneville.
1814. W. R. Lake.	3025. J. Player.
1823. W. R. Lake.	3028. J. M. A. Stroh.

From Commissioners of Patents' Journal, December 7.

Patents Sealed.

1767. H. Carter & G. H. Edwards.	1966. B. Templar.
1768. D. Cole.	1991. E. Roe.
1774. W. E. Gedge.	2026. W. E. Newton.
1776. D. J. Field and I. W. Lister.	2050. W. E. Newton.
1777. J. Mabson.	2323. A. Louden.
1792. J Blair.	2763. R. C. Wallace and D. Crawford.
1799. J. G. Marshall.	2834. W. and A. Kempe.
1809. A. Lafargue.	2922. G. W. Hawksley and M. Wild.
1888. J. B. Brooks and G. Picken.	2988 C. W. Siemens.
1891. S. Nicholls.	2990. E. Lane.
1902. C. D Abel.	3106. J. Sheldon.
1918. A. J. Deblon.	
1921. A. M. Clark.	
1931. A. H. Still and D. Lane.	

Patents on which the Stamp Duty of £50 has been paid.

3171. J. T. A. Mallet.	3237. G. Haseltine.
3178. W. H. Harfield.	3190. E. L. Paraire.
3222. J. C. MacDonald and J. Calverley.	3195. C E. Brooman.
3155. P. McGregor.	3179. J. A. Coffey.
3193. T. Bayley and J. Taylor.	3189. W. H. Richardson.

Patents on which the Stamp Duty of £100 has been Paid.

3262. L. Christoph, W. Hawksworth, and G. P. Harding.	3259. R. Hornsby, jun.
	3230. G. F. Blumberg.
	3310. S. B. Whitfield.

Journal of the Society of Arts.

FRIDAY, DECEMBER 17, 1869.

Announcements by the Council.

ORGANISATION OF TRAINED TEACHING POWER FOR NATIONAL EDUCATION.

The attention of the members, and of all those specially interested in the National Education question, is particularly requested to the copy of the instructions given to the deputation from the Council to the Birmingham Education League, and to the Manchester Education Union, forwarded as a supplement to this week's *Journal*, as containing an exposition of means for extending Science and Art instruction to the whole of the children of the middle classes, as well as the artizan class, throughout the country. This, it is now demonstrated, may be accomplished by shortening the time generally occupied in elementary instruction, and by improving the quality of that instruction, by improved and augmented teaching power. Especial attention is requested to the information appended to the document, derived from the highest sources, displaying practical examples of the means of accomplishing that object without increased expense, by division of educational labour, and by different applications of trained teaching power, which, in this country, are as new in principle as they are important for the consideration of the question of national education and progress. Examination is requested of the evidence of the different results of the application of one and two teacher power in one class of schools, as compared with the results obtained from the application of six, eight, or ten teacher power or more in a class of schools of a higher degree of organisation. A further illustration of the application of trained teaching power, which, in education, may be said to be like a new application of power in mechanics, is presented in this week's *Journal*, of the application of a seventeen trained-teacher power of the first class to the advancement of the pupils of the City of London Middle Class Schools, where it will be seen that, by an improved organisation, promoted by the Rev. W. Rogers, a member of the Council, an extent of science and art culture is imparted by the end of the fourteenth year that is not at present commonly attained, in the adult stages, in public schools, or in the most expensive private schools.

The Council, under the conviction of the great importance of the principle for science and art and national education, is endeavouring to obtain other practical examples of the means of applying it under varied conditions, in rural as well as in urban districts.

LOCAL SCIENCE COLLEGES.

The meeting called by the circular published in the last *Journal* (p. 61) takes place at Manchester this day (Friday), and the Secretary has been instructed to accompany such members of the Council as may be able to attend. The following document, expressing the views of the Council, will be read to the meeting :—

1. The Council of the Society of Arts have received a communication from Owens College Extension Committee, Manchester, asking their co-operation in the extension of technical education, or, more properly, Scientific Instruction ; and it affords them much pleasure to do whatever lies in their power to advance this important national object. With this view, the Council have invited the members of the Society, and especially those resident in the locality, as well as the authorities of Owens College, to meet them in conference on the subject, to discuss the best means by which scientific instruction may be promoted, and to establish an organisation which will keep an influence at work to accomplish what is so urgently needed.

2. The necessity and importance of improved scientific instruction for the people of the United Kingdom, in order that they may be placed in a favourable position in the race of industrial competition with other nations, has, for some time past, been forced upon the notice of the Society of Arts, whose chartered objects are the Promotion of Arts, Manufactures, and Commerce.

3. The great international displays of industry in 1851, 1855, 1862, and 1867, have shown unmistakably that, if this country is to maintain her position as a commercial and manufacturing power, the people (and in this term are comprehended not only artisans, but also persons of higher position in the social scale) must have at their command the means of education improved in its general character, and embracing, if not based upon, science to a far greater extent than has hitherto been the case. The official jury reports at all the exhibitions abound in declarations of this character, and the country can no longer afford to ignore the fact, but must earnestly set to work to bring about a change. These reports, as well as those of the artisans who were sent to the Paris Exhibition of 1867 by the Society, one and all point out the great educational facilities which are available for all classes, and especially the artisan class, upon the Continent.

4. The Council are of opinion that existing schools and colleges, where science has hitherto been all but excluded, should adopt some means for its being taught; and that where such teaching already exists, measures should be taken for extending the usefulness of the institutions, and rendering them more easy of access to the great body of the people; whilst in localities where no such facilities exist, means should be taken to secure their foundation. The localities must themselves stir in this reform, and their efforts should be aided by pecuniary assistance and countenance by the State.

5. The nation must set itself earnestly to work to bring about the sought-for change in the education of the people. The evils have been so often pointed out, that it is unnecessary to enter into detail; our duty is to supply the remedy. This the Council believe to be by the localities setting themselves heartily to work, and when they have shown themselves in earnest by raising funds and organising establishments for the teaching of science, they should be entitled, as of right, to aid from the State.

6. In order, however, that such establishments, colleges, or schools should be of value to the mass of the people

so that they can take advantage of the facilities which would then be offered to them, it is absolutely necessary that elementary education, commonly known as primary education, should be extended far more widely than at present. To an ignorant population the establishment of colleges and schools for the teaching of science will be of little avail, and unless the blessings of an ordinary elementary education, *i.e.*, reading, writing, and arithmetic, at least, can be more diffused, so as to place our people on a par with those of Switzerland, Prussia, Saxony, &c., the attempt to extend the teaching of science will be in vain. Again, not only must we have improved elementary education, but these elements must themselves be taught by improved methods and organisation, so that less time may be occupied in acquiring them, thus leaving free for the learning of elementary science some of those years which are now unnecessarily taken up in mastering the mere rudiments of knowledge. Abroad, it is the custom of the state only to deal with this and many other matters of public concern, but such is not the case here. The Council do not recommend state interference as of choice, but of necessity. This work of education must be done, and it will have to be done wholly by government if not otherwise. Experience proves that it can be done by a combination of voluntary efforts, with government aid, as in the existing system of primary education, and in the instruction aided by the Science and Art Department. The Council think that the work is to be done in part nationally, in part voluntarily, but not upon a hap-hazard system.

7. Adam Smith, the earliest, and, perhaps, the first English writer on political economy, as well as Mr. J. Stuart Mill, its present most able exponent, recommend scientific instruction as profitable to the nation. Her Majesty's Government must not plead economy as an excuse, for the highest and wisest economy comes out of wise expenditure.

8. The Council believe that this is the feeling of the country, which the government will regard with respectful attention. Government must be urged to co-operate with Owens College and other bodies, either existing or to be established. Parliamentary grants are now made to the old universities of England and Scotland, and to the Queen's Colleges in Ireland, and there is no reason why the same principle should not be extended, and grants made to modern educational establishments in the great centres of industry. The Council are of opinion that a government resulting from a wide representation of the whole people ought adequately to represent the highest intelligence and aspirations of that people for improvement, and not limit its responsibility and its labours to matters of police. There can be no more profitable investment of national capital drawn from taxes paid by the whole nation, than in promoting the best education among all classes of the people, and the widest extension of sound knowledge, on which the Arts, Manufactures, and Commerce of a kingdom rest.

(By order)

Henry G. Lennox, *Chairman.*
P. Le Neve Foster, *Secretary.*

Collection of Engravings and Prints.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, "On Prints and their Production," read on Wednesday evening, the 8th instant, will be open for the inspection of members and their friends, between the hours of 10 and 4 o'clock, up to Saturday, the 8th January, 1870, inclusive.

Tickets for members' friends are forwarded with this week's *Journal.*

Ordinary Meetings.

Wednesday Evenings at eight o'clock:—

December 22.*—"On Wines, their Origin, Nature Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea." By J. L. W. Thudichum, Esq., M.D. On this evening A. W. Williamson, Esq., F.R.S., Professor of Chemistry in University College, London, will preside.

Cantor Lectures.

The second lecture of the course "On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., was delivered on Monday evening last, the 13th inst. The third and concluding lecture will be delivered on Monday evening, the 20th inst., at Eight o'clock. The whole course of lectures will be published in the *Journal.*

Donations to the Library.

The following work has been presented to the Library, and the thanks of the Council have been communicated to the donors:—

The Lord's Prayer, illustrated. By Henry Alford, D.D., and F. R. Pickersgill, R.A.; presented by Messrs. Longmans, Green, and Co.

Subscriptions.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

India Committee.

The second Conference of the Session was held on Friday evening, December 10th, W. S. Fitzwilliam, Esq., late member of the Supreme Legislative Council of India, in the chair. The paper discussed was by Andrew Cassels, Esq., on "A Gold Currency for India." On the motion of Dr. Boycott, the discussion was adjourned to Friday evening, January 28th, 1870. A report of the proceedings will appear in a subsequent number of the *Journal.*

Fifth Ordinary Meeting.

Wednesday, December 15th, 1869; Dr. Berthold Seemann, F.R.G.S., F.L.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Bowles, Thomas G., 88, St. James's-street, S.W.
Marchant, William J., 106, Great Russell-street, W.C.
Olsson, Martin, 69, Richmond-road, Barnsbury, N.

* Captain O'Hea's paper on "Recent Improvements in Small Arms" is postponed till after Christmas.

The following candidates were balloted for, and duly elected members of the Society:—

Ford, Stephen, Vestry Offices, Bermondsey, S.E.
Giles, Francis G., Clatsford, Andover.
Ikin, Alfred, Eccleston, Cheshire.
Mackie, Samuel J., 84, Kensington-park-road, Bayswater, W.
Pooley, T. A., South Side, Clapham-common, S.W.
Tyler, Captain, Board of Trade, S.W.

The Paper read was—

ON INDIA-RUBBER, ITS HISTORY, COMMERCE, AND SUPPLY.

By James Collins, Esq.

(Curator of the Museum of the Pharmaceutical Society, Fellow of the Edinburgh Botanical Society.)

In 1867, I read before the Society of Amateur Botanists a paper on the "Commercial Kinds of India-rubber or Caoutchouc." This, after I had somewhat amplified it, was published in Dr. Seemann's *Journal of Botany* for January, 1868. Since that period I have been instituting inquiries abroad, and at the present moment am waiting for material from several parts of the world. When your worthy Secretary asked me to read a paper here, I gladly acquiesced, trusting that it may be the means of introducing the subject more thoroughly to the notice of those who from residence, mercantile connections, or other equally advantageous causes, may be induced to assist me in my further researches, with the result, I hope, that the supply of this useful article will be much augmented. On the present occasion, I shall restrict myself to the history of the raw product, apart from its manufacturing interest. For the better understanding of our subject, I propose to treat of india-rubber under four geographical groups, viz:—1. American; 2. Asiatic; 3. African; 4. Australian; closing by a few general remarks on the whole question.

For the purpose of illustration I have on the table specimens of nearly all the different kinds of india-rubber, as also dried specimens of a few of the plants by which they are produced. Before proceeding, however, I must express my best thanks to Mr. Henry Norris, of Edinburgh, and Messrs. J. H. Rayner and Co., of Liverpool, for specimens they have unsolicited sent me, forming a very welcome addition to my collection.

I.—American Kinds of India-rubber.

Of the early history of American caoutchouc we have very interesting accounts. Among the earliest is that of Herrera,* who, in his account of Columbus' second voyage, speaking of the natives of Hayti, says:—"They had other amusements, such as the game of ball, for which they had a house set apart, and they played it so many on each side, without sticks or bats, for they struck the balls with any part of their bodies, and with great dexterity and nimbleness. And the balls were of the *gum of a tree*, and, although large, were lighter and bounced better than the wind-balls of Castile." Juan de Torquemada, however, seems to be the first who mentions the tree yielding this substance, viz., the ulequahuitl, or *Castilloa elastica*, Cerv. In his "De la Monarquia Indiana" (tom. 2, cap. xliii., p. 663), published at Madrid in 1615, when speaking of Mexico, he says:—"There is a tree which the Indians call Ulequahuitl; it is held in great estimation, and grows in the hot country. It is not a very high tree; the leaves are round and of an ashy colour. This tree yields a white milky substance, thick and gummy, and in great abundance. To obtain it, the tree is wounded with an axe or cutlass, and from these wounds the liquid drops. The natives collect it in round vessels of different sizes, called, in their language, "xicalli," but by us calabashes. In these they allow it to settle in round balls, of the size most convenient for the purposes to which they are about to apply them. When quite set they boil them in water, in which state the gum is called "ulli." The Indians who have got no calabashes smear their bodies over with it (for Nature is never without a resource), and when it becomes dry they remove the whole incrustation, which comes off in the form of a very smooth membrane, its thickness depending on the will of the party collecting. They then make it into balls and boil them as before. Anciently, they used to play with these balls, striking them against the ground, and making them rise to a great height. But in the game of pelota it was not struck against the ground, but caught upon the hip or shoulder. From the ulli an oil is extracted of great value in various applications. It was formerly much used by the natives, nor have they forgotten its properties now, for it is soft and lubricous, and of especial effect in removing any tightness of the chest. The oil is extracted from the ulli by heat; it starts out in a manner to excite admiration, leaving nothing to compare it unto. The oil is drunk mixed with cocoa, and, indeed, it softens any other medicine, however hard its quality. It is also found of great advantage in stopping hæmorrhage, for which it is taken internally. The coagulated ulli is so strong in itself, that a breastplate made of it no arrow will pass through; for, being of a nature leathery and membranous, it ejects the point. The kings and nobles were accustomed to make shoes of the ulli, and to order the fools and jesters, the humpbacked and dwarfs of the palace, to be shod therewith, in order to make them sport, for the wearers could not step without falling, which, with their awkward actions, gave rise to much jesting and merriment. Our people (*i.e.*, the Spaniards) used it in waxing their cloaks, which were made of coarse canvas, so as to make them resist water; and, in truth, it is of great effect in resisting the water, but not so the sun, for the rays thereof melt it."

* Herrera, Historia, decada i., libro iii., cap. iv.

To M. Charles Marie de la Condamine we are indebted for our first accurate information respecting the india-rubber furnished by the different species of *Hevea*, or *Siphonia*. In 1735, this gentleman, together with three fellow members of the French Academy, started on an astronomical mission to South America. He found here seringa trees in great abundance. When writing of them, he says:—"The rosin named cahout-chou in those countries of the province of Quito adjacent to the sea, is very common also on the banks of the Maranon, and serves for the same uses. When it is fresh, they work it with moulds into what shape they please, and it is impenetrable by the rain; but what renders it most remarkable is its great elasticity. They make bottles thereof which it is not easy to break; boots and hollow bowls, which may be squeezed flat, and, when no longer under restraint, resume their first form. The Portuguese of Para have learnt of the Omaquas to make squirts or syringes thereof that have no need of piston or sucker; they are made hollow, in the form of a pear, when scooped, having a little hole at the small end, to which a pipe of the same size is fitted; they are then filled with water, and, by squeezing them, they have the same effect as a common squirt! This machine is mightily in vogue among the Omaquas; when they meet together by themselves for any merry-making, the master of the house never fails to present one to each of his guests; and the use of the squirt with them is always the prelude to their most solemn feasts." I do not suppose there is any likelihood of this custom being introduced into our country. This use of the ulli led to the Portuguese name, "Pao di Xirringa."

After Condamine left America, M. Fresnau, an engineer, who had lived for many years at Cazenove, in Guiana, turned his attention to the subject, he having seen various articles made of india-rubber brought to Para, and became very anxious to discover the tree from which the substance was obtained. For this purpose, failing to

get information from the Indians at Para, he at last obtained clay models of the fruit of the tree; these he distributed among his correspondents, with the inquiry whether they knew of a tree having such a fruit. This plan, as it deserved, met with success, and he had the satisfaction of making himself various articles, such as boots, bottles, &c., of the rubber. An account of his researches was published by the French Academy in 1751.

To M. Fuse Aublet, the distinguished French botanist, we are indebted for a description of *Hevea Guayanensis*. In his "Flora of Guiana," published in 1755, he says that the fruit is much sought after by the natives for food, and that caoutchouc is collected in the following manner:—"The natives begin by making, at the bottom of the trunk, a deep gash, which penetrates into the wood. They then make another incision, from the upper part of the trunk, vertically downwards to the former one, and at various distances a number of oblique incisions are made, running into the first. These incisions form channels for the oozing sap, and convey it into a vessel placed for this purpose at the foot of the tree. In this the sap collects, loses its moisture, and becomes a soft elastic mass, which, when quite fresh, is readily made to take the shape of any instruments or vessels upon which it is applied layer by layer. The moulds are sometimes made of unbaked clay, and are then removed by pouring in water, which softens them, so that the caoutchouc alone remains. Sometimes they are made of baked clay, and are removed by being broken in pieces, the elasticity of caoutchouc enabling it to bear the violence necessary without injury to its structure."

We now pass to the consideration of the different kinds of American caoutchouc. These we may treat in geographical order.

Brazil.

Of all the kinds of india-rubber known to us, that of Brazil is most highly esteemed. Of Brazilian rubber there are four kinds we may mention, namely, Para, Maranham, Ceara, and Pernambuco.

Para.—The rubber known as Para is the best and most valuable kind, fetching a higher price than any other rubber in commerce. It is one of the most important articles of trade at Para, the duty on it being equal to one-third of the whole revenue. Para rubber is the produce of *Hevea Guayanensis*, Aubl. (being the same plant as the *Siphonia elastica*, Pers. and the *S. cahuchu*, Willd.) and other species of the same genus. These trees are found abundantly in the provinces of the Amazons and of Para, less common in Maranham, and in large quantities in Ceara and the Rio Grande du Nord, frequenting the river banks and marshy places. Through the perseverance and industry of Dr. Spruce, we are in possession of much accurate information respecting these trees and their produce. In a paper by Mr. George Bentham, on plants collected by Dr. Spruce, the following notes occur:*—

"*Siphonia Brasiliensis*, Willd. (*Hevea Brasiliensis*, Muell.). In the forests of Para. A lofty handsome tree, branching from the base, and yielding the caoutchouc the most abundantly exported."—*R. Spruce.*

"*S. lutea.*—From the forests of the Rio Uaupés. A tree of 70 feet; the milk copious, speedily turning black, and staining linen permanently. When dry, elastic and very tenacious."—*R. Spruce.*

"*S. discolor.*—Scarcely elastic when dry."—*R. Spruce.*

"*S. paucifolia.* — A large tree, 40 to 50 feet high, yielding a copious milky juice."—*R. Spruce.*

"This genus seems abundant throughout the Amazon, but not all the species yield caoutchouc (or xiringue, as it is here called) of good quality, those of the Gapó and Caatinga producing a brittle gum."—*R. Spruce, ms.*

In a paper on the india-rubber of the Amazon, Dr. Spruce says:*—"On the upper Rio Negro and lower Casiquiare are two species—*Siphonia lutea*, Spr., and *S. brevifolia*, Spr., known respectively as the long-leaved and short-leaved seringa. The former yields most milk, but neither are so productive as the seringa of Para (*S. Brasiliensis.*) Both are straight, tall, and not very thick trees, with smoothish, thin bark, and yellow, very odoriferous flowers. I suppose their average height may be about 100 feet. I cut down a tree of *S. brevifolia*, near San Carlos, which measured 110 feet. I first saw and gathered *S. lutea* in the mouth of the Uaupés; and as I came down the Rio Negro in December, 1854, found a rancho erected on the spot, and a person employed in extracting rubber from the same trees as I had taken the flowers."

Dr. Spruce, in a letter dated October, 1867, kindly favoured me with the following information:—"Caoutchouc is obtained at Para, from *Siphonia (Hevea) Brasiliensis*, Willd. (and probably from several other species); on the Amazon, about the mouth of the Tapajoz, from *S. Spruceana*, Bth.; on the Amazon, towards the mouth of the Madeira, are other species, not seen by me in good state; on the Rio Negro, Uaupés, and Casiquiari, from *S. discolor*, Spruce, *S. rigidifolia*, Spruce, *S. lutea*, Spruce, *S. pauciflora*, Spruce, and *S. apiculata*, Spruce.

Very interesting accounts of these trees, together with the mode of collecting the rubber, have been given by travellers.

Edwards,† speaking of one of the many islands to be found in the Amazon River, says:—"This island was covered with a fine forest, in which were abundance of seringa trees, all scarred with wounds; we made some incisions with our tresedos, and the milk oozed out, and dripped in little streams. Its taste was agreeable, something like sweetened cream, which it resembles in colour. These trees were often of a great height, and from two to three feet in diameter; the trunks were round and smooth, and the bark was of a light colour, and not very smooth; the wood was soft, and we easily cut off a large root, and brought it away with us. The top of the seringa is not very wide-spreading, but beautiful, from its long leaves, which grow in clusters of three together, and are of oblong, ovate shape, the centre one more than a foot in length, and the others a little shorter. We found also the fruit of the seringa; it is ligneous; the size of a large peach, and divided into three lobes, each of which contains a small black nut."

And, again, Mr. Bates says:‡—"In descending the river [Rio Toncantins], leaving Baiao, we took our last farewell of the limpid waters and varied scenery of the upper river, and found ourselves again in the humid flat region of the Amazons valley. We . . . frequently went ashore on the low islands in mid river. . . . These are covered with water in the wet season, but at this time, there having been three months of fine weather, they were dry. . . . They are covered with a most luxuriant forest, comprising a large number of india-rubber trees. We found several people encamped here, who were engaged in collecting and preparing the rubber, and thus had an opportunity of observing the process. The tree which yields tho valuable sap is the *Siphonia elastica*. . . It grows only on the low lands in the Amazons region; hitherto tho rubber has been collected chiefly in the islands and swampy parts of the mainland, within a distance of fifty to a hundred miles to the west of Para; but there are plenty of untapped trees still growing in the wilds of Tapajos, Maderia, Jurua, and Jauari, as far as 1,800 miles from the Atlantic coast. The tree is not remarkable in appearance; in bark and foliage it is not unlike the European ash, but the trunk, like that of all forest trees, shoots up to an immense height before throwing off branches. Tho trees seems to be no man's property hereabouts. The people we met with told us

* Hooker's *Journal of Botany*, 1854, page 369.

* Hooker's Jour. Bot., 1855, p. 193.

† "A Voyage up the River Amazon." New York, 1847.

‡ Bates, Naturalist on the River Amazon. Vol. i, p. 142. 1863.

they came every year to collect rubber on these islands, as soon as the waters had subsided, namely, in August, and remained till January or February. The process is very simple. Every morning each person, man or woman, to whom is allotted a certain number of trees, goes the round of the whole, and collects, in a large vessel, the milky sap which trickles from gashes made in the bark on the preceding evening, and which is received in little clay cups, or in amphullaria shells stuck beneath the wounds. The sap, which at first is of the consistence of cream, soon thickens; the collectors are provided with a great number of wooden moulds of the shape in which the rubber is wanted, and when they return to the camp they dip them in liquid, laying on, in the course of several days, one coat after another. When this is done, the substance is white and hard; the proper colour and consistency are giving by passing it repeatedly through a thick black smoke obtained by burning the nuts of certain palm trees, after which process the article is ready for sale."

More recent information is to be found in a work on Brazil, published at Rio Janeiro, in 1867.* The passage may be translated as follows:—

Crude Caoutchouc.—The milky fluid extracted from the *Siphonia elastica* is known in Brazil under the names of "borracha," "seringa," and "cahuchu," the designation employed by the natives. The juice of the caoutchouc tree contains about thirty per cent. of india-rubber. . . . Caoutchouc is extracted by effecting incisions into the trunk of the tree. A transverse cut is first made of sufficient depth into the bark, a few feet above the root, a perpendicular incision being then made from the trunk down to the cross cut, and, at intervals, inclined cuts into the perpendicular one. This operation is often promoted by binding the tree with cords or bands, which frequently kills it. In a few hours the juice which flows out fills the basins made of large leaves and plastic clay, which are adapted to the lower part of the tree. It is then poured into other vessels of various shapes; in a short time it becomes thickened, and solidifies in consequence of the evaporation of the liquid part. In order to dry it completely, the practice is to expose it to a gentle heat; for this purpose it is suspended over a brasier lighted with wood, and the flame maintained with the fruits of auricuri, in such a manner that it may receive the smoke, hence the blackish colour which the caoutchouc of commerce generally presents. Whilst it is liquid it is fashioned by means of moulds, according to the purposes to which it is destined.

For a considerable time after the discovery of this kind of india-rubber, it remained a mere curiosity. Dr. Priestley, in the preface to his book on "Perspective" (1770), says:—"Since this work was printed off, I have seen a substance excellently adapted to the purpose of wiping from paper the marks of black lead pencil. It must, therefore, be of singular use to those who practice drawing. It is sold by Mr. Nairne, mathematical instrument maker, opposite the Royal Exchange. He sells a cubic piece of about ½ inch for 3 shillings, and he says it will last for several years." The trade in Para rubber has altered since that date. In 1836-7, 141,735 lbs. of good quality rubber was exported from Para; in 1855-6, the quantity was 3,477,445 lbs. There are three or four forms in which we receive Para caoutchouc in this country:—1st, flat pouches, called biscuit; 2nd, the well-known bottles; 3rd, Negrohead; and 4th, scrap. The "biscuit" consists of all the fine rubber, carefully prepared. It is made in the same manner as bottles—by successive dipping—thus showing a beautifully even, laminated appearance. The necks are very narrow, thus necessitating cutting the sides to let the mould out. The "Negrohead" consists of all the "scrap" left after the preparation of the fine, rolled into very large balls or blocks, sometimes about twelve inches in diameter. These offer an excellent opportunity for adulteration, which the Indians are not slow to avail themselves of. But of this I shall have more to say further on.

The entire imports of Para india-rubber into England, for 1867, was 4,750 tons. The price of Para rubber, as in the case of all other rubbers, varies according to supply and demand. The lowest price ever paid is said to have been 7¼d. per lb. During 1866 the price ranged between 1s. 7½d. and 3s. 1d. The present price for fine rubber is about 3s. 3d. per lb.

Maranham.—Occasionally parcels are received from this Brazilian province. It has much the appearance of that of Para, and in all probability it is produced by the same trees. At least species of *Hevea* are found there in quantity.

Pernambuco.—This rubber is most probably obtained from *Hancornia speciosa*, Gomes, a tree well known to Brazilians under the name of "mangava," or "mangaba," the fruit being held in very high estimation. This tree, according to Chev. de Claussen,* "grows on the high plateaux of South America, between the 10th and 20th degrees of south latitude, at a height of from 3,000 to 5,000 feet above the level of the sea." Dr. Gardner describes the tree as reaching to the size of an ordinary apple-tree, though its small leaves and drooping branches give it more the appearance of the weeping birch. The fruit is yellow, a little streaked with red on one side, about the size of an Orleans plum, and of delicious flavour. When in season it is brought to Pernambuco for sale.

In the Catalogue of the Brazilian Products, at the Paris Exposition of 1867†, the following notice occurs:—[Translation.] "The milk of the tree called 'mangabeira' (*Hancornia speciosa*), gives an extremely fine caoutchouc, but whether, in consequence of a fear of compromising the life or duration of the tree whose fruit is much sought after, or because the tree is not abundant, the caoutchouc is met with only as a rarity."

This rubber is of a very fine quality, being in value very near that of Para. I am indebted to Messrs. J. H. Rayner, of Liverpool, for my specimen of this rubber. It is hard, very clean, of an even, yellowish-white colour, and on the outside of a black colour. At present we may not expect any large quantities of this rubber, the tree being valued for its delicious fruit more than for its caoutchouc, and therefore, on this account, the natives are rather chary in collecting rubber from it lest its fruiting should thereby be injured. The wood is compact, hard, and durable, being used for cabinet-work, blocks, wheels, &c.

Hancornia speciosa is common also in the province of Sergipe, the milk being employed in medicine.

Ceara.—This rubber consists of reddish brown, string-like pieces rolled up into balls or blocks, and known commercially as "Ceará scrap." With regard to this rubber, Mr. Henry Lee Norris, the manager of the North British Rubber Company, thus writes to me:—"Ceará rubber is collected by puncturing the tree in the beginning of the dry season; the rubber heals the wound by exuding in the shape of tears, which, at the end of the dry season, are picked off from the trunk of the tree. The quality is good, but much mixed with bark, etc."

French Guiana.

India-rubber exists in large quantities in French Guiana. According to the Catalogue des Produits des Colonies Françaises, &c., p. 33, it is produced by *Hevea Guyanensis*, Aub. The passage is as follows:—[Translation]. "*Hevea Guyanensis* is abundant in Guiana, though not in large quantities, except in the contested part between Brazil and the Oyapock, where it is collected by the Indians and transported to Para."

* L'Empire du Brésil à L'Exposition Universelle de 1867, à Paris. Rio Janeiro, 1867, p. 61

* British Association Report, 1855, p. 103.

† L'Empire du Bresil, etc., p. 72.

British Guiana.

As far back as 1840, Robert Schomburgk says*—"That valuable substance, caoutchouc, is yielded by different trees and plants." In the catalogue of the British Guiana products at the Exhibition of 1862, there is the following:—"Caoutchouc. Contributed by J. Outridge. From River Demerary, near the Falls. Taken from the india-rubber tree by tapping, and formed into balls by the Indians, who climb the tree, and, as the gum exudes, rub it on their bodies till it assumes a sufficient consistency to be formed into balls." In the catalogue of the British Guiana products at the Paris Exposition of 1867, india-rubber is mentioned, though its botanical source is stated to be undetermined:—A specimen of *Hevea pauciflora*, Spruce, yielding a copious milky juice, was collected in this colony by Schomburgk,† as also a species of *Tabernæmontana*, noted by him as having the same property.

In January, 1866, I obtained a specimen of Demerara rubber, in the shape of small round bottles and balls. They have much the appearance of Para gutty bottles. My specimens are identical with specimens Mr. Silver received from Sir W. H. Holmes.

Venezuela.

From Venezuela, I believe, large quantities of india-rubber can be obtained. I, however, am expecting information relative to this state from my excellent friend Dr. Ernst, of Caracas. From Dr. Ernst, who is a good botanist, and the Natural History Society of Caracas, of which he is president, Venezuela will doubtless receive much benefit in the way of developing her resources.

Having thus dealt with the *Hevea* group of rubbers, we now pass to a second well-marked group, viz., those produced by the *Castilloa elastica*, Cerv. To this plant we are indebted for nearly all our india-rubber obtained from Central America, New Granada, Ecuador, and the West Indies. It is found in Mexico, all the Central American republics (viz., Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica), the Isthmus of Panama, West Coast of America down to Guayaquil and the slopes of the Chimborazo; it also grows in Cuba; and, if the early account of Columbus may be relied upon, in Hayti. The Spanish name of this tree is "Arbol de Ulé," or Ulé-tree, an exact translation of the Aztec "Ulequahuitl." Of this group, those kinds which appear in commerce are known as—1. West India; 2. Carthagena; 3. Nicaragua; 4. Honduras; 5. Guayaquil; 6. Guatemala. These I shall treat under their respective countries.

New Grenada.

New Grenadian rubber, or Carthagena as it is called, is imported in the form of sheets of about ¾ of an inch in thickness, having a peculiar "chewed" appearance, resulting most probably from the pressure used in cleansing and drying the rubber. This rubber is now used, on account of its purity, for many purposes for which Para alone was formerly used. It is black in colour, tough, and occasionally "tarry" in appearance. Its price is about 1s. 2d. per lb. As to this rubber, if analogy of character be any criterion, I should say that, in all probability, it is derived from *Castilloa elastica*. However, Dr. Spruce says, "I have often been told of a pinnate-leaved tree, yielding caoutchouc, which I could never fall in with. I am, therefore, unable to guess even at the family to which it belongs; but there is said to be such a one about Serpa, on the Amazon, and the same (or a cognate species) in some inland region of New Granada or Venezuela, whence it finds its way to Carthagena."

Ecuador.

The rubber of Ecuador is exported from Guayaquil, and known under this name. It is imported in the form of large black flakes or lumps. When cut, it is sometimes whitish, but in the lower kinds very porous, the pores being filled with a black liquid, which stains the hands and knife, leaving a disagreeable odour behind. Sometimes, by the mere pressure of the hand, a large quantity will exude. Its price is from 1s. to 1s. 2d. per lb.

On a specimen of *Castilloa elastica*, Cerv, collected in Ecuador by Dr. Spruce in December, 1860, are the words, "The India-rubber Tree of Guayaquil." The exports from Ecuador in 1861 were 811 quintals; in 1862, 300; 1863, 2,227; 1864, 1,889; 1865, 3,788; and in 1866, 5,708 quintals.

Peru.

According to Mr. Clements Markham, india-rubber trees are plentiful in Peru. The *Castilloa elastica* is found here. In the Kew Herbarium there is a specimen of *Hevea Peruviana*, collected in Peru, and said to yield gum elastic.

Panama.

The *Castilloa elastica* grows here in large quantities. On a specimen in the Kew Herbarium, collected by Mr. Sutton Hayes, the following notes occur:—

"Leaves of the Ulé-tree, collected in Sonsonate, in San Salvador, May 15th, 1860. I also got ripe fruit from the same place at the same time. Sometimes the leaves are much larger than these. I have collected the leaves of this same tree on the Isthmus of Panama, at a small native town on the Rio Gatun, called Corriente de Lechi, about six miles from the railroad. At this place I saw the natives making the caoutchouc; but the tree is most abundant on the Rio Trinidad, where there is an establishment producing very fine and pure caoutchouc from it. The caoutchouc furnished by this tree, when well cleaned and prepared, is very nearly equal to that of Para, some fine lots of it having been sold in New York for nearly as high a price as that from Brazil; but the finest specimen of the caoutchouc I ever saw were made from the milk of this same tree at Chinandega, in Nicaragua. Caoutchouc, within the last year, has been shipped quite largely from all the Central American ports at which the Panama Railroad Company's steamers touch."

Costa-rica.

There are reported to be whole forests of *Castilloa elastica* in Costa Rica. At the request of Mr. Silver, I drew up instructions for the collection and preparation of trial samples for a resident, who is very anxious to develop this branch of commerce.

Nicaragua.

Recently very good rubber has been shipped from Greytown, Nicaragua. About 100 tons have been received in England during the last year, selling for about 1s. 3d. per lb. It is in the form of thin sheets and well prepared. The following account, written by M. Diezmann, of Greytown, and forwarded by Mr. John Collinson, C.E., to Dr. Seemann, will be of interest:—"'Ule' (or 'Tassa' of the Mosquito Indians) is an important article of export from Nicaragua, and San Juan del Norte, or Greytown, is the principal port whence it is shipped. Having for many years dealt in it, and having never seen a correct account of the manner in which it is collected and manufactured, I shall offer a few remarks on the subject. Expeditions for collecting Ule, or Nicaraguan india-rubber, are organised by a number of men clubbing together, and applying to one of the india-rubber dealers, who furnishes them with the necessary outfit, including provisions, blankets, machetes, axes, pans, pails, baskets, &c. They bind themselves before the local authorities to work a certain time for the dealer, and deliver the produce of their work to him. This formality gone through, the men—or Uleros, as they are now called—generally have a series of amusements, dancing, drinking, and

* Description of British Guiana, London, 1840.
† Hooker's Jour. Bot., vol. iii., 1841, p. 245.

gambling, until the dealer intimates to them that their departure ought not to be delayed any longer. All the necessary things are now embarked, and under the blowing of conch-shells and shouts of friends, the canoe shoves off. Often the poor fellows have to travel a fortnight before they arrive at their destination,—passing rocks and rapids, and being frequently compelled to unload the canoe and drag it over them by sheer main force. At last, when arrived at their goal, their first efforts are directed towards building a hut to live in, beds being made of sticks, and on stages a few feet above the ground. A workshop is also built, if possible, as close as practicable to a river, a great quantity of water being required in the manufacture of the rubber. After an early breakfast, the men go to work, each man carrying a machete, a tin-can holding five gallons, and one or two wooden pails.

"As soon as the Ulero has selected his tree, he clears the ground about it of underwood and the stem of vines and epiphytical plants, and makes a ladder by tying pieces of cane two feet long to some tough vines about eighteen inches in diameter. All this preliminary work gone through, the Ulero cuts diagonal channels in the bark of the tree, first from his right side, then from his left, so that both meet in the middle. At the bottom of the lowest channel, an iron spout, about four inches long and two inches broad, is driven, underneath which a pail is put. Now the Ulero ascends his ladder, cutting channels right and left, every two feet apart. By the time he has done this he has to hurry down, his pail being now quite full, and it has to be emptied into the larger vessels, in which it is carried to the workshop. A tree 4 feet in diameter, and 20 to 30 feet to the first branches, will yield 20 gallons of milk, each gallon producing 2 lbs., and if rich 2 lbs. 2 oz., of good dried rubber. A good working man is able to get from 10 to 25 gallons of milk a day. In the evening the milk is pressed through a wire sieve, so that all the impurities are excluded before it is put into the barrels. When the barrels are full, the real manufacture of the rubber commences. This is generally intrusted to the most skilful of the party. The best manner of converting the milk into rubber is by mixing with it the juice of a certain vine, termed 'Achuca'* by the natives, which has the singular property of coagulating it within the space of five minutes. This vine generally abounds in the woods, and has fine large white flowers. Bundles of it are collected, and each stick well beaten with a piece of wood, and soaked in water, which is strained through a piece of cloth, and about a pint of it is well mixed with every gallon of the milk. This is done in a large tin pan, in which it coagulates quickly, forming a soft mass floating in a brown fluid, and smelling like fresh cheese. This mass is slightly pressed by hand, placed on a board, and then rolled out with a piece of heavy wood. I have used with advantage an iron roller, 150 lbs. in weight, for this purpose. By this operation a great quantity of dark brown water is squeezed out, and the rubber, which has now assumed its elasticity, is in flat round pieces, of $\frac{1}{4}$ to $\frac{1}{3}$-inch thick, by 20 inches in diameter, and perfectly white. The weight of one of these pieces ('tortillas,' the men call them) is about 7lbs. The tortillas are hung up in a shed on poles to dry, which in fair weather takes about a fortnight; the rubber assumes then its dark colour, and weighs 2lbs. a piece. If the vine is not to be had in the neighbourhood, two-third parts of water are mixed with one-third of milk in a barrel, and this has to remain undisturbed for twelve hours; after this time the water is slowly discharged, and the residue—a dark cream—is put in vats made in the ground, and left to dry. The drying process takes from twelve to fourteen days

SALVADOR.

India-rubber is found in Salvador, and is collected for exportation. I have never seen any specimens of it. Mr. Sutton Hayes gathered the *Castilloa elastica* here in 1860.

WEST INDIA.

Under this name the best kind of Central American rubber is known. The finest is received in the form of blocks, consisting of thin sheets, and of great purity. The lower kind is known as "scrap," consisting of all the refuse pieces left in the preparation of the best; its price is about 1s. 6d. per lb. This rubber, as far as I can at present ascertain, is not the produce of any of the West India Islands, being merely called "West India" from the fact that the mail steamer calls at St. Thomas, on the way home. Does Belize or Yucatan contribute anything towards it?

HONDURAS.

This rubber is rarely met with in commerce. The exterior is of a dark colour, the interior of a greenish grey. In texture, it is firm, and not porous. The price is about 1s. 6d. per lb. This rubber may be the produce of *Castilloa elastica*, but of this I am not certain; its different appearance from other accredited products of the same plant may be the result of chemical treatment.

GUATEMALA.

This rubber is the lowest kind of American rubber. It is in large blocks, consisting of thin sheets pressed together. From between these sheets, when fresh, a black, thick, resinous fluid exudes; after a time the water evaporates, and leaves a hard resinous substance behind, unaffected by hot water or steam. The rubber itself is jet black in colour, though, when purified from its resinous contents, I believe of a whitish colour. On a specimen collected in Guatemala, in 1861, by Mr. Sutton Hayes, he says, "All the caoutchouc of Central America is derived from this tree, and that from Carthagena and Guayaquil probably from the same source." Its price is about 1s. 2d. per lb.

MEXICO.

India-rubber can be obtained in Mexico. In an interesting work, on the "Materia Medica of Mexico,"* there is the following notice:—(Translation).—"Ulé.—*Castilloa elastica*, Cervantes, is a tree which grows in the warm coast regions of the Republic, and particularly in that of the Rumbo of Vera Cruz. It also occurs in the hacienda of S. José del Corral at Cordova. Its resin, recently extracted, is of a colour like milk, in which state it serves for economical purposes, and also for making elastic instruments used in surgery. They also prepare with this liquid resin sheets of silk, linen, or cotton, which are made use of in medicine to produce perspiration, and disperse tumours."

Heller † also makes mention of the rubber obtained from the ulé in Mexico, and says that waterproof boots and shoes are manufactured in great quantity, especially in Tabasco.

Having thus far dealt with the different kinds of caoutchouc afforded us in America, we next pass to the consideration of

II.—ASIATIC KINDS OF INDIA-RUBBER.

The interest which the discovery in South America of a substance with such remarkable properties, stimulated search being made for it in other parts of the globe. This led to its being found in the East Indies and the Archipelago. The credit of its first discovery is due to James Howison, a surgeon, in Prince of Wales Island. His paper is entitled "Some Account of the Elastic Gum Vine of Prince of Wales Island, and of Experiments Made on the Milky Juice which it Produces, with Hints

* Dr. Seemann, in his recent travels in Nicaragua, found the plant to be *Calonyction speciosum*.

* "Ensayo Para la Materia Medica Mexicana, Puebla, 1832." In the library of Mr. Daniel Hanbury, to whom I am indebted for the translation.

† "Reisen in Mexiko, 1845-8. Leipsig, 1851. Von Bartholomaeus Heller.

respecting the Useful Purposes to which it may be applied."* In this paper he says that the tree has branches, sometimes 200 paces long. The Malays taste the juice to find which is the elastic variety. The usual manner of drawing off the milk was by tapping, a quart in two days being considered full employment for one person. But the quickest way was to cut up the "vine" in lengths of about two feet. The oldest vines produced the best caoutchouc, the juice of which, being of the consistency of thick cream, yielded two-thirds of caoutchouc by weight.

In his experiments he made wax moulds of articles such as gloves, boots, &c., and dipped them in the liquid caoutchouc. He also made himself a complete suit of waterproof garments, spreading the liquid caoutchouc on the cloth with a ruler, and hanging them out in the air, the mere exposure rendering them dry immediately. Roxburgh, being in India at the time, directed his attention to the subject, named Howison's plant *Urceola elastica*, and described it as a native of the islands of Penang and Sumatra, &c., and the Malayan countries; stem woody, climbing over trees, &c., to a great extent; young shoots twining, and a little hairy; bark of the old woody parts thick, dark-coloured, and considerably uneven, a little scabrous, the wood being white, light, and porous.

The next discovery was in 1810, by Dr. Roxburgh himself; this, however, we shall notice under the head of Assam rubber. Asiatic kinds of caoutchouc may be noticed under two groups, viz., those of the Malayan Archipelago, and those of India, the former of which we shall treat of first.

Malayan Archipelago.

Singapore.—From this island the greater part of the rubber of the Malayan Archipelago is exported. Singapore is an apt illustration of the difficulties one has to contend with in determining the geographical source of vegetable products. Here is an island, no larger than our Isle of Wight, exporting enormous quantities of raw goods, and the question naturally arises, Are these home products? Singapore, from her highly favourable position, not only forms a vast entrepôt for the surrounding states, but also for Calcutta, Java, Siam, Burmah, China, &c. The value of its imports in 1863 amounted to £6,461,720. With regard to our immediate subject of caoutchouc, Mr. Thomas Hancock † gives the following instructive table:—

Imports at Singapore of caoutchouc for the years 1849-50 *to* 1854-5.

	lbs.
From Java	358,736
„ Sumatra	763,280
„ China	1,680
„ Manilla	14,896
„ Borneo	3,024
„ Malay Peninsula	448
„ Penang and Malacca	253,568
„ Elsewhere	130,256

During the period from 1849-55, only 723,968 lbs. were native produce, and since that period nearly all the trees have been destroyed. In a table given by Cameron, ‡ it is stated that £14,110 was the value of the india-rubber exported to Great Britain, in 1863, from Singapore; and he adds that it is not a native product, but that it is received from neighbouring states and stored up in the godowns or warehouses for re-exportation. The rubber known as Singapore has a very bright red, mottled appearance, and is very hard in texture, especially when old. It is received in baskets, weighing about three cwt., made of split rattans, covered with a jute gunny bag.

Borneo.—This kind of rubber is received either from Sarawak or *viâ* Singapore. It made its first appearance in our markets in 1864, under the name of "gutta susu" (Malay, *milk-gum*). This rubber in appearance is unlike all the other Asiatic kinds, being white, soft, porous or spongy, and very wet. In a new specimen it is no difficult matter to press out a large quantity of water having a saline taste. When old it changes colour to a dull pink, or brown, the cut portions being frequently encrusted with salt after the evaporation of the water. It has rather an unpleasant smell. This rubber is collected by the natives and sold to the Europeans. The published accounts of this kind of rubber are very interesting. Mr. Low* has the following:—

"Caoutchouc might be obtained in quantities in Borneo, as well as in many other of the islands, and on the peninsula; it is the produce of a climbing plant, of the genus *Urceola*, which grows to the size of a man's body. The bark, which is soft and thick, with a very rough appearance on being cut, emits the sap in the greatest abundance, and without destroying the tree. Very large quantities might be obtained from a single trunk.

There are three kinds in Borneo, called by the generic name "Jintiwan" by the natives. Two are common in Sarawak, viz., "J. susuh, or milky jintiwan, and the J. bulat, or round-fruited jintiwan. They equally produce the caoutchouc. The natives of Borneo use it to cover sticks, with which they beat their gongs and other musical instruments. The fruit, which is large, and of a fine apricot colour, contains ten to twelve seeds, enveloped in one of the most grateful fruits of the country to the European palate."

In the *Singapore Local Reporter*, of August 7th, 1853,† the following appeared:—"This gum, the produce of creepers known in that part of Borneo under the names of Serapit, Petabo, and Menungan, is nothing else than the watery milk-sap of these creepers, which, by a simple process, in the addition of a little salt water, takes the consistency and all the peculiarities of real india-rubber, being at first snow-white, but by exposure to the air changing slowly to a dirty yellow, and afterwards brown colour. The serapit produces the most common, the petabo the best, and the menungan the greatest quantity of sap. The gum obtained in this way contains water enclosed in small cavities, which we believe to have been formed by the celerity with which the sap hardens, preventing the salt water, and perhaps the watery part of the sap, from finding an issue. . . . During our peregrinations in the jungle of Singapore, we have met with the identical creeper, called menungan in Borneo, but which the Malays here call ngerit, or ngret, and on inquiry have heard from the native wood-cutters that the same is found in great quantities in Johore and the neighbouring islands. . . The process for obtaining the sap in use by the Badjows and the Muruts is very simple, but we should like to see an attempt made to obtain it in a manner less destructive to the plant. These people cut the creeper into small pieces, of one foot to eighteen inches in length, allow the sap to flow into their jars or buckets, and put one end of the piece over a slow fire, whenever the sap does not flow quick enough. They, therefore, destroy the plant in order to obtain the juice. The creeper could also form a new branch of agriculture, for it grows fast enough to procure a supply of sap in less than three years, and after planting requires no further cultivation."

Mr. James Motley, in a letter dated Singapore, March, 1854 (*Kew Journ. Bot.*, vol. v., p. 285), thus describes the plant:—"A very abundant creeper was the india-rubber producing *Urceola;* its fruit is about the size of an orange, and colour of an apricot, the thick outer skin full of milky juice, while within are about eight or ten seeds enveloped in a tawny pulp, tasting like well-bletted medlars. The natives use the juice only as birdlime." Again, while at Sumatra, he writes

* Asiatic Researches," vol. v. Calcutta, 1798.
† India-rubber Manufacture in England (London, 1857), p. 168.
‡ Our Tropical Possessions in Malayan India (London, 1865).

* Sarawak; its Inhabitants and Productions, by Hugh Low, London, 1848, p. 51.
† As quoted in Hooker's *Journal of Botany*, vol. v., page 157.

(*Kew Journ. Bot.*, p. 167):—"The plant yielding the best india-rubber, I think an *Urceola*, is common here; it is a large climber, as thick as a man's leg, with a dark rugged bark; it is called 'Jintawan' by the Malays, but this includes three species—menungan, serapit, and the petabo. The fruit of the serapit is the best, but all are much valued by the Malays, the pulp surrounding the seeds being very sweet, with a pleasant acid and a fine vinous flavour. To collect the sap, the stem is usually cut into billets a few feet long, from both ends of which the milky juice flows abundantly, and the plant soon springs up again. The gum is not collected among these islands, though the locality, always within the reach of the sea, is highly favourable, the only preparation required being to mix salt-water with the sap, the solid parts of which instantly coalesce."

All these quotations given refer to one and the same plant, viz., *Urceola elastica*, Roxb., and the descriptions given agree well with the known characteristics of the Borneo rubber of commerce.

When this rubber first made its appearance, I took considerable pains to determine its botanical origin. Dr. Roxburgh, in his description (before referred to) of Howison's plant, speaking of a ball of the india-rubber before him, says:—"Its colour on the outside is that of American caoutchouc; when fresh cut into, a light-brown colour, till the action of the air darkens it; throughout there are numerous small cells, filled with a portion of light-brown watery liquid."

These accounts agree as to the varieties, mode of collection, and treatment with salt-water. As to colour—an important consideration—Roxburgh had not the opportunity of examining a recent specimen; and it is well known how soon Borneo rubber, especially the more porous species, will change colour. Mention, too, is also made of its white colour when fresh, and of its alteration when exposed to the atmosphere. Both Roxburgh and the *Singapore Reporter* refer to the "cellular" formation in this rubber. There is, moreover, no other description of Asiatic rubber which would at all answer to the well-marked characteristics of the caoutchouc of *Urceola elastica*. On a specimen of this plant in the herbarium of the British Museum, collected in Sumatra by Campbell, there is this note—"White Caoutchouc. The *Urceola elastica*, Roxb., has a wide distribution, growing in the Malayan Archipelago, Sumatra, island of Penang, &c."

Java.—The india-rubber known under this name has a dark glossy appearance, with streaks of reddish and white colour, giving it a mottled look. For a considerable time I was unable to obtain any information respecting the botanical source of this india-rubber. It was, therefore, with pleasure I availed myself of a visit, paid me last month, by Dr. J. E. de Vrij, who was connected with the Java Cinchona Plantations, to ask his opinion. He stated that it was the produce of *Ficus elastica*, and subsequently kindly furnished me with the following interesting account:—"In Java, india-rubber is extracted from *Ficus elastica*. The native name of this tree is "pohon karet," or "kohlehlet." When the natives find this tree they make incisions in the stem, from which incisions there immediately flows a milky juice, which very soon coagulates, and becomes of a reddish colour. They collect these coagulated masses and combine them in the form of a thick rope. In this form it is sold in the markets. The natives often use these ropes for illuminating purposes when they are in search of the famous edible birds'-nests to be found in the caverns. That the india-rubber of Java is really obtained from *Ficus elastica* I am quite sure, as I have collected it with my own hands from that tree. The amount collected is, however, not very great. More important is the quantity of india-rubber collected in Sumatra. The native name of the tree from which it is collected there is "Getah-katjai," but the scientific name is unknown to me." [Dated The Hague, Nov. 27, 1869.]

Miquel (Fl. Ind. Bat. vol. iii.,) mentions *Willughbeia edulis* and *Vahea gummifera*.

The remarks of Dr. de Vrij, with regard to Sumatran rubber, prompt me to ask what becomes of this kind of rubber. *Urceola elastica*, as we have seen, grows in Sumatra. Is any of the rubber of this plant which we receive from Singapore produced in Sumatra, and thence taken to Singapore?

Penang.—This rubber is of a dark colour. Is it the produce of *Cynanchum ovalifolium*, Wight, which is stated by Dr. Wallich as yielding an excellent caoutchouc, and was found by him in Penang? It is a smooth twining plant (Lindl. Fl. Med., p. 542.)

Siam.—This india-rubber is of a white, or pinky, or liver-like appearance; it is rare in our markets. I do not know by what plant it is produced.

India.

Assam india-rubber is the only kind we obtain from India. It is the produce of *Ficus elastica*, Roxb. As we have incidentally mentioned, Roxburgh made the second discovery of a tree yielding india-rubber. He named the tree *Ficus elastica*, and gave the history of its discovery. "Towards the close of 1810," he says, "Mr. Matthew Richard Smith, of Silhet, sent me a vessel, there called a turong, filled with honey, in the very state in which it had been brought from the Pundua or Juntipoor mountains, north of Silhet. The vessel was a rather common or rather coarse basket, in the shape of a four-cornered, wide-mouthed bottle, made of split rattans, several species of which grow in abundance amongst the above-mentioned mountains, and contained about two gallons. Mr. Smith observed that the inside of the vessel was smeared over with the juice of a tree which grows on the mountains. I was, therefore, more anxious to examine the nature of this lining than the quality of the honey. The turong was, therefore, emptied and washed out, when, to my gratification, I found it very perfectly lined with a thin coat of caoutchouc." (*Roxb. Flor. Ind.* iii. 543.)

Roxburgh also found that older trees seemed to yield a richer juice, which, when exposed to the air, separated spontaneously into an elastic substance or caoutchouc, and a fetid whey-coloured liquid. It is collected by making incisions through the bark to the wood. About 50 ounces of the pure milk taken from the trees in August yielded $15\frac{1}{2}$ ounces of clean washed caoutchouc. After one operation, the tree requires a fortnight's rest, when it may be repeated. During the cool season, from October till March, the juice is more scanty than in the warm weather, from March to October, but richer. Assam rubber is shipped from Calcutta in baskets made of split rattans, and weighing about 3 cwt. each. These are generally covered with a jute gunny bag. This india-rubber has a peculiar mottled appearance, of a bright pinky colour, and very glossy. The baskets consist of either a great number of small "balls" pressed together, or a large irregular mass called "slab." The former is not so much liked, as it offers greater facilities for adulteration than the latter. It is curious to see this and other kinds of hard india-rubber sampled at the London wharves, &c., as, owing to its resistance, it will only allow of being cut with a chopper or knife constantly kept wet with a stream of water. It sometimes takes three or four men some considerable time to cut out a slab about twelve or fourteen inches long. According to Royle, any quantity of rubber can be obtained from India. One great fault, however, clings tenaciously, not only to this, but to all East Indian varieties—that is, its impurities. There is no reason why the caoutchouc of India should not be as pure as fine Para, if proper care were taken. In 1836, while Para rubber was selling at 2s. 6d. to 3s. per lb., East India was only selling at 2d.! and, although there is more care taken now, yet there is great room for improvement. How ignorance may retard the development of a country's resources! In 1828, a zealous

collector sent a parcel of rubber from Assam to a large agency in Calcutta, but the consignee, at a loss what to do with it, sent back the sample with the following reply, much to the disappointment of the collector:—"The article being unknown in the Calcutta market, we are sorry we can give you no idea of its value." Samples of it are said to have been in England as early as 1828, and first used in 1832.

Roxburgh mentions several other plants producing caoutchouc; among others is the *Willughbeia edulis*, Roxb., found in the forests of Chittagong and Silhet, where it is called Luti-am. It is a large climbing plant, and when wounded discharges copiously a very pure viscid juice, which soon, by exposure to the air, changes into an indifferent caoutchouc. (Roxb. Fl. Ind., vol. ii., p. 57.)

Large quantities of india-rubber are said to exist in China; I have not heard of any direct shipments. If we receive it at all, it is *viâ* Singapore.

III.—African Kinds of India-Rubber.

Everything connected with Africa and its intrepid explorers fails not to create attention, and the question of the production of caoutchouc in this vast country is one of great interest. I shall first direct your attention to the East Coast and the adjacent islands, beginning with

Madagascar.

This description of india-rubber, which is rather rare in this country, and generally passing, I believe, under the name of Mauritius-rubber, is used largely in France.

Dr. C. Meller, in his account of an expedition to Madagascar (read before the Linnean Society, December, 1862), says of the natives:—"To procure india-rubber they are less careful, merely making incisions, and allowing the sap to flow into a hole at the root of a tree. They procure their india-rubber from a trailing and climbing plant, whose order I am unacquainted with. It has thick cordate leaves, pear-shaped and sized fruit; the native name is 'Vaughina.' The *Ficus elastica* is found along the seaboard route, and a *Theophrasta;* but I am not aware that the Malagasy have recourse to them." Miquel (Flor. Ind. Bat., vol. iii.) mentions Madagascar as one of the habitats of *Willughbeia edulis*, Roxb.

Mons. F. Coignet, in an account of an excursion on the north-east coast of Madagascar,* gives some interesting notes on the india-rubber of this island, of which I will give a brief abstract. He says that there are two descriptions of caoutchouc, one obtained from three species of a climbing plant, which, I believe, will prove to be species of *Vahea*, and a shrub which often attains a height of from five to six metres, and having a smooth bark. Of these climbers, one yields a much superior product, though the natives do not keep it separate from the other two. The milk is collected by incision and coagulation, brought about in two ways; first, by the addition of salt water, and, second, by the application of artificial heat.

A short time since, I received the specimen exhibited from Messrs. E. Crouan, of Nantes, through the interest of Dr. Edward Bureau, of Paris, who, I am glad to say, has promised to institute inquiries for me respecting this description of rubber.

India-rubber producing plants occur also in Nossi Bé, on the north-west coast, and in St. Marie, on the east coast of Madagascar.

Comoro Islands.

Johanna.—Dr. Meller collected a species of *Vahea* here, and on his specimen he remarks that it is identical with the "Vaughinia" or "Vaughina" of Madagascar.

* Bulletin de la Société de Geographie. Septembre, 1867, p. 289. For a M.S. copy of this account I am indebted to my good friend M. Augustin Delondre, of Paris, as also together with M. le Dr. J. L. Soubeiran, for several French pamphlets, from which I have quoted in the present paper.

Mohilla.—Species of *Vahea* were collected here by Dr. Meller. The same plants grow also in the Isle of Mazotte, and in the Isle of France.

Eastern Africa.

Zanzibar.—In the Kew Museum there is an interesting specimen of india-rubber, collected by Dr. Kirk, in Zanzibar, from a species of *Landolphia*. This specimen is of good quality, having a semi-translucent appearance, and of a reddish-pink colour, looking much like bright Assam.

Mozambique.—Recently a small parcel of india-rubber, of good quality, has been received from this district. According to MM. Soubeiran and Delondre,* there is a great abundance of caoutchouc obtainable in the Inhambane district, large quantities of which are exported.

Zambesi.—The explorations of Dr. Livingstone in this district, thanks to the Drs. Kirk and Stewart, have been the means of increasing our knowledge on the subject before us. India-rubber-yielding plants have been found near Lakes Nyassa and Shirwa. In the Kew Museum there are two specimens collected by Dr. Kirk, one on the River Shire, supposed to be produced by a species of *Carpodinus*, of a dark Java description, and the other, of a Singapore character, from a species of *Carissa*. On the table is a specimen of caoutchouc, which was collected by the Rev. Dr. Stewart, now of Natal, up the Zambesi.

Southern Africa.

Cape Colony.—About twelve months ago, the Rev. J. C. Brown, LL.D., formerly the government botanist at the Cape, wrote me concerning the utilisation of the sap of different species of *Euphorbia*, and kindly forwarded such of his official reports as contained notices on the subject.

In his letter, he says:—"We have, at the Cape of Good Hope, extensive plots of different species of cactus-like *Euphorbias*, cumbering the ground and useless. The milk sap of all the species is said to have been made into india-rubber. The milk sap of one species is made by boys, for amusement, into a substance like masticated india-rubber. The milk saps of other species have been made into ebonite and vulcanite, or substances closely resembling them. The same, and others again, have been used in making waterproof buckets, and coatings of the same have been successfully used in insulating wires for electric telegraphs. But every attempt to get liquid, desiccated or coagulated, milk sap brought to this country in a state to be useful in india-rubber manufactories, has failed." [Dated Haddington, October, 1868.]

Dr. Brown has given great attention to the subject, and, at his suggestion, I drew up instructions for the collection and preparation of such samples as should allow of an opinion being formed on the subject. From what little I know of the products of other species of the same genus, *E. Cattimandoo*, &c., I should suspect that the so-called india-rubber has more the character of some of the brittle kinds of gutta-percha.

Western Africa.

West Coast.—The caoutchouc known in commerce as African is obtained from the West Coast. The first importation took place in 1856. We receive it in the form of flakes, round balls, and "tongues." The last are about four inches long, angular from adpression, and a little thicker than your thumb. It has a most offensive odour. I am, as you may admit, rather fond of india-rubber, but the less I have to handle this kind the better I like it, my liking for it certainly not improving on better acquaintance. It is of a yellowish white colour when new, very adhesive, and very slightly elastic; when old, it turns black, and loses much of its fœtid

* "Produits Vegetaux du Portugal" (Paris, 1867), p. 22.

odour. It is the poorest of our commercial kinds, its price ranging from about 8d. to 1s. per lb. The lowest price it has been sold at is stated to be 4¼d. per lb. The plant yielding this india-rubber seems to be common to the whole of west tropical Africa; large forests of it are said to exist in Guinea, Gaboon, Congo, Angola, &c. Up to the present time I have been unable to ascertain the botanical source of this description of caoutchouc.

In the Kew Museum there is a piece of wood with pieces of rubber exuded from it, brought from the West Coast by Dr. Africanus Horton. This rubber is undoubtedly identical with our commercial kind, but, unfortunately, the fragment of the plant brought home, possessing neither flowers nor fruit, did not admit of identification. A short time since, I received a letter from Dr. Horton, dated Cape Coast Castle, August, 1869, in which he says:—"The plant of my specimen was discovered far in the interior, about 200 miles from here, and the means of communication, now that the interior is in a state of commotion, is by no means easy. I have, therefore, but a poor chance at present of getting the flower of the plant. However, I shall make an effort, and, should I succeed, I shall write you on the subject." It may prove a species of *Landolphia*.

Gaboon.—According to the catalogue of the French colonies at the Exhibition, 1862,* caoutchouc is obtained in great quantities in Gaboon, from two climbing plants, which I suppose are species of *Landolphia*. It is brought down to the coast by the natives in the form of small balls and flakes. It is described as being very viscous, and of a disagreeable odour.

Congo.—From the River Congo, part of our commercial "West Coast" caoutchouc is shipped.

Angola.—Thanks to the great liberality and warm support accorded by the Portuguese Government, important botanical investigations have been made in Angola by Dr. Freidrich Welwitsch. This gentleman has kindly given me the following account for publication:—

"The very considerable number of milk-yielding trees and shrubs amongst the natural orders of *Moraceæ*, *Artocarpaceæ*, *Euphorbiaceæ*, and *Apocynaceæ*, to be found in the flora of tropical Africa is likely to lead one to the assertion that india-rubber yielding plants must be very plentiful, and I foster the conviction that this will really prove to be the case, although the quantity of india-rubber exported up to the present time, from tropical West Africa, and nominally from Angola, has been very insignificant, and in some cases restricted to mere samples."

"I am, however, fully convinced that this penury of exportation of so valuable an article in the European market is by no means to be attributed to the rarity of rubber-yielding plants in Angola, but results principally from the greater attention which other colonial products, such as ivory, wax, palm oil, gum copal, coffee, &c., call forth, principally on account of the easier sale and larger profit, than, under the present system, would be obtainable by the extraction of india-rubber, as the mode of collection and manipulation observed in America and Asia by the rubber-collectors seems never to have presented itself to the minds of the aborigines of tropical Africa.

"The trees and shrubs from which, according to my own observations and repeated inquiries on the spot, india-rubber is obtained from in Angola, are several large-leaved species of fig trees (*Ficus*, L.), and also several species of the Apocynaceous genus, *Landolphia*, which latter form large climbing shrubs, with stems often reaching six to eight inches in diameter, when growing undisturbed in the primeval forests, where, too, they often climb to the height of 50 to 80 feet, spreading their leafy heads like a verdant carpet amongst and along the crowns of the larger forest trees. There is also a tree belonging to the same order, an undescribed species of *Toxicophlæa*, growing in the less crowded woods of the highlands of inner Angola, from which a rather valuable kind of india-rubber is at times collected by the negroes, but only in small quantities, as the tree itself rarely attains to a large size, and is neither so frequent nor so rich in milky juice as are nearly all the species of *Landolphia*."

"Amongst the four or five species of *Landolphia*, which I found indigenous in various parts of the highlands of Angola, is principally the *L. owariensis*, Beauv., from which I have seen india-rubber collected by the negroes in the districts of Golungo Alto, and of Cazengo. This magnificent climbing shrub, which is by no means rare in the primeval forests of these districts, attains, under favourable circumstances, a considerable size, having a stem from four to seven inches in diameter, at the height of two to three feet from the ground. From this point it is divided into several long thin branches, which are again and again divided, climbing along the stems and larger branches of neighbouring trees, to which they fix themselves by means of most tenacious spirally-twisted tendrils formed out of the indurated flower-stalks after the ripe fruit has fallen off. The fruit is about the shape of a middle-sized orange, containing, under a hard, nearly woody, reddish-brown shell, a sweet, rather acidulous pulp, which is eaten by the natives. The fruit, and also the rubber obtained from the *Landolphia owariensis*, is called "Licongue" by the natives."

"The method which I saw employed in some districts of the highlands of Angola, by the "licongue" collectors for the extraction of caoutchouc, is a very rude and imperfect one. Having selected a tree, the collector makes a horizontal cut through the bark, and placing the palm of his hand flat on the tree below the incision, allows the milk to trickle down over the back of his hand, the mere exposure of the milk to the atmosphere causing it to coagulate, and envelope the arm in a sheet of india-rubber. When the tree has ceased to yield freely, he repeats the operation on another tree. After he had as much on his arm as he deems sufficient, beginning at his wrist, he rolls the incasing rubber back towards his elbow, the rubber being thus taken off in the form of a ring."

"From this description, it will be readily understood that, by such an imperfect method, both the quality and quantity would be considerably improved were more appropriate means used. I was, therefore, not surprised to hear that rubber prepared in such a manner did not fetch a sufficiently remunerative price in the markets in the coast towns of Angola, which circumstance had the effect, at least during my stay in Angola, of discouraging the few natives and colonists who engaged themselves in the collection and sale of this valuable product."

"With regard to the geographical distribution of these rubber-yielding plants, I may observe that *Landolphia owariensis*, first discovered by Palisot de Beauvais, in Owar and Benin, and afterwards Don, in Sierra Leone, I have encountered rather frequently in several of the highland districts of Angola, and consequently the habitat of this plant may be stated as extending from 10° lat. N. to 10° lat. S. on the tropical coasts of West Africa. The *Landolphia florida*, Benth., first found in Fernando Po, by Vogel, enjoys almost as wide a geographical range, being rather frequent in most of the primeval forests of inner Angola, where, at an elevation from 1,500 to 2,500 feet, I often met with this beautiful climber, and gratified myself with its sweet acidulous fruit, though not less so with the beauty and marvellous abundance of its large snow-white and jasmin-scented flowers."

It is to be hoped that not only the production of this substance, but also of others, will be fostered and extended in this valuable and highly interesting Portuguese colony.

Benguela. — India-rubber has been exported from Quicombo, of rather better quality than the ordinary

* Catalogue des Produits Françaises (Expos. Univ. Lond., 1862), Colonies d'Afrique, page 50.

West Coast description. Rubber is said to have been obtained in Novo Rodondo from *Ficus elastica*.*

India-rubber yielding plants have also been collected up the Niger, by Mr. Barter and Captains Speke and Grant; on the Gambia, by Dr. Vogel; and in Sierra Leone, by Mr. Don.

IV.—Australian Kinds of India-rubber.

In November, 1867, I obtained a small fragment of india-rubber collected in Australia. As well as one might judge from such a piece, it had the character of that of Assam. Dr. Ferd. von Mueller, in his essay on "Australian Vegetation" (Melbourne, 1867), p. 5, says:—"Caoutchouc might be obtained from various trees, especially the tall kinds of *Ficus*. Subsequently, on my writing to Dr. Mueller on the subject, he, with his usual courtesy, replied that "There are several species of *Ficus* in east Australia, more particularly *F. rubiginosa* and *F. macrophylla*, which yield india-rubber; but as yet we have been unable to compete with such countries as hitherto furnish caoutchouc, inasmuch as wages here is so different to what it is in India." However, I trust before long to receive specimens which will enable a more definite opinion being given.

A specimen of caoutchouc, obtained from *Ficus religiosa*, is mentioned among the products of New Caledonia, in the Exhibition of 1862.

The use of india-rubber is no longer restricted to the mere rubbing out of pencil marks, but its applications are legion, and still more numerous would they be if larger quantities, at lower prices, could be supplied. This is really the question, the practicability of which has to be solved. On the present occasion I must content myself with but a few remarks on the subject, trusting to do it more justice on a future occasion. First, as regards

1.—Quality.

Mode of Collection.—There are three ways in which the milk sap is collected. 1st, by simple successive incisions; 2nd, by incision assisted by binding the tree; 3rd, by cutting the tree down. The time of year at which the milk sap is collected has an effect on the quality of the product. At the time of flowering of the seringas, scarcely any milk can be obtained from the stem, whereas if the pannicles be cut, the milk starts out in large drops. If a tree be tapped too often, the milk at each successive tapping is of less strength, and becomes at last quite watery. After tapping, a period of rest from two to three years should elapse before the operation is repeated, to allow the tree to recover its strength, otherwise the milk sap will be deficient in richness and the tree injured.

Preparation.—Various methods, as we have seen, are used to bring about the separation of the particles of caoutchouc from the whey-like portion of the milk sap. They may be thus stated:—

Group. 1.—*Coalescence brought about by Heat.—Examples.*

(1). Artificial heat ....Brazilian, &c.
(2). Natural heat......Ceara and Ficus group.

Group 2.—*Coalescence brought about by the addition of Various Substances.*

(3). Alum ....Brazilian.
(4). Certain plants ....Nicaragua.
(5). Fresh water ...... Do.
(6). Salt water........Borneo, Madagascar.

One of the desiderata in rubber is, that it should be dry. The old mode of drying Para rubber is as follows:—After the milk is collected, the Indians gather heaps of Urucuri nuts (the fruit of *Attalea excelsa*, Mart.),† which give off a thick white smoke. They then dip their clay moulds in the milk, and holding them over the fire, repeat the dippings till a sufficient thickness has been obtained, thus giving rise to the laminated appearance observable in Para bottle rubber. By some, this smoking process has been questioned; but Dr. Spruce, in his letter, says:—"India-rubber was certainly smoked when I was on the Amazon. The smoke used was produced by heating (toasting or roasting, not properly burning) the hard but somewhat oily nuts of the Urucuri Palm (*Attalea excelsa*, Mart.) It was very white and vaporous, and deposited no fuliginous matter whatever. A recently-made smoke-dried India-rubber shoe was of a straw-colour, or pale yellow brown; so that Martius was wrong in supposing 'Incolæ fructos tostos ad fumigandum succum *Siphoniæ elasticæ* adhibent, ut resinæ elasticæ *nigrum colorem* comparent.'" The mistake, I believe, has arisen from the change of colour from the yellowish-white to brownish-black tinge, which Para rubber assumes on exposure to the atmosphere, being attributed to the action of the smoke; whereas, in all the specimens examined, I have invariably found the centre unchanged in colour, and no trace whatever of any fuliginous deposit between the laminæ. Frequently I have cut off all the exterior portions of a piece of this kind of rubber, and have noticed how soon the cut edges assume the browny tinge on exposure.

I believe sulphur is also used in the preparation of Para rubber. The very hard character of the rubber can hardly be referred to simple drying; and, in the catalogue of the Brazilian products at the Paris Exposition of 1867, notice is made of the hardening effect sulphur has on rubber. The province of Para purchased of Henry Strauss his method of preparing rubber by the addition of a certain quantity of aqueous solution of alum. This operation can be performed in the houses of the collectors, thus not necessitating exposure to the boggy soil, which, in whites, always brings on fever. The Brazilian finds only one fault with this process; that is, its simplicity, the result being, all the rural population give their attention to its preparation, to the neglect of other pursuits. I may mention that, when the milk is desired to be kept in a liquid form, a small quantity of ammonia is used for the purpose.

To the second group, those prepared without heat, there is a great objection, viz., the excessive moisture of the rubber, caused through the outer portions being acted upon first, and thus enclosing the watery part in numerous cells. Great pressure is necessary to free the rubber from the watery part, and this is not always available.

Purity, and freedom from false packing, are of the greatest importance. The adulteration may arise from—1. Careless collection, in letting fall pieces of bark, &c., into the milk, or in mixing the milk of another tree. As is well known, there are numerous lactiferous trees, and a collector is not always careful, especially as with him quantity is the motto, and not quality. 2. Bad preparation, in allowing pieces of clay, &c., to drop into the milk or remain in the bottles after being used as moulds. 3. Intentional fraud. If anything tends to depreciate a rubber, however good its quality may be, it is this "false packing," clay being too plentiful in this country to justify paying 1s. 6d. or 2s. per lb. for it.

In the specimens of Mozambique rubber on the table, one has a large piece of heavy wood in the centre, and only a mere coating of rubber covering it. Any one having to do with the preparation and importation of rubber should look to this, as requiring the very greatest attention. It is by far the better plan to prepare the rubber in flat slabs, like the "biscuit Para," as this gives a buyer confidence in the article, because adulteration becomes much more difficult.

II.—Supply.

The want of a larger supply of good caoutchouc, and at a lower rate than manufacturers have to pay at present, is much felt. To go no farther back than 1861, the highest price paid during that year for fine Para

* Prod. Veg. du Portugal, p. 20.

† Failing these other palm fruits are used.

rubber was 2s.; last month it was 3s. 3½d. The question has naturally been asked, What is the cause? and to answer it I cannot do better than quote from a note forwarded me by Messrs. Rayner and Co., of Liverpool, and written by Mr. Augustus Tappenbeck :—

"*Para.*—This year's crop will probably fall short of last year's, the reasons being want of hands, caused by constant recruiting for the war, and the natural decrease of the Indian population. The districts in which the largest quantities of rubber are collected are very unhealthy. The rubber trees abound most on the banks of the rivers, which, during the rainy season, are under water. With the beginning of summer, when the rivers begin to fall, the principal season for collecting commences, and the people have to work in mud, and surrounded by decaying vegetable matter, which produces fever and ague in white people, whilst the Indians and blacks do but rarely suffer from the disease."

"*Ceara.*—The annual crop does not amount to much; people collect rubber only in the intervals when they are not occupied with their cotton and coffee plantations, which takes nearly all their time."

Mr. Tappenbeck also mentions that the right of collecting the rubber of Pernambuco and of the adjoining provinces has been leased to one individual, but who, for want of hands through the war, is doing nothing. Such has been, and ever will be, the case, where the native populations have to be depended on. No amount of persuasion will induce many of them into making an effort beyond their own inclinations. In Africa, the trading stations are in most cases at least dependent on the caprice of the natives. They bring products for barter, and the wars and quarrels of their chiefs are constantly interrupting the trade. Such being the case, it becomes necessary to see whether these matters can be remedied. This can be done in four ways, opening new sources of supply, by preserving and improving existing ones, and by cultivation and acclimatisation.

Of new sources of supply, I cannot help looking with considerable interest on the vast resources of Africa and the Malayan Archipelago. The vegetable wealth of these must be enormous. South America, too, is susceptible of much improvement. India is far behind-hand. The *Ficus elastica* is easy of cultivation, and Assam should furnish good caoutchouc in large quantities. The *Ficus elastica* is so abundant in Assam and Cachar as almost to form forests. Dr. Anderson, the Director of the Calcutta Gardens, and formerly Conservator of the Forests of Bengal, says that the right of collecting india-rubber has been leased, for periods of six or seven years, principally to natives, the sum paid being about £1,000, and that he fully intended, when other urgent forest business would admit, to place the india-rubber forests under the direct control of the Forest Department. This his successor has done in the present year. Under the old system of long uncontrolled leases, the trees were much injured by overtapping, as each lessee endeavoured to get as much out of each tree as possible. The best manner, however, of preserving the Assam india-rubber trees, and the improvement of the manufacture, is at present engaging the earnest attention of the district officers and of the Forest Department.

Here let me say a word respecting the injury done to india-rubber trees by natives, as showing the necessity of conservation. This injury is of three kinds—1. Overtapping; 2. Binding the trees in order to obtain a greater quantity; 3. Total destruction of the tree. With regard to the second, this is found in Brazil to do the trees a great injury, and rendering them liable to the attacks of insects, and death follows as a matter of course. With regard to the total destruction of trees, the reason generally given, especially with respect to the gutta-percha tree, is that otherwise the collection of such products would prove unremunerative; but this is not the true reason. Wherever proprietary right or conservancy does not exist, total destruction of trees will be the rule. The only valid reason ever given by a native has been, if he spared the tree, others would not, and that he did not see any reason why he should not enjoy the full benefit himself, rather than leave it to others. In fact, there are many natives who do not like cutting down trees, as, beside the labour, they have constantly to shift their field of operation.

In closing these remarks, there is one subject which I would more especially recommend to the attention not only of those present, but also submit to the attention of her Majesty's government, that is, the acclimatisation of the different species of *Hevea* (and also incidentally I would mention the species of *Isonandra*, which yield gutta percha) in such of our eastern possessions as will be found best suited. The introduction of the invaluable cinchonas into India has been attended with marvellous success, and is alike an honour to this country at large as to those scientific men who have been engaged in the undertaking. Though I would not plead an equality of value in these articles, yet all will agree that fine descriptions of india-rubber are sadly needed; that increasing supplies do not seem to be forthcoming; and that the Para rubber, furnished by the species of *Hevea*, is superior to any other.

Thus, gentlemen, I have endeavoured to lay before you a few facts on this interesting subject. There are many other points which I should have liked to have brought under your notice, but these I must reserve, if thought of sufficient value, to a future occasion, when I may again have the honour of addressing you.

DISCUSSION.

The CHAIRMAN said it must have struck everyone as a curious fact, that a substance of such extraordinary value, and possessing such remarkable qualities, should only have been extensively used within the last few years. Caoutchouc did not appear to have been known at all to the ancients, not being mentioned or alluded to in any of their writings, and in fact its properties had been entirely unknown in the eastern hemisphere, although, as they had heard, it abounded there. It was reserved for the American Indians to discover the ex-extraordinary properties of this article, and, as they would no doubt remember, it was Columbus who brought the knowledge of it to Europe. He found the Indians of St. Domingo amusing themselves by playing with balls made of india-rubber, and when, shortly afterwards, Cortes went to Mexico, he found that the jesters at the court of Montezuma used to dance before the Emperor in shoes made of that substance. It had been said of old that there was nothing new under the sun, and it appeared that what was called macintosh cloth was well known to the American Indians and their Spanish conquerers. It was very curious, therefore, that such a thing was not appreciated by Europeans for so long after it was known; but this was the case with many great discoveries. India-rubber had been spoken of and written about by various persons, but it was not until the last century that it came into use in England, and then only to a small extent, for rubbing out pencil-marks on paper; hence the name india-rubber, to which Mr. Hancock objected as being too long, while he thought caoutchouc difficult to pronounce. He therefore advocated the use of the term "rubber" alone. He (the chairman) saw no objection to the word "caoutchouc," and thought it would ultimately prevail. The supply had kept tolerably equal to the demand until of late years, when fears began to be entertained that there would be a deficient supply. He himself did not share those fears, because there was such an enormous extent of country yet remaining to be explored, in differents parts of the globe, where india-rubber might be found. They all knew, for instance, that on the American Continent there were immense virgin forests, only known

to Europeans by the rivers which passed through them, and from the highway, as it might be called, across the isthmus of Panama. As soon as they began to make railways, as they were now doing in Honduras and other parts, there was no doubt but that a great number of india-rubber trees would be discovered. In Nicaragua there were large tracts of country entirely unexplored, some of which were inhabited by hostile Indians, particularly one district, about which a great many curious stories are circulated. No white man had ever penetrated up these rivers until within the last few years, when the high price of rubber induced some of the collectors to make an attempt to penetrate into the interior, in search of caoutchouc, and forming a strong party, well armed, they succeeded in their endeavour. This was the country between Nicaragua and Costa Rica, to which allusion was made in the paper. He had no doubt that when the country was opened up, almost any amount of india-rubber could be obtained, and the same thing would, no doubt, be true of Asia and Africa. There were a great number of plants which yielded this material, the genus *Ficus* alone consisting of several hundred species, all of which yielded milk capable of being converted into caoutchouc of more or less value. Again, the cultivation of caoutchouc trees might turn out very profitable, inasmuch as they grew with great rapidity, and did not require much attention after once being planted. Under regular treatment, they might be tapped every two or three years, and no doubt they would yield very profitable returns. One thing which made india-rubber expensive was, that the trees did not seem to grow in forests, but were scattered about amongst other vegetation, so that the collector had to waste a good deal of time in searching for them. A great deal of time was saved in Nicaragua and Central America by thickening the milk at once after it had been collected, various plants being employed for this purpose. Until within the last few months it was not known what these plants were, but he (the Chairman) had succeeded in identifying one, which was a kind of convolvulus, very abundant there. After employing the juice of this plant, the milk at once became thick, and was easily dealt with.

Admiral Sir Edward Belcher said one of the reasons why india-rubber did not find its way to this country from Panama at an early period was, that at that time it was simply used here for rubbing out pencil-marks, and consequently there was not much demand. To his knowledge there was, in 1836, a very extensive trade carried on there by the acting Vice-Consul, but all he could procure was taken by the United States. In fact, he (Sir E. Belcher) had found, all over the world, that wherever anything would fetch 1s. per lb. in the English market the Americans would intercept it, and pay 1s. 6d. He believed some of the finest india-rubber which he had seen at Panama in 1836 was equal to any specimens exhibited on the present occasion; and in Borneo he had seen specimens in use by the natives quite equal to ordinary bottle rubber. In the year 1832, while he was in the United States, he saw little grotesque ornaments of India rubber, such as were so much in use in England about twenty years ago. With regard to the Eastern sources of supply, he might say that Singapore might be considered as the London of the East, all the products of the different countries in that quarter of the globe being received there by the native traders, who came in their prows. Sumatra, Borneo, the Spanish possessions, and even the settlements on the Irrawaddy, all sent their products to Singapore, because the Chinese bought up everything they could get hold of there, and there was an immense demand for india-rubber throughout China, for making varnish. When at Macao, he had some gold-size given him, the finest he had ever seen, as would be proved by the fact that the trucks of his ships were gilt with it, and, after six years, they looked as fresh as on the first day. With regard to our present supplies, it must be borne in mind that the caoutchouc must be purchased by the agent abroad at such a price as would enable him to send it to England at a profit. As far as the plant itself was concerned, he believed that all forests in foreign lands were free property, and that they could not be protected in any way by law; and with respect both to india-rubber and gutta-percha plants, if they attempted to remove the other trees which protected them, they would very soon die; that he had seen both at Borneo and Singapore. When at Borneo, Dr. Oxley gave him some of the first specimens of gutta-percha, which were now in Kew museum, and furnished him with guides for an excursion into the country, in search of the plants. He had never seen the process of manufacture, but he had seen the result, and he was informed that the way in which the finest india-rubber balls were made, was by using a strong reed or porous rush, and treating the india-rubber like a soap bubble, dipping the reed into the milk and blowing very gradually until it was about the size of a cricket-ball; it was then tied to prevent the escape of the air, and hung up to dry.

Mr. Collins then proceeded to describe several of the specimens on the table, remarking incidentally that the dark colour on the outside of the india-rubber was due simply to exposure to air, for the darkest kinds externally were often nearly white below the surface. With reference to the adulteration of rubber, there was in the Kew Museum a curious specimen of Negro-head rubber, which he had sent there. There was an external coating of caoutchouc, inside which was a large ring of earthenware, and inside that again cloth, reeds, clay, and other rubbish, so that the weight of the rubber itself was not more than one-fifteenth or one-twentieth of the whole mass. This was always the case, more or less, with this description of rubber, and the consequence was that it did not fetch anything like the price it was intrinsically worth. With regard to Singapore rubber, also, the great fault was its adulteration with sand and bark, the natives trying to make it as heavy as possible. The specimen from Java was very interesting, being in the form of the ropes spoken of by Dr. de Vrij as being used for torches. It was of the utmost importance that every one connected with this branch of commerce should take every opportunity of impressing upon the agents abroad the necessity of procuring the caoutchouc as free from adulteration as possible. He might also mention that many of the milks from which the rubber was prepared were very palatable, indeed, he had been informed by one European that he had been in the habit of mixing it with his tea and coffee, until he saw one of the natives using it for sticking together pieces of cabinet-work, when he discontinued it.

Mr. Walter Hancock said the subject of the paper had been treated from a point of view from which the manufacturer hardly ever regarded it, viz., the geographical and botanical. Some of the remarks of Mr. Collins were similar to what he (Mr. Hancock) had ventured to make on former occasions. For instance, in the collection of vegetable matter of this kind it was most important that the right season should be chosen, and that it should be taken from a healthy tree of mature age. Among the reasons why the india-rubber and gutta-percha when first introduced into England appeared perfectly sound and satisfactory, and afterwards turned out to be quite the reverse, was, he believed, the neglect of these precautions. With regard to what had been said as to calling the attention of those who collected india-rubber and gutta-percha to the importance of getting it pure, he must say that, for many years past, the strongest representations on this subject had been sent to the merchants abroad, who bought it direct from the natives. But, in dealing with people like the Indians, it was found that you must take what they thought proper to send, or nothing at all. It appeared that in Para they had at length arrived at a traditional and perfect mode of collecting it, but in

other parts, where it had been more recently found, the process appeared very rough indeed. More particularly was this the case with regard to East Indian rubber, and that which came from Singapore, Sumatra, Borneo, and the adjacent districts. With regard to the collection of gutta-percha, he had several times sent out very carefully selected samples, with a long list of hints that he thought ought to be attended to, but this did not seem to produce much effect. Some samples of Balata gum, which was somewhat intermediate between india-rubber and gutta-percha, had been sent over by Sir Wm. Holmes, which appeared perfectly pure, not having even a half per cent. of impurity. And there certainly appeared no reason why, if the same skill and care were devoted to the collection of india-rubber and gutta-percha, a similar result should not be obtained. There was no doubt as to the immense importance of this part of the question.

The Chairman said one of the great advantages of the meetings of the Society of Arts was, that men of science and manufacturers could join hands, and each discuss any particular subject from his own point of view; whereas it was too often the case that science and practice were kept distinct. He should, therefore, much like to hear some further observations from any manufacturers who might be present.

Mr. P. R. Hodge quite agreed with the Chairman, that if any manufacturer or person thoroughly acquainted with the practical application of india-rubber could be found to contribute a paper on this subject, to supplement the one they had just heard, it would be of the utmost value. He must compliment Mr. Collins on his valuable paper, which showed an immense amount of research; but he feared that such a paper as he had described would not be forthcoming, knowing, as he did, a great deal of the manufacture and how many secrets there were in the trade. To give one instance, a gentleman, who was present, had spent twenty years in endeavouring to make one article, and he was just now beginning to reap the benefit of his experiments, and had obtained a patent. For a long time he had been able to get the correct form, but not the composition, but he had now obtained that, and there was no other manufacturer who could produce the article. There were, as he had said, so many secrets in this trade, which each one kept to himself, that he much doubted whether such a practical paper as he had spoken of could be obtained, but there was no doubt, if it could, it would be invaluable.

The Chairman then proposed a cordial vote of thanks to Mr. Collins for his valuable paper, which was carried unanimously.

Proceedings of Institutions.

Royal Polytechnic Institution Classes.—On Friday evening, the 10th December, Dr. William Brewer, M.P., distributed to the successful candidates of the evening classes at the Polytechnic Institution the prizes awarded for proficiency displayed by pupils at the examinations of the Society of Arts, of the Department of Science and Art at South Kensington, and of the City of London College. The number of students during the past year have averaged 400 each term, being a small increase on the preceding year, and an increase of about one-fourth over the number of five years past. The pupils had been very successful at the examinations, having gained, besides the Prince Consort's prize of 25 guineas, two first prizes of £5 each, and three second prizes of £3 each. About £40 had been added in prizes from the donation fund. These prizes consisted, for the most part, of useful works and instruments.—Dr. Brewer said that, while elementary education had been engaging universal attention, and whilst it was such a question as ought to occupy the attention of every lover of his country, and while there was in truth no collision between this and the subject of denominational education, there being ample room for both, there was another cognate subject which the Polytechnic Institution had taken up, which was likewise of the utmost importance, namely, technical education. No great step could be made without a deep knowledge of the laws of nature, and it was to this knowledge mankind were indebted for improvements in manufactures, science, and the arts, and without advances in this knowledge England would be distanced in the race. It was needless for him to say that the Polytechnic Institution gained nothing from these evening classes. They were purely philanthropic on their part. He bore a high testimony to the long-continued and valuable exertions of the Rev. C. Mackenzie and Professor Pepper.—The Rev. C. Mackenzie congratulated the students on the Prince Consort's prize having been again gained by one of their number. They had three examinations, one at the Society of Arts, one at South Kensington, and one at the City of London College. To all these bodies they were much indebted. For the Prince Consort's prize the work must be continuous, and it was the result of four years' success. He had informed her Majesty that this prize had been won for two years by students of the Polytechnic, and the Queen had been pleased to send to the library of the institution copies of the books which she had edited, containing the following words:—"Presented to the Evening Classes at the Polytechnic Institution. Victoria R." The pupils of the evening classes had gained 21 first-class certificates, 40 of the second class, and 35 of the third. They had gained, including the Prince Consort's prize, prizes amounting to £45 5s. out of a total of £306.—The successful candidates were then called forward to receive their prizes:—Mr. H. Fisher, who had obtained four first-class certificates, and a prize of £3 from the Society of Arts, was loudly cheered; Mr. J. G. Riorden had gained three first-class and one second-class; Mr. H. Spriggs, who had, in a competition with 253 others, taken the second place in book-keeping and a first-class in arithmetic, received also £3 from the Society of Arts. The number of successful candidates was 96 in all; several also had obtained prizes from the Society of Arts. The hero of the evening was Mr. W. J. Wilson, who had gained the Prince Consort's prize (presented to him at the opening meeting of the present session of the Society of Arts), as well as two prizes of £5 each, and one of £3 from the Society of Arts. The subjects for which his six first-classes this year had been gained were metallurgy, magnetism, &c., civil government, political ecomony, and logic and mental science, four from the Society of Arts, and two from the Science and Art Department, South Kensington. This gentleman was called up last, and to him Dr. Brewer presented a purse containing twelve guineas, amid loud cheers from those assembled.—Mr. Wilson, on receiving his prizes, begged to say that if encouragement and assistance made successful students, it was natural to expect that those of the Polytechnic would succeed, for they received all possible aid and encouragement in their efforts, and he begged to thank the committee for that which had been so kindly bestowed upon himself.—The Rev. J. B. Owen proposed a vote of thanks to Dr. Brewer, which was seconded by Professor Pepper, and passed unanimously.—Dr. Brewer briefly returned thanks, and the meeting terminated.

CITY OF LONDON MIDDLE-CLASS SCHOOL.

On Thursday, the 19th December, the Chairman of the Council, Lord Henry Lennox, M.P., and Mr. Edwin Chadwick, C.B., Mr. Hyde Clarke, members of Council, with Mr. Bartley, auditor, attended the distribution of prizes at the City of London Middle-Class School. The Lord Mayor took the chair. Amongst those present were, besides the Lord Mayor and Sheriffs, Sir William Tite, M.P., Mr. George Moore, Mr. J. P. Gassiot, Mr. C. K. Freshfield, Mr. Philip Cazenove, the Hon. and

Rev. S. Best, Mr. Arthur Hobhouse, Q.C., the Rev. Canon Robinson, Mr. Clifton, the Rev. William Rogers, M.A., hon. secretary, and the Rev. Mr. Jowitt, the head master.

The school contains upwards of eight hundred children, chiefly of shopkeepers. About 20 per cent. of the children may be said to be of the foremost artisan class, such as the foremen of warehouses, railway-station masters, and the like. The children are not admitted before their seventh year, and the majority enter by about their eighth year. They come from an average distance of about three miles from the school. Some come by railway as far as from Croydon, Woolwich, and Leyton (in Essex), and they come because they can find no education within their respective districts as good. The school fee is £1 per quarter.

The pupils with the best previous preparation, come from the national and other schools under trained teachers, such as those at the Home and Colonial schools, or the Birkbeck schools; the worst from the small academies, or the private adventure schools, usually of a single master, with one usher, from few of which, though many charging much more than £1 a quarter, do the children get much beyond the three R's before the fourteenth year, and without music or elementary drawing, or any foreign language, or any physical training whatsoever. This middle-class school, indeed, contrasts with the schools of the more expensive class, such as those in which had been educated 437 gentlemen, from 1851 to 1854, both inclusive, of which number 132 failed in English, and 243 in arithmetic.

The teaching power applied to the children in this middle-class school is that of seventeen teachers; all (except four who have been at the universities) from the training colleges, and from practice in elementary schools. These are assisted by the occasional services of four scientific lecturers.

The teaching is in classes of fifty each, which are deemed very large for first-class teaching, but which is justified in this instance by the great number in the school, enabling so many classes to be each got up to the same plane for teaching, and this is, moreover, justified by the results.

The attainments up to the 11th year, taken as the nominal period for children of the wage classes, and up to the 14th year, the nominal school period for the great body of the middle classes, are as follow:—

Attainments at End of the 11th Year.

Reading:—To read fluently.

Writing:—To write a clear round hand.

Arithmetic:—The simple rules, vulgar fractions, decimals, practice, and proportion. To perform mental calculations with rapidity.

Grammar:—To classify words and analyse simple sentences.

English history:—Outlines.

Geography:—Physical geography of the world; Great Britain and colonies.

Dictation:—To write from dictation passages of not great difficulty.

Drawing:—Free-hand.

French:—The French verbs. To translate simple sentences from French into English.

Drill:—To march in columns, companies, sub-division; to form files two deep, four deep, or companies on the march.

Attainments at the End of the 14th Year.

Reading:—To read with expression an ordinary newspaper article, or an extract from any of the best poets or dramatists. To recite passages from several classical writers in English.

Writing:—To write a commercial hand.

Arithmetic:—The ordinary rules.

Algebra:—To end of quadratic equations.

Geometry:—The geometry of Euclid's first six books.

Mechanics:—Elementary mechanics; physics.

Chemistry of the non-metallic elements, and a few of the metals.

Elements of descriptive botany and zoology.

English:—The English grammar; outlines of English literature; the works of a few standard authors.

Geography:—Commercial geography of the world.

French:—To translate several French authors; to translate simple sentences into French.

Constitutional history of England, and outlines of the history of Europe.

Drawing:—Freehand, geometrical, perspective, architectural and model drawing.

Drill:—Same as the lower half, with a few additional manœuvres.

All classes are exercised in vocal music, and some of them, forming the band, are taught instrumental music. The singing on the present occasion was very good.

The pupils are proved in examination to be well up in their attainments; but, great as these are, as compared with the common school attainments, it is declared, and it is evident, that if all came in as well prepared as a few are from the Home and Colonial and the Birkbeck schools, the standards would, by the present teaching-power, be gained a year or more earlier.

After a few remarks from the Lord Mayor,

The Head-Master read the more material portions of a report by Mr. J. G. Fitch, one of her Majesty's Inspectors of Schools, and Assistant-Commissioner to the Schools' Inquiry Commission, made to the Senate of the University of London, at their request, on the new school established by the Middle-class Corporation. In that Mr. Fitch said he had visited the institution on the 21st of June and following days. He had the great advantage, he said, of Dr. Carpenter's personal assistance in relation to the papers on physiology. Professor Cassal took charge of the examination in French, and Dr. Mills of that in chymistry and physic. Dr. Bidlake also rendered useful service in some of the elementary work, and in revising the papers on geography and history. The detailed examination extended over eight days, and Mr. Fitch subsequently spent three mornings in visiting each class in succession, with a view to observe the condition of the school in its normal state, and to estimate the methods of instruction adopted by the various masters. All, he said, were men of experience, accustomed to oral teaching and to the handling of large classes. The general character of the school was remarkably life-like and intelligent, and its effects on the mental activity of the pupils were very marked. He had rarely seen a school so thoroughly pervaded with the spirit of work, or affording such strong evidence of the sympathy and interest with which the scholars followed the explanations of their teachers. Nothing could be more satisfactory than the discipline of the whole establishment. It was maintained without any corporal punishment, and its excellence was largely owing to the personal influence of the head-master, and to the loyalty with which he had inspired the boys. It was also in a great degree attributable to an excellent system of drill. At the beginning and end of each day the boys were assembled in the large parade-ground, each class headed by its own master, and went through various quasi-military movements and evolutions. They marched in companies to the music of their own brass band, which had been organised and taught by Mr. Alcock, one of the masters, and were thus acquiring, not only healthful physical exercise, but a manliness of bearing and a pride and interest in their school which were very striking, and are of great value in the formation of character. Latin was not included in the school course, and the reasons which had led the head-master to omit it appeared to have much weight. The slender knowledge of Latin attainable by boys who were leaving school for business at 15 often proved a very sterile possession, yet it

was apt to be rated at an undue value, and to absorb a disproportionate amount of the time of teachers and scholars. Mr. Fitch could not, therefore, doubt that in determining for the present, at least, to make the systematic study of English and French the substitute for the linguistic training usually aimed at, though so seldom attained, by means of Latin in middle-class schools, the authorities of this school had exercised a wise discretion. This impression was strongly confirmed by the performances of the boys of the sixth form, who, besides a very careful analysis of a difficult English sentence, evinced a good critical knowledge of a play of Shakespeare, and of two books of Spenser, commented with great accuracy on some of the archaic and less familiar words, and showed by their paraphrase and written composition that their studies had taught them to use their own language with some precision and judgment. On the whole, notwithstanding the great mental activity which prevailed throughout the school, he was inclined to wish for rather more of the discipline which tended to throw boys on their own resources, and make them work out difficulties by themselves. An excess of sympathy and assistance, a readiness to anticipate a learner's difficulties by oral explanation, was not a common fault in schools, and, if it was a fault, it was one on the right side. But there was a little tendency to it in the teaching of English grammar, geography, and history there, and that tendency might be usefully corrected by the adoption of good text-books on those subjects, and by the infusion of a rather larger proportion of written and memory exercise into the scheme of the teaching. He was quite aware that considerations of economy had largely influenced the head-master in regard to the adoption of books, but he could not believe that, when so much excellent work was already done, parents would object to the purchase of such text-books as might be needed to give effect to the valuable oral lessons of the masters, and to fix with clearness and exactness those lessons on the memory. It only remained for him to say that Mr. Jowitt kindly conducted him over the new premises in Cowper-street. They were commodious and well-arranged, and provided accommodation for 1,000 scholars. The class-rooms would give room for the movement and variety of arrangement which were so seriously lacking in the present temporary premises. All the plans for dining and for recreation, as well as for teaching, had been thoughtfully devised, and the new building would seem to him complete but for one want;—a large hall, capable of accommodating the whole school, was much needed, not only for public and commercial occasions, but also for those gatherings of all the classes for special purposes which were so necessary in sustaining the unity and efficiency of the schools.

The Lord Mayor—I have heard that report read with great pleasure, but, as an old mercantile man, I cannot but think there is one great omission—namely, that there are no boys' copybooks to be seen—no writing; and so biased am I in favour of good writing, that I take it to be a great test of itself. I hold that in writing we are behind-hand; we are going back. The schoolmasters of the present day think themselves above teaching handwriting, and we have scrawls forced upon us in the shape of handwriting, which are nothing more than hieroglyphics. You will excuse me, Mr. Jowitt, for making this suggestion.

The Head Master explained that, for the sake of brevity, he had omitted to read from the report the passage in reference to the writing of the pupils. He read it now, and it was to the effect that in the school every boy either wrote, or was on his way to writing, a clear legible hand, sufficient for all business purposes.

Mr. Arthur Hobhouse, Q.C., said it must have been gratifying to all present to hear the great success of the school. Perhaps none of the company, however, looked at it with precisely the same feelings as himself, for his memory carried him back to the earlier exploits of his friend the honorary secretary (the Rev. William Rogers) in the cause of education. He remembered the time, some 24 years ago, when his friend went alone, and equipped only with his own energy, into some of the most neglected parts of London, and, finding there great masses of people without any means of education, moved heaven and earth, so to speak, and ultimately succeeded in establishing three schools for the education, in all, of about 3,000 children. Now they had a school which promised to be as useful and enduring as any the citizens of London, in their munificence, had ever set on foot. They had there a school which educated 800 boys, and gave them a training fitting them for any career to which their talents entitled them to aspire. It was a great success, and those who had achieved it might well rest for a moment and look back upon it with a feeling of satisfaction. They saw it in full and efficient working, but time ran on, and the problem arose how the continuance of that working was to be insured. The school was not capable of being supported entirely by the payments of the parents. There must be a combination of income from realised property and a payment for value received. Of the extent of the funds belonging to the Corporation, and of the claims upon them, he knew nothing. He did happen to know, however, that there were large funds taking their origin in the City of London, and expended within it, which were doing little but mischief now, but were capable of being applied to the aid of this good work. That kind of almsgiving was, after all, a selfish habit, springing partly from pity and partly from superstition, and defended by ignorance. Would they not aid in diverting the funds which were feeding the evil, and in applying them to the cure? In some cases the ordinary powers of the legal tribunals would suffice for the purpose. In the last session of Parliament, however, a statute was passed creating a new tribunal, which, if acting in combination with the trustees of an endowment, had very large powers applicable to that very purpose. He asked the Council of the Middle-class Corporation to show themselves worthy of the confidence which had been placed in them, to look around and see what funds there were, how they were applied, and, if they thought change was needed, to gird up their loins to effect it. It would be good work, and good men would honour them for it. Endowments might be made excellent servants, but were most miserable masters. The men who, at or about the Reformation, set themselves to found schools, defined their objects with wisdom, and pursued them with simplicity. They held grammar to be the key to the noble science of antiquity; they guarded the schools they founded from priestly influence, and, in the result, secured for us that freedom of thought and action which had made us what we are as a nation, and which was a noble inheritance to be transmitted to posterity.

Lord Henry Lennox, M.P., speaking as Chairman of the Council of the Society of Arts, bore witness to the admirable work which was being carried on in that great middle-class school. He had visited it himself, and had made himself master of the system of teaching in practice there. He was also present recently when Dr. Lyon Playfair put the boys through their scientific "bearings," and was extremely well pleased with the result. As to good writing, nobody was probably more aware of its value than he (Lord Henry). For three years he held an onerous post in the Government, and he had painful experience of how much valuable time was lost there in deciphering the difficult, and often inscrutable, hieroglyphics in which even great questions of State were sometimes involved; and he must say that some of the greatest offenders in that respect were amongst the noblest of the land. He for one wished to offer a public tribute, on the part of the Society whose mouthpiece he was, to the noble manner in which difficulties had been surmounted in the establishment of this school, and shoals avoided. The movement so begun could not stop there. Its very success made one long to see such schools

multiplied and extended throughout this great country. He hoped the day had now come when there would be some definite action upon this important subject. Public opinion was ripe upon it; for years it had been discussed in and out of Parliament and in the press, and the English people now desired to see a system of popular education placed within the reach of every one. While he wished to see a comprehensive measure of instruction, he deplored the time that had been lost, up to this point, in meeting the great want of technical education. They had always, in those matters, to consult a certain "bogie," in the Chancellor of the Exchequer for the time being, and he wanted them to tell the present Chancellor of the Exchequer, or any other, that the country did not consider the appropriation of money for such purposes as waste, but as true economy. He sincerely trusted Mr. Forster would be able to present a sound, comprehensive, and drastic measure of education in the forthcoming session of Parliament, which he was sure his would be when it came, and so dispose of a solid grievance before the legislature was engaged in considering a sentimental one. Addressing the boys before him, Lord Henry said the future of their lives, under God's Providence, was in their own hands. The children of the middle-class might now obtain an education which was far more adapted to the position in which they might pass their lives than that of the wealthier classes. He belonged to one of what was called the "leisure" classes, and his education commenced at Westminster and finished at Oxford; but he now regretted that he had not had the chance, when a boy, of being instructed in such a school as this. Again, he said, the future of the boys before him was in their own hands. There was no country like England in which men could rise by their own merits, and it was, after all, merit and not birth which won the most honours and the most solid and lasting reputation. In future years, when some of them had reached the summit of their ambition, they would then look back with satisfaction to their connexion with this school. He sincerely hoped they would soon see a belt of such institutions surrounding this vast metropolis. What with the City companies, the public feeling on the subject, and with a government measure properly devised and introduced, he trusted also that such schools would be greatly multiplied throughout the country, and form in the end an insuperable barrier to ignorance and her too frequent sister—crime.

Sir William Tite, M.P., speaking for the Council, of whom he is one, expressed their obligations to the Lord Mayor for extending his countenance to the ceremony, and said they hoped before long to establish a similar school, and one just as useful, on the south side of the Thames.

The Lord Mayor then distributed the prizes.

Mr. C. K. Freshfield, a member of the Council, bore testimony to the complete efficiency and self-devotion of the head-master (Mr. Jowitt), and said they had been fortunate in obtaining such a man. He also referred to the harmony with which the subordinate masters cooperated with him.

The Hon. and Rev. Samuel Best expressed his deep interest in the school, and earnestly hoped next year some general measure would be carried, which would remove the difficulties and obstacles that, in various forms, had hitherto prevented the education of all classes, he would not say on a secular, for he disliked the word, but on an unsectarian basis.

At the instance of Mr. J. P. Gassiot, F.R.S., and Sir William Tite, M.P., cordial votes of thanks were presented to the Lord Mayor and to Mr. Alderman and Sheriff Causton and Mr. Sheriff Vallentin.

The Lord Mayor, referring to an enthusiastic cheer which the 800 boys raised at the mention of his name, said—That is my prize; I shall take it home with me. Any man who has ever thought kindly of his fellow-men, and who will not come forward to help the cause of general education, is unfit to live in a free country. I see instances every day which convince me that the sources of education have been choked up with Latin and Greek. They were all very well in their way, but of no use to a working man's son. I believe this school contains the germ of a great institution, and that it will tend to make men—emphatically men—of the boys.

The Sheriffs acknowledged the compliment paid to them, and with that the ceremony terminated.

BIRKBECK SCHOOLS.

THE PECKHAM SCHOOL, LONDON.

By George C. T. Bartley.

The Birkbeck schools which exist in the following places, viz.:—Southampton-buildings, Chancery-lane; Peckham, Hackney, Gospel-oak-fields (Kentish-town), and Bethnal-green, have been established almost entirely by the private liberality of Mr. William Ellis. In numerous parts of the country, schools are in existence on a similar principle, though they do not bear this special name; they are institutions where not only an elementary education is given at a comparatively low cost to children, but where a higher and even an advanced training is obtainable. Two chief characteristics are, first, that they are totally unsectarian, no religious dogma of any description being inculcated; and, secondly, that they do not receive any grants from the Education Department for elementary instruction. Another feature which may be considered as almost peculiar to them, and in which, at the time of their commencement, they were quite unique, is the instruction given in the elementary principles of social and political economy.

It may be said that the idea of increasing the knowledge of the principles which must be at the root of all commercial and industrial pursuits, was one of the chief objects which led Mr. Ellis to create these institutions. The great ignorance displayed by so many persons, in questions such as the currency, strikes, and panics, he had noticed for many years, and it had induced him to write several valuable educational books on these subjects, giving, in simple and easy language, the true principles of these important topics. He finally resolved to establish schools in which these subjects would be taught in a pleasing and intelligent manner. This is fully described in the following extract from Mr. Knight's "English Encyclopœdia":—

"Since his childhood, Mr. Ellis has seen our currency, as at present established, assailed in every panic from that of 1825 to that of 1848; and during the same period there have passed under his scrutiny all the great strikes by which workmen have been deluded into the hope of alleviating the sufferings incident to insufficient wages. These evils induced Mr. Ellis to make some attempt at removing them; and, further impelled, it may be, by the kindly feelings towards children which form a prominent feature in his character, he determined, if possible, to introduce into schools such instruction as should send boys into the world furnished with intelligent thoughts upon all the great questions relating to industrial life. With this view he began, in 1846, a series of lessons to the elder boys of a British school, to which, for some years previously, he had been accustomed to render assistance; and, about the same time, he also gathered round him a group of schoolmasters, with whom he went over the course of inquiry which will be found in his 'Progressive Lessons,' and these lessons will also furnish a good illustration of the mode of teaching adopted. The boys had no tasks to learn by rote, but the whole of the subjects brought before them, with the exception of things merely technical and arbitrary, were, so to speak, developed by the boys themselves, they being guided in their inquiries, of course, by the questions of the teacher. Thus, these lessons came to be something more than the mere teaching of dry academical political economy; they assumed, in fact, the character of moral lessons. For,

thus taught, not only do children learn as a matter of fact about what is going on as the every-day work of industrial life, but they are continually invited to investigate what ought to be the rule of conduct of those who are engaged both in production and distribution. Not only, for example, would children learn the fact that the merchant does buy in the cheapest and sell in the dearest market, but the questions would come, 'Ought he to buy in the cheapest market?' 'Ought he to sell in the dearest market?' 'Why? or why not?' And such questioning, as may easily be perceived, when managed by a competent teacher, tends to a high order of mental and moral training. Having thus satisfied himself that social science may be made attractive to intelligent boys, and feeling certain that the habits of reflection and self-examination which its study calls forth cannot fail to impart a useful bias to their character and conduct in after-life, Mr. Ellis proceeded to establish schools in which instruction in social science should be a leading feature."

Such was the origin of these schools, which were named after the founder of the Mechanics' Institution in Chancery-lane, the father of all the similar institutions now existing in every part of the country. The reason which led to their being called after this eminent man was from the fact that the first school of this description, and the only one which was not absolutely established by Mr. Ellis, was commenced in Chancery-lane. Considerable difficulty was found in giving a special name to the schools, as Mr. Ellis modestly objected to his own name being publicly known in connection with them, and, after some discussion, they were called after the worthy philanthropist, Dr. George Birkbeck. This led to many narrow-minded persons objecting to the schools on account of Dr. Birkbeck's religious opinions not agreeing with their own; and to this day not a few have vague scruples concerning the schools, which are the more unjust, as, though strictly unsectarian, the moral tone of the children, particularly at Peckham, is considerably above that met with in most other schools.

It may be stated, from observations made at Bethnal-green and the other districts, that several interesting examples have been remarked of the appreciation often shown by comparatively poor parents for the value of an advanced education to their children. It frequently happens that great sacrifices are made, to enable at least one of a family to have the benefit of a year or two at the Birkbeck School, which is felt in the neighbourhood to give a sort of finishing education. If one of the boys in a family show great promise, he is sent there after leaving the elementary school. But generally the eldest son has the advantage; and, in some cases, this feeling of the rights of primogeniture is so strong, that the youngest children are sent to work earlier than they otherwise would be, in order to provide funds for continuing the studies of the first-born.

The following remarks, though relating chiefly to the Peckham establishment, apply, in principle, to the other Birkbeck schools, which, as before stated, are all conducted much on the same plan.

This institution, situated in a populous part of the south-east of London, was opened in 1852, under the management of Mr. Shields, who still conducts it. At its commencement it was on a somewhat smaller scale, but has increased from time to time, as the neighbourhood gradually appreciated the excellent education to be obtained in it, until, at the present time, about 600 children are daily under the instruction of fourteen teachers. All the children are day scholars, the greater part, of course, residing in the neighbourhood of Peckham, though a large number come from Walworth, and a few from even a greater distance. Of these about a quarter are girls. Those over seven years of age of either sex, have separate class-rooms and play-grounds.

The school is divided into two:—1. The infant-school for boys and girls under seven years of age. 2. The junior school. 3. The upper school. The difference between these last two divisions does not consist in the grade of advancement of the children, but is more of a social difference, the payment being higher, and the children, consequently, belonging to parents of a higher position in life.

This arrangement is not adopted because it is the best, as no doubt a system such as that at Faversham, with a junior culminating into an upper school, would be far better, but the social class-feeling among parents renders this at present impossible. At the same time, in either division there is a considerable variety of children, this variety being greatest in the upper school, as promising boys, who stay longer than usual, though, perhaps, of the artizan class, find their way out of the junior division.

One great disadvantage of this social feeling, which prevents parents, whatever their position or means, from sending their children to begin in the lowest class and advance as they rise in learning, is the fact that it duplicates the elementary instruction. Many of the children in the upper school require the first lessons given to the lowest classes of the junior school, and, as they cannot be made into one class, a considerable amount of teaching power and time is lost.

The fees paid form a large part of the income of the school, though they are not quite sufficient to render it self-supporting. In the upper school they vary somewhat; but 12s. a-quarter is the general charge. At Hackney, no less than £1 per quarter is paid in some cases; in the lower school, 6d. a-week for those under eleven, and 1s. for those over that age. But even this limited fee of 6d., to some of the poorer pupils, is sometimes an occasion of irregularity. It is found absolutely necessary to charge some fee; but, during seasons of short work, the schooling is the first thing to be stopped, and, in the winter, if sending the child to school involves the purchase of a pair of boots, this will too often be the cause of a break of some weeks in its attendance.

The system of teaching largely adopted is that of question and answer—a mode advocated by Mr. Ellis, and carried on in this school with remarkable success. Few books are used, and the children are made familiar with the objects and facts which are being described to them, and in all cases, where possible, the black-board becomes an important auxiliary to the teacher.

A peculiarity of the institution is the entire absence of the usual stimulus given to pupils by prizes and rewards. Occasionally a book may be given to a boy on leaving, as a private present, but there is no system of competition for prizes in the different classes.

The highest boys in the school are formed into the monitor's class, and great care is taken to secure only those who, by private character and habit, are good examples of conduct, as well as apt teachers. These monitors during certain hours, take each a few of the lower classes and form what is called a collective class. Each small division of six or seven, under its monitor, is gathered round a black-board, and some problem in arithmetic or other subject is worked at by all; the monitor learning probably more than any by the repeated questions of his pupils. The teacher is stationed at one end of the room, and appealed to in all cases of difficulty. In this way nearly all the masters in the school have been trained.

Some attention is given to drill both with the boys and girls, but, with the latter, not to any great extent, and the whole time of the pupils is devoted to mental study, no part of the day being given to industrial training.

The subjects of instruction embrace those usually given in elementary schools, and, in addition, in the junior and upper schools, geography, history, French, drawing, and elementary and practical science.

The chief feature in the infant school is the great stress laid on instructing the children in printing. This is taught almost before writing, and, judging from the

excellent writing throughout the school, there can be no doubt but that the mode adopted is most successful in forming a clear, good hand. Another plan, which is carried on with the same object, is the method of requiring the children to copy sentences on large sheets of paper, which are needed from time to time to hang on the black-board, for the use of the classes. These are done with a broad quill pen, in letters an inch or more in size, and the work is found to give freedom and neatness.

Arithmetic is really taught at this school, for it is unfortunately a fact that but few places exist where intelligent teaching of this subject is understood. The girls show an aptitude and quickness which it is unusual to see for mathematical pursuits, so much so that it suggests that possibly the female deficiency of power in following mathematical facts and reasonings may, to a great extent, be due to the imperfect manner in which they receive instruction in elementary arithmetic. Text-books are here used but rarely, and then only for obtaining examples; the rules are practically explained in a common-sense manner, and each child's understanding of them is tested daily by numerous examples. By this means learning by heart is possible.

The amount of scientific instruction given to the children is considerable, and that, too, at an unusually early age. The youngest classes of the junior and upper school are taught the elementary principles of animal physiology and the laws of health. The mode of instruction in this is similar to that pursued in most other subjects, namely, by means of a conversational lecture, interspersed by frequent questions from both teachers and pupils. In all cases the lessons are accompanied with experiments, and all facts practically exemplified as much as possible. Thus, in explaining the nature of the skin and its uses, its physiological properties would be shown as bearing on the necessary requirements for keeping it in such a state as to enable it to perform its functions; from these, its commercial uses would be touched upon, as in the manufacture of leather and glue, and experiments made showing the processes used in these arts.

To both boys and girls this instruction is given, and it is probable that no school for children of a similar description in the kingdom is so advanced as for the highest girls' class to be able to understand some of the facts concerning the Darwinian system of development of peculiarities in animals, a subject which is not considered too abstruse in this institution. This result is arrived at, not by the cram and showy system so often developed out of public and competitive examination, but by a gradual course of agreeable instruction enjoyed by the children, and likely to be permanently impressed and to have an exalting influence on their minds.

The schools are open to all children presenting themselves, who pay the fees, provided they show proper respect to the rules and discipline. No religious doctrine is taught, and the parents of the children belong to almost every sect, the moral tone of the whole instruction being such as is rarely met among so large and so miscellaneous a collection.

In concluding these remarks, and in drawing comparisons between this school and others, it is not difficult to see why it is so eminently successful, far above schools under ordinary management. It is from the fact that the children enjoy the services of a head master, who, makes them his study, and whose whole mind and unusual powers are given to render the training of the greatest possible benefit to the children in his charge. It is to be regretted that such excellent institutions as this one at Peckham do not exist in all parts of London and our great towns. The only thing to prevent it is, no doubt, the difficulty of finding men competent and willing to undertake the duty, which is not often so highly remunerated as its importance would warrant. It is clear that wherever such schools are established, there is no lack of parents of the industrial class willing and anxious to pay a considerable fee for a sound, or even an advanced education for their children.

SCHOLASTIC REGISTRATION ASSOCIATION.

The annual general meeting of this association will be held on Tuesday, January 11th, 1870, at four p.m., at the House of the Society of Arts (by permission of the Council), to receive the reports of the secretary, of the treasurer, and of the auditors; to elect ten persons to serve on the committee, and two auditors; and to take into consideration certain notices of motions, especially referring to the Educational Council Bill. A public meeting, convened by the association, will be held in the evening of the same day, at seven o'clock, at the same place, in support of the Educational Council Bill. The following resolutions will be proposed:—

1. "That this meeting expresses its entire concurrence in the proposal to register and classify teachers who have passed an examination held by the Educational Council, or some other recognised examination, or who have produced evidence of efficiency in teaching satisfactory to the Council, as affording a means whereby the public may distinguish qualified from unqualified educators, and as an inducement to future teachers fully to prepare themselves for the duties of their office, to the advantage at once of themselves, and still more of those whom they instruct; and that, in the opinion of this meeting, it is important that the Educational Council should, as far as possible, recognise practical experience in teaching as a condition of registration."

2. "That this meeting further suggests the substitution of the words 'Great Britain and Ireland,' for that of 'England,' in clause 13."

3. "That this meeting, while approving generally the proposed constitution of the Educational Council, believes that the appointment thereon of representatives of teachers elected from among themselves will be both just and wise, as tending to secure the cheerful confidence of all thus represented; and that, in order to provide for the due representation of the various branches of the profession, it is most desirable that of the three representatives of teachers, one be elected by the masters of endowed schools, one by those of 'Registered' schools, and one by the masters—if registered—of schools which are, or might be, under the direction of the Committee of Council on Education."

4. "That while this meeting fully admits the importance of registering teachers, it as firmly maintains that no reform of education will be complete without a far more widely extended and well-organised examination of schools, as proposed in the Bill,—obligatory in the case of endowed schools, and permissive in that of others—either by persons appointed by the Educational Council, or by others approved by them; and that, in order to secure the confidence and respect of teachers, and the ultimate success of the measure, it is necessary that the examiners be persons of practical experience in teaching."

5. "That this meeting regards the proposal to place 'registered' schools on an equality with endowed schools, and to entitle them to compete for exhibitions on certain conditions, as sound in principle, and as designed to effect much good by upholding and advancing existing institutions."

6. "That this meeting rejoices to find in the Bill a considerable, if not a full, recognition of the claims of girls' schools to an equality of position with boys' schools."

Notice of any amendment must be sent to Mr. Barrow Rule, hon. secretary of the Scholastic Registration Association, Boswell-house, Croydon, on or before Friday, 7th of January, 1870, for the consideration of the committee.

THE NEW CAB REGULATIONS.

A meeting of the hackney-carriage proprietors was held on Tuesday last, in Cambridge Hall, Newman-street, to consider the new rules and regulations as submitted by Colonel Henderson, the Chief Commissioner of Police. The meeting was called by the Amalgamated Association of Cab Proprietors, and was requested to express an opinion on the following points:—

1. Hackney-carriage licence; the price, and time allowed for obtaining the same. 2. Hackney-carriage inspection; nature of the same, and when to be inspected. 3. Table of fares; what plan or pattern, and what rate of fares, and on what part of the cab to be placed. 4. A licensed number of persons to carry, and not allowed to recover the fare for more. 5. Luggage; a "reasonable quantity" to be defined. 6. Property found in cabs; a reward for the same. 7. The lamp, and where to fix it.

Mr. J. S. Crocker, secretary to the association, detailed what had passed on these questions between himself and the Chief Commissioner of Police, aud submitted the following suggestions as proposals from him:—

1. Licenses (£2 each) be issued on and after the 1st January, 1870. 2. The inspection will, on this occasion, merely be made to see that the cabs are reasonably fit for public use. 3. In a month to be hereafter fixed, the regular inspection will be made. 4. The existing rate of fares will be continued during the month of January. 5. On the 1st of February next, each cab to be provided with a plate, of a pattern to be seen at Scotland-yard, showing the rate of fare per mile and per hour at which it is proposed to ply for hire.

The general feeling of the meeting was in favour of these suggestions. It was unanimously agreed that a metal flag, to be displayed from the top of the cab as an indicator that it was for hire, would be the best form of announcing the fare; and the meeting agreed that, for the present cabs, the present fares should be adopted, with the following modifications:—No fare under one shilling; hansoms to charge half-a-crown an hour, when engaged by time; children to be paid for as adults; and luggage outside always to be paid for. The four-mile radius to be reckoned along the roads, and a shilling a-mile to be charged under all circumstances beyond it. The inspection of the cabs to be in September, and the lamp not to be insisted on. The tone of the meeting was hopeful as to the prospects of the trade, under the regulations which will be issued in pursuance of the Act of last session.

Commerce.

The French Treaty.—Mr. Shaw Lefevre, Vice-President of the Board of Trade, addressed a meeting of merchants in Liverpool, on Monday, the 29th ult. He explained the Merchant Shipping Bill, which is to be proposed next session. He said that the repeal of the French Treaty would be a great misfortune to England. But there was no fear of such a course being taken. France had treaties similar to that with this country with almost every European government, and it would be almost against the comity of nations to abrogate the treaty with us while some of the treaties with other countries had five or six years to run. There was no objection to an inquiry into its operation, but it must be complete, and not partial.

Colonies.

Aloe Fibre in Mauritius.—Another article of colonial production which has for years past, from time to time, attracted public notice, seems now to have some chance of assuming, ere very long, an important place in the exports of Mauritius. This is aloe fibre, which is now being extracted for exportation by several persons; and in Bourbon, where sugar planting has ever been less successful than Mauritius, a still larger amount of attention has been bestowed on this fibre; and machines have been erected in several places, capable of beating out 1,000 lb. of it per diem. The aloe (that known as the Yucca) grows wild in immense numbers on the mountains of these islands; and, like all species of aloes, it is very hardy, being little affected by dry seasons. The fibre is worth £25 to £30 per ton in Europe, and it is believed that it will gradually become an article of considerable importance in the colony.

The Agricultural Society of New South Wales is progressing. Negotiations are being made between the Corporation of Sydney and the Society with reference to the erection of a large building in the Alfred-park.

Notes.

Bavarian Fetes.—It is said that the King of Bavaria intends to establish literary, scientific, artistic, and industrial prizes, to be competed for at the annual fêtes, which usually take place in the month of October.

Silk Supply Association.—The offices of this association, referred to in Mr. Dickins' paper "On Silk Supply," read before the Society on the 24th November, are at 3, Castle-street, Holborn, where all communications should be addressed.

Correspondence.

Prints and their Production.—Sir,—Finding that what I have stated in reference to the production of photographic surface-blocks for printing has been misunderstood, as I appear to imply that Mr. Linton alone has produced such blocks successfully, I shall be glad to be allowed to correct any such misapprehension. What I desired to say was, that of the various processes with which I was acquainted, the most satisfactory results had been attained by the processes of Mr. Hancock and Mr. Linton, and not exclusively by the last-named gentleman. Mr. Hancock claims to be the only producer of surface-blocks by electro-photography. Messrs. Day and Haghe should have been referred to in my paper as among the very earliest producers of colour-printing by means of lithography. Roberts' "Holy Land" and "The Siege of Jerusalem" may be mentioned as among their productions; "and Blue Lights," produced in 1851, after the well-known picture by Turner, was the work of the same firm, which was then known as Messrs. Day and Sons. Various other works produced by them, such as Owen Jones's "Grammar of Ornament," "The Manchester Art Treasures," and "Wyatt's Metal Work," will be remembered by all who have watched the progress of the art.—I am., &c., S. T. Davenport.

Anglo-French Communication.—Sir,—Mr. Austin objects, not probably without cause, to the small capacity for railway traffic of a single channel tube, worked on the atmospheric or other principle. But one train, in either direction, could be permitted in the tube at one time, and not less than three-quarters of an hour would probably be consumed in traversing the twenty-one miles, including the timo occupied in entering and delivering the train clear of the divergent lines at either end, on which other trains were coming out or waiting to start. Practically there could be but one train each way in every two hours, or twelve trains each way daily. Were each train to carry one hundred passengers, on the average there would be 16,800 passengers weekly, or nearly 875,000 per annum, and, with an average charge of 5s. per passenger for the

twenty-one miles, this would return £210 per mile per week, nearly equal to the interest upon the cost of the work, if estimated at £6,000,000. It should be added that constant telegraphic communication from end to end would be maintained by submarine cables laid alongside. If there be any objection to the atmospheric system it is that the trains are pushed instead of pulled, although even a train of twenty carriages might probably be pushed with safety through a tube of a section hardly larger than their own.—I am, &c., Zerah Colburn.
December 14th.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Mr. J. Norman Lockyer, F.R.S., "On the Spectroscope and its Applications."
Actuaries, 7. Mr. T. B. Sprague, "On the Rate of Mortality prevailing among Assured Lives, as influenced by the Length of Time for which they have been Assured."
Society of Engineers, 7½. Adjourned discussion upon Mr. Vaughan Pendred's paper, "On Apparatus for Measuring the Velocity of Ships."
Social Science Assoc., 8. Mr. Edwin Pears, "On Grade Schools, and on Scholarships between Primary and Grade Schools and the Universities."
Medical, 8.
Asiatic, 3.
London Inst., 4.
Tues ...Civil Engineers, 8. Annual Meeting.
Statistical, 8. 1. Mr. Samuel Brown, "Report on the International Statistical Congress of 1869." 2. Mr. R. H. J. Palgrave, "House Accommodation in England, in relation to the Census of 1871."
Pathological, 8.
Ethnological, 8 1. Prof. Busk, "On an Ancient Calvaria, assigned to Confucius." 2. Major Millingen, "On the Koords and Armenians." 3. Dr. Gustav Oppert, "On the Kitar and Kara-Kitai."
Wed ...Society of Arts, 8. Dr. J. L. W. Thudichum, "On Wines, their Origin, Nature, Analysis, and Uses; with special reference to a new Alcoholic Drink made from Tea."
Geological, 8. 1. Messrs. Ralph Tate and J. S. Holden, "On the Iron-ores associated with the Basalts of the North-east of Ireland." 2. Mr. J. W. Hulke, "Note on the Skull of the Large Kimmeridge Crocodilian, *Dakosaurus maximus*, Quenstedt, *Steneosaurus*, Geoffr. St. Hilaire." 3. Mr. J. W. Hulke, "Note on a Fragment of a Jaw with peculiar Teeth from Kimmeridge Bay." 4. Principal Dawson, "Notes on the Structure of *Sigillaria*." 5. Principal Dawson (of Montreal), "Notes on some new Animal Remains from the Carboniferous and Devonian of Canada."
R. Society of Literature, 8½.
Thur ...Antiquaries, 8½.

Patents.

From Commissioners of Patents' Journal, December 10.

Grants of Provisional Protection.

Blast furnaces, removal of dross out of—3321—G. B. d'Adelswärd.
Boxes—3443—S., J. J., and L. H. Perry.
Bricks, &c., machinery for making—3291—F. Clark.
Buckles—3413—J. Keats.
Buckles and clasps—3438—A. E. Loram.
Card for facilitating the withdrawal of single threads for sewing purposes—3421—S. Tatton.
Carding engines, machinery for feeding—3465—B. Acton and J. Mustard.
Chaff, &c., machinery for cutting—3449—J. Tester.
Clothes lines, supporting—3366—G. H. Wilkes.
Condensers, &c.—3432—A. Barclay.
Cooking, toasting, and roasting apparatus—3448—J. Williams, jun.
Cork-cutting machines—3485—G. Hammer.
Cots or bedsteads—3461—C. H. Hudson.
Cotton, &c., preventing roller laps on roller ends of machines for carding—3455—J. Edwards and J. Quin.
Earthenware articles, &c., appliances used in manufacturing—3473—T. G. Green.
Elliptic springs—3462—E. T. Hughes.
Fire-arms and cartridges—3481—W. Richards.
Flax, &c., machinery for hackling—3425—J. Combe.
Friction engine for producing motive-power—3302—W. Srigley.
Fusees, &c.—3424—W. Perkins.
Games, &c., apparatus for registering the points of—3464—W. H. Willis.
Grain, machinery for cleaning, &c.—3357—A. B. Childs.
Graphoscopes—3140—G. Lockett.
Hats, &c., ventilating—3460—J., J., and W. H. Wood.
Hides and skins, apparatus used in tanning—3453—H. Draper.
Horticultural and other buildings, &c.—3457—W. Parham.
Hydraulic cranes—3409—B. Johnson and E. B. Ellington.
Indicators for marking games of chance, &c.—3381—E. Round.
Ink bottles, &c.—3407—E. F. Goodall.
Iron—3247—J. P. Budd.
Kilns for burning pottery, &c.—3467—E. Ensor, jun.
Letters, &c., apparatus for stamping—3475—J. James.
Lock fastenings for expanding cases, &c.—3436—W. Johnson.
Locomotive engines, &c.—3403—F. W. Webb.
Lubricators—3348—L. Folliet.
Meat, preserving—3428—S. Wyatt.
Men's wearing apparel, adjusting—3429—H. S. Freeman.
Metal healds, manufacturing—3350—J. Bélicard.
Metal sheets, &c., machinery for cutting—3454—G. & A. B. Marquis.
Metallic barrels—3422—E. H. Burke.
Metals, &c., machinery for shaping, &c.—3434—J., J., E., and W. Pitt.
Millstones, balancing—3447—E. Lethbridge.
Millstones, dressing—3459—W. H. Shaw and J. M. Audus.
Mortar mills, &c.—3419—J. Fletcher, sen., J. Fletcher, jun., and W. Fletcher.
Motive-power, obtaining—3452—J. C. Mewburn.
Paint and varnish, manufacturing—3335—G. F. Cornelius.
Paper pulp, apparatus for straining—3433—G. Bertram and M. Patterson.
Paper pulp, manufacturing—3418—J. Denis.
Phenol, &c., making a new derivative of—3451—T. Reissig.
Powder for destroying the oïdium in vines, &c.—3415—W. E. Gedge.
Railway axle-boxes, lids for—3423—B. Wood.
Railway points and signals, working and locking—3427—J. Brunton.
Reaping and mowing machines—3471—R. Hornsby & J. E. Phillips.
Reels, bobbins, &c.—3420—S. Tatton.
Rocks, &c., machinery for boring—3411—T. Brown.
Rotary motion, converting reciprocating motion into—3468—A. V. Newton.
Shawls—3439—W. Cross.
Show cards, &c.—3426—A. C. Engert.
Sponge, rendering suitable for stuffing beds, &c.—3477—J. T. Griffin.
Standing crops, cutting and collecting—3437—J. Howard and E. T. Bousfield.
Steam engine governors—3483—R. Robey and J. Richardson.
Stone, &c., apparatus for dressing—3435—L. Pochet.
Tank filters, &c.—3470—J. F. Crease.
Treenails, bobbins, &c., boring, &c.—3444—S. Fox and J. Reffitt.
Turbines, &c., regulating the supply of water to—3016—A. H. Douché.
Umbrellas and parasols—3466—W. Avery.
Varnish and varnish paints—3417—D. Barker.
Velocipedes—2733—M. Doirier.
Velocipedes—3197—W. E. Gedge.
Vent plugs—3450—E. Oades.
Water, &c., meters for measuring—3463—A. W. Pocock.
Water-closets—3479—F. N. Target.
Wood and metals, machine for shaping, &c.—3275—W. E. Gedge.
Wool, &c., machinery for preparing, &c.—3430—F. Preston.
Worsted, &c., spinning, &c.—3458—J. Speight.
Yarns and threads, machinery for polishing—3405—J. Nichols.

Inventions with Complete Specifications Filed.

Fluid lenses—3515—W. Brookes.
Grain or seed, machinery for hulling—3527—W. R. Lake.
Metals and magnetic substances, separating from other bodies—3538—C. Vavin.
Mortising, tenoning, and sawing machines—3509—J. F. Kent.

Patents Sealed.

1810. J. H. Riddell.	1872. J. G. Tongue.
1816. E. G. Brewer.	1920. A. M. Clark.
1818. J. Taylor.	2317. F. A. Yeo and H. Hanna.
1819. W. S. Underhill and J. Smith.	2441. J. Blyde.
1821. J. Young.	2539. A. Moncrieff.
1834. J. Lindley.	2813. F. Armstrong.
1840. J. T. Masbon.	2911. J. F. M. Pollock.
1854. E. Cardon.	2929. J. Frearson.
1864. W. McNabb.	2963. M. Andrew.
	3003. J. Mackie.

From Commissioners of Patents' Journal, December 14.

Patents Sealed.

1842. H. Tylor.	2047. R. Mallet.
1849. W. R. Lake.	2054. J. H. Johnson.
1853. W. Woofe.	2212. J. H. Johnson.
1855. T. Routledge.	2264. B. Hunt.
1860. W. R. Lake.	2784. J. W. Morgan.
1866 J. H. Johnson.	2976. T. Parry and J. McHardy.
1867. C. and E. Brightman.	2995. J. Taft and J. C. Edwards.
1881. T. Silver.	3048. J. H. Johnson.
2037. W. Bray.	3054. J. Scharr.

Patents on which the Stamp Duty of £50 has been paid.

3228. W. Clark.	3328. W. R. Lake.
3255. W. Hopkinson.	3262. R. B. Boyman.
3438. G. Shrewsbury.	3265. S. Chatwood.
3247. W. F. Smith and A. Coventry.	3288. H. Brinsmead.
	3405. W. Clark.
3299. G. Bertram.	3432. G. Payne.
3419. C. F. Flach.	3273. C. E. Brooman.
3253. W. E. Newton.	3292. T. V. Morgan and E. Hyles.

Patents on which the Stamp Duty of £100 has been Paid.

3281. W. Palliser.	3384. J. Clayton.
3300. G. Jeffries.	

Journal of the Society of Arts.

FRIDAY, DECEMBER 24, 1869.

Announcements by the Council.

The Society's Shilling Colour-box.

It will be remembered that, in 1852, the Society's medal was awarded to the late Mr. Joshua Rogers, for the best shilling colour-box, and some years afterwards the Council also gave its approval to a shilling colour-box manufactured by Mr. Miller, of Long-acre.

The Council have received a letter from Mr. J. Rogers, son and successor to the late Mr. Rogers, drawing their attention to the fact that other manufacturers are selling colour-boxes with the words, "as recommended by the Society of Arts," or in some other form making use of the words "Society of Arts," which are usually printed upon the box in prominent capitals, and in some cases actually impressed upon the cakes of colour.

The Council have directed the Secretary to write to all such manufacturers cautioning them against this unauthorized use of the Society's name.

It may be added that Mr. Rogers mentions in his letter that upwards of seven million boxes have been sold by his firm since the Society's medal was awarded.

Collection of Engravings and Prints.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, "On Prints and their Production," read on Wednesday evening, the 8th instant, will be open for the inspection of members and their friends, between the hours of 10 and 4 o'clock, up to Saturday, the 8th January, 1870, inclusive.

A brief account of the collection is given at page 121.

Cantor Lectures.

The third and concluding lecture of the course "On the Spectroscope and its Applications," by J. Norman Lockyer, Esq., F.R.S., was delivered on Monday evening last, the 20th inst. The whole course of lectures will be published in the *Journal*.

Channel Steamers.

The Committee met on Wednesday, the 22nd December. Present, Admiral Ommanney, F.R.S., in the chair; Captain Boxer, R.N.; Messrs. C. W. Merrifield, F.R.S., E. J. Reed, C.B., and Seymour Teulon. The Committee proceeded to consider their report, and adjourned for further consideration.

Donations to the Library.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors:—

The Rob Roy on the Jordan; a Canoe Cruise in Palestine and Egypt. By John Macgregor, M.A.; presented by the author.

A Pamphlet on School Museums, with Suggestions for their Formation. By W. E. Bayles; presented by the author.

Proceedings of the Society.

India Committee.

The second Conference of the session, on subjects connected with India, was held on Friday, December 10th, W. S. Fitzwilliam, Esq., late member of the Supreme Legislative Council of India, in the chair.

Mr. Hyde Clarke said that the reason Mr. Fitzwilliam had been asked to take the chair was because he had for many years been advocating the establishment of a gold currency for India, and had been the first to draw the attention of the Indian government to its necessity and convenience.

The paper read was—

ON A GOLD CURRENCY FOR INDIA.

By Andrew Cassels, Esq.

I approach the subject of "A Gold Currency for India" with much distrust in my ability to sketch even its outlines with the clearness that is due to its importance. But I hope that the speakers who will follow me this evening will be able to supply the details and information I may fail to give. I will endeavour to be as brief as possible, in order to leave time for discussion after my task is done.

The inadequacy of a silver currency to the wants of so vast a country as India is a subject which, from time to time, for several years back, has attracted the attention of thinking men in both India and England, but the question was first prominently brought forward at the commencement of the year 1864, in consequence of the extraordinary expansion which had at that period been given to trade in Bombay, by the demand from Europe for cotton to supply the vacuum created by the cessation of production in the Southern States of America, during the continuance of the civil war. The merit of having taken the initiative in drawing public attention to the question is due to my brother, at that time a member of the Legislative Council of Bombay. In a letter, dated the 1st of January, 1864, and addressed to Sir Bartle Frere, at that period the Governor of his Presidency, Mr. Walter R. Cassels pointed out very forcibly the total inadequacy of a silver currency to deal with the increasing trade of our Indian empire, and the desirableness of superseding it by a gold currency. The Bombay Chamber of Commerce and the Bombay Native Association immediately memorialised government in favour of the proposed change of system. The Chambers of Commerce of Calcutta and Madras followed in the same spirit. The movement was warmly supported by the Manchester Chamber of Commerce, both by memorial and by deputation to the Secretary of State for India. Shortly afterwards, a commission to

inquire into the state of the currency was appointed by the Governor-General of India in Council. The commission had for its president that very able man, Sir William Mansfield, and its report was handed in to government in October, 1866. Its conclusions were in favour of re-introducing a gold currency. But though it has been understood that the government of India admitted the force of the reasons that had been advanced in favour of the proposed change, and were only checked by the technical difficulties which had to be considered and surmounted, India is still, at the end of 1869, without a gold currency.

The government of India has indeed virtually rescinded the prohibition to receive gold in payment of its dues, which it issued in 1852, when the gold discoveries of California and Australia were startling the world. In the first instance, permission was given to its officers to receive the sovereign as the equivalent of 10 rupees 2 annas, but as the sovereign was at that time very current in the bazaar at a better rate, little or no gold was then tendered to the State. Subsequently, the Treasury was allowed to receive the sovereign as the equivalent of 10 rupees 4 annas, and this arrangement is still in force. But it contains no elements of stability, and is, and no doubt was intended to be, a temporary or subsidiary measure only.

The desirableness of re-introducing a gold coinage into India will not be disputed by many of those who have resided in India, and are practically acquainted with the inconveniences which attend a silver currency. The external trade of India may safely be said to amount in value to 100 millions sterling per annum. The amount of coin in circulation in a country which contains about 200 millions of people must be very large; it was estimated by the late Mr. Wilson at 100 millions sterling in his time. A trade and circulation such as these call for a less cumbrous and inconvenient currency than a silver one. And when a monetary crisis occurs —and such crises do occur but too frequently in the mercantile world—its pressure is aggravated by the fact that silver only is a legal tender. The mints of the three Presidencies are then kept at work day and night, but all the rupees they can coin are totally inadequate to the wants of the community. If the same mechanical power could be applied to the coinage of gold, a large, and perhaps a sufficient, amount of money could be produced. During a recent monetary crisis at Bombay, a quantity of silver, valued at 80 lakhs, or £800,000, was lying in the mint of the presidency, waiting for conversion into rupees.

In private life, the inconvenience of a silver currency is universally felt. It may be said that no European or native gentleman ever carries money about with him on his person. The transport of silver for mercantile or other purposes is attended with difficulty and expense. The late Mr. Wilson, in his currency speech of 1860, stated that he had seen an estimate made by Sir Charles Napier, that in his day the protection of government treasure, in escort and in other ways, gave employment to something like 30,000 native troops. Then the wastage of silver coins, which are constantly being turned over, is very considerable, and the coinage of silver is an extremely costly process, when compared with that of the more precious metal.

It has been calculated that the average production of gold and silver in the world, during the fifteen years commencing in 1849 and ending in 1863, inclusive, was as follows:—Gold, £34,002,400 per annum; silver, £16,735,666. These figures furnish another strong argument in favour of substituting a gold for a silver currency in India. It seems to be impossible at present to obtain in this country complete returns of the import of treasure into India, up to any date later than April, 1866. The amount imported during the ten years ending in 1866 was £179,424,403. The import into Bombay alone during the fifteen years ending in 1868-69, according to a statement which I have seen, and which was compiled with great care, reached the large sum of £143,534,091. Of course a not inconsiderable quantity of gold is included in these imports, but I believe that a careful analysis of the nature of the bullion and coin poured into India for years back, would show that India is absorbing all—or almost all—the silver that the world produces.

The late Mr. Wilson, Mr. Laing, Sir Charles Trevelyan, and other eminent public men, have all pronounced the adoption of a silver currency for India to have been a mistake. Sir Charles Trevelyan, in a letter addressed some years ago to the *Times*, summed up the charges against it in the following words:—

"When the cost of conveyance, protection, and insurance, the time spent in counting, examining and weighing, the wear and tear of so vast a mass of coin, and the habitual exactions of the shroffs (money-changers) consequent on that wear and tear, are considered in connection with the present advanced state of knowledge, it may reasonably be maintained that the silver money of British India is a greater barbarism than the iron money of Sparta."

It may be added that the substitution of a gold for a silver currency in India would have but a slightly disturbing effect upon the public mind. India had her own gold coinage of old, and the re-introduction of a gold coinage would therefore appear to be no new or startling experiment. Within the last few years, we have seen gold ingots, stamped with the names of some of the leading banks of Bombay, in circulation in the interior of the Western Presidency. Sir William Mansfield, writing in March, 1864, states that no less than 21 millions of gold had been imported into India since Mr. Wilson's currency scheme was propounded, say since 1860-61.

At the present moment, the state of trade is not such as to cause large quantities of silver to be forwarded to India. But what has been may again be. We have seen the bullion market of England thrown into a state of feverish excitement, and the silver coinage of France swept away, by a demand for the East. Is it impossible, or even improbable, that India should again, and at no distant date, attract enormous quantities of silver to her shores, to the great disturbance of the money markets of Europe? The failure, or even the partial failure, of one year's crop of cotton in America would, in all likelihood, bring such an event to pass.

But the late Mr. Wilson has left upon record his opinion that, though the currency of India was in a most unsatisfactory state, and that if we had to begin *de novo*, no one would doubt that a gold standard, supplemented by silver tokens of limited tender, would be a much preferable plan to that which is in use, yet, as the debt of India had been contracted in silver, so must it be paid in silver; and, therefore, that a change was beset with difficulties. The opinions of so eminent a man are entitled to the greatest respect; but, I confess, I fail to see the matter in the light in which it appeared to him. His objection might be met by the question, if an erroneous system has once been adopted, can no economy or improvement be introduced by a government charged with the duty of advancing improvement and civilisation in a State? Mr. Walter Cassels, in his excellent letter to Sir Bartle Frere, and Sir William Mansfield, in an able treatise published a few months later in 1864, have shown, I think conclusively, that Mr. Wilson had not given the subject his mature consideration, and that his objection would not bear close and searching scrutiny.

But even if it be admitted that Mr. Wilson was right, and that the debt of India, having been contracted in silver, must be paid off in silver, would it not be prudent to raise loans in gold, to pay off all old loans, and to cancel all such obligations? Of the public debt of India, twenty millions sterling cannot be liquidated before 1872, and five millions are not redeemable before 1879. The remainder may be paid off at any time, I

believe. If, as many of us think, the prosperity and commerce of India are likely to increase in an extraordinary degree under the fostering influence of new roads, rail-roads, canals, works of irrigation, &c., must not the value of silver advance, if all this prosperity and commerce are to be based on a silver currency only? Surely, the State is bound to protect the interests of the debtor as well as those of the creditor. Will it fulfil that duty if its debt be permitted to become more onerous because of a rise in the value of silver?

It would, therefore, seem to be very desirable that steps should be taken by the government of India to supersede that silver currency which is at present in use, and to adopt a gold standard instead.

When we come to deal with the details of a gold coinage, the task is a different one, and I feel great diffidence in giving any opinion on a subject of such grave importance.

On the one hand, it has been proposed to issue gold coins similar to the sovereign and half-sovereign, of the value of Rs. 10 and Rs. 5 respectively. On the other, it is suggested that the government of India should re-issue a gold mohur and gold half mohur, representing a value of Rs. 15 and Rs. 7½ respectively. The advocates of the latter scheme maintain that it would be desirable that India should possess a distinct and separate coinage of her own, and that nothing could be more seemly or natural than that India should re-issue the old familiar coins of India. It appears to them that, in this way, the silver currency could be gradually and quietly converted into a gold one, without disturbance to the public mind or to private interests.

But it seems to me that a more philosophical plan, and one more likely to be a permanent settlement of the question, would be to issue an Indian sovereign and half-sovereign, which should be a legal tender in England, with subsidiary silver tokens of such value, as silver, that they could never be preferred to gold. Is the hope that England and all her colonies may one day have but one and the same language and one and the same coinage—a mere day-dream? I think not. Already the sovereign of Australia is in circulation in the mother country, and is well known in India. Why should not an Indian sovereign circulate equally freely in Australia and at home? The technical difficulties which lie in the way of fixing the Indian mint value of gold would have to be considered and surmounted by scientific men. The present silver coinage would have to be called in gradually, and to be replaced by a new one.

The establishment of a gold currency would have to be followed, I presume, by a short transition period, during which either gold or silver—the latter, perhaps, to a limited extent only—should be a legal tender. The greater portability and convenience of gold would soon bring it into general favour and use.

I have purposely excluded the consideration of a paper currency for India from my remarks, though no one can be more deeply impressed with a conviction of the desirableness of a paper currency, based on a metallic standard, than I am. But whether you have a paper currency or not, a gold standard for India is, in my opinion, a necessity.

Such are the mere outlines of this important subject, and for which I am chiefly indebted to the writings of my brother and Sir William Mansfield—in some instances I have used their own words. I wish it had been in my power to have brought the matter more forcibly and vividly before you. I shall be glad indeed if light is thrown upon it in the course of the discussion of this evening. It is attended with some difficulties, no doubt; but I feel that it deserves the serious consideration of everyone who is interested in the progress and material prosperity of India. Mr. Laing, Sir Charles Trevelyan, and other distinguished men, have pronounced the silver currency of India to be a "barbarism." Unfortunately, they have been content to denounce an unsound financial system; they have one and all shrunk from the labour and responsibility of introducing a better one. But I have no doubt whatever that, sooner or later, the irresistible force of public opinion will compel the government of India to substitute a gold currency for the cumbrous, wasteful, and inadequate silver currency, which at present is permitted to cramp and harass the commerce of the empire.

Mr. FREDERICK HENDRIKS, F.S.S., said that they had heard an Indian view of the subject; he now begged leave to give them the ideas of one who looked upon the matter from an English point of view, and he would entitle his remarks, "Suggestions for a Gold Currency for India, in connection with International Coinage":—

Notwithstanding the unanimous decisions of repeated commissions of inquiry in India, in favour of the speediest practicable introduction of a gold currency, and especially the resolution, No. 1,325, of the government of India, dated Simla, 12th July, 1864; the report of the commission over which General Sir William Mansfield presided, dated Simla, 4th of October, 1866; and the strong recommendation of Sir Richard Temple, in his last financial statement to the Legislative Council of India, at their meeting in Calcutta, on the 6th March, 1869,* the question has, more or less persistently, been put upon the shelf. It has, apparently, been placed aside for the advent of some more auspicious occasion, as was formerly the case with the well-conceived intentions in favour of a gold currency, so frequently expressed in by-gone years by Sir Charles Trevelyan and Lord Halifax. No more seems likely to come of it than reference to the Secretary of State for India in Council, who, in turn, may probably relegate it again to India; and thus the matter may, for an indefinite term, be handed backwards and forwards, until the pressure of circumstances brings itself to bear upon it in England as well as in India. The question is, however, not only one of great practical moment, but one upon which a speedy decision, and something like a consent of public opinion, is of pressing importance, in view of the general tendency of all the great commercial nations, at the present time, towards the favourable consideration and adoption of plans for the unification and internationalisation of their various systems of coinage.

The only difficulties advanced, with any appearance of sound foundation, as obstacles in the way of a single gold standard of currency for India, are—

1. The prevalence there, for so long a period, of a single silver standard, and the alleged existence of so vast an accumulation of silver coin, that it would be difficult or dangerous to displace or to demonetise it.

2. That taking the average commercial price of the English sovereign in India upon an average of years, it does not represent 10 rupees, but 10 rupees and one quarter (*i.e.*, 10 rupees 4 annas), and that, consequently, we cannot adopt Sir Charles Trevelyan or Lord Halifax's views of making 10 rupees equal to one sovereign, which would lay the foundation of an international coinage,

---

* "The provision of an effective gold currency for India has engaged our earnest attention. The offer of 10 rupees for the sovereign at our treasuries, by the notification of 1864, having been found by experience to be insufficient to attract sovereigns, and to declare the fulfilled intention of facilitating the circulation of that coin, we determined, in November last, to offer 10 rupees and 4 annas for the sovereign, a rate more nearly approaching to its intrinsic and market value. This measure has met with some success, for already upwards of 100,000 sovereigns have been received at our treasuries, and taken out again by the public. We have also removed the prohibition, existing since 1852, against receiving at our treasuries the gold pieces coined under Act xvii. of 1835, of which coin numbers (more than 1½ million) have been, and still are being, coined at our mints, in exchange for gold bullion received from the public—a sure proof of the popular demand for them. Thus, by improving the rate offered for the sovereign; by assimilating it to the standard established by law for coinage of gold in India; by restoring the status which the Indian gold coins properly possess, and which they only lost casually in 1852, we hope to obtain such a circulation of gold coins in India as may hereafter justify their being declared to be legal tender.'

and be a link of union between the finance of India and of other great countries, but must perpetuate awkward fractions, and come to the conclusion aimed at in the 51st paragraph of Sir William Mansfield's minute of the 4th August, 1864, in which he observed:—"We can hardly then resist the conclusion that the golden multiple of the rupee should be calculated and minted with regard to the value of the rupee only, and apart from all other considerations, sovereigns being allowed to run for their relative value."

The answer to difficulty No. 1 is, that the idea of the immense amount of silver coin existing in India is a mere myth. There is no collateral testimony to prove it. On the contrary, so far as it extends, the collateral testimony rather disproves the existence of anything of the kind. It is certainly matter of statistical history that, during the British rule in India, from the year 1800, about £250,000,000 sterling worth of silver rupees have been coined at the mints of Calcutta, Madras, and Bombay. But when we take the analogy of other countries as our guide to form an estimate of what proportion of this £250,000,000 worth has passed out of circulation, or represents meltings or repeated re-meltings of old, wern-out coinage into new, we may question whether more than forty per cent. of the total now exists in the shape of rupees, say 1,000,000,000 rupees, or £100,000,000 sterling worth. It is pretty well determined that about 50 per cent. of the gold coinage of England, since 1816, and about 80 per cent. of the American gold coinage, since 1792, has disappeared from circulation. The wear and re-coinage of silver coinage, the exclusive national circulation in India until recent times, when bank notes have come in aid, must have been vastly greater than that of any gold circulation in European or American countries. Silver coin is softer, more liable to abrasion, than gold coin, and is thus more rapidly deteriorated below the limit of legal tender weight, so that its duration, without need for re-coinage, is very much shorter.* Then, again, in India, it is notorious that vast amounts of rupee coinage are constantly melted down, for conversion into objects of use, of a domestic and artistic character, and into personal ornaments, such as the bangles for arms and legs, so generally worn by an enormous native population. That 40 per cent. of the whole aggregate original amount of silver coined since 1800, in India, should still remain in circulation, is a liberal and, perhaps, even an over-estimate. The history of financial operations in British India may be appealed to, as supplying a strong instance in point, as to over-estimation of the quantity of coin in circulation, by the highest authorities whose opinion could be appealed to by our government there. We refer to the example of what occurred in the period 1835-39. The Act xvii., of 1835, the Magna Charta of the existing Indian silver standard coin, was passed to give effect to a long meditated purpose of establishing one coinage of a uniform character, and bearing a British device. It was reckoned before-hand that the amount of sicca rupees then current, and to be brought to the mint for re-coinage, would amount to a sum of very great magnitude. But what was really the result, when certainty took the place of hypothesis, was the effectual substitution of company's rupees for sicca rupees by a re-coinage of less than five crores, or under one-half of the lowest estimate that had been formed, in anticipation, on the basis of the aggregate amount of sicca rupees issued from the Mint in the preceding 30 years.

We now revert to difficulty No. 2, that the equivalent of the English sovereign must be counted at ten rupees and a fraction, instead of at ten rupees precisely, and that, consequently, it cannot be made either international, as between England and India, like the sovereign of Australia is as between that country and England; and, *à fortiori*, that it must remain also non-international so far as regards a junction with the Monetary Convention of Paris of December 1865, which repudiates all coins that are uneven multiples of five francs of gold.

But this second difficulty is just as imaginary and unsubstantial as the first. This can neither be explained nor understood without some minute reference to figures. It is proposed now to examine these in the most compendious manner that the inherent complexity of the question will admit.

The government of India has made a wrong calculation, in agreeing to take English and Australian sovereigns at the value of ten rupees and four annas. Their notification, dated Simla, 28th October, 1868, is based on the erroneous conclusion that such a tariff of conversion of the sovereign is in conformity with the values of the gold pieces stated in section 13 of Act xvii. of the government of India, 1835. The notification of October 28, 1868, also sets forth that the gold pieces stated in section 13 of Act xvii. of 1835, will thenceforth be received in all treasuries of British India and its dependencies, according to the values stated in that Act. The modified legal tender, so far as the government is concerned, which this notification of the government gives to the English and Australian sovereign, in authoritatively regulating the terms on which it is to be paid and received in proportion to Indian coin, is correct enough if the word "weights" were substituted for "values," but it is not correct in its actual form and practical application, when it is borne in mind that a diferential rate of seignorage in India between silver bullion, on which it is two per cent., and gold bullion, on which it is one per cent., affects "values," and makes the mere comparison of proportionate weights of gold and silver coin, involved in the government calculation, neither equitable nor applicable to a solemn legislative enactment on the standard, if such should come to be recommended in India on the basis of the notification of October 28, 1868.

The Act xvii., of 1835, established a proportion, in intrinsic weight, of 15 silver to 1 gold in the Indian currency. The silver rupee is there defined (see clause 1) as of 180 grains troy, and the standard 11-12ths, or 165 grains of pure silver, with 1-12th, or 15 grains, of alloy; and the gold mohur-piece of 15 rupees (see clause 7) as of the same weight, 180 grains troy; and its standard 11-12ths or 165 grains of pure gold, with 1-12th or 15 grains of alloy.

If this intrinsic proportion of weight were the correct one of value, either according to the practical experience of the relative present worth of gold in the open markets of the world, which it is not confoımable to; or else, if it were practicable, which it is not, to have a fixed double standard which should not perpetually oscillate, then the estimate of the government of India, under its notification of 28th October, 1868, might be justified, irrespective of the question of seignorage on bullion, to be presently adverted to in further detail. The proportion of 15 to 1, translated into trade language, means a price of $62\frac{7}{8}$ pence per ounce troy of standard silver; but the value of that commodity in the London market has been as low as 60 pence per ounce troy during the present year, 1869. This means a proportion of 15.7165 to 1 between silver bullion and mint price of gold respectively in England. And, similarly, the proportionate values of the two metals in India are, and must remain, ever oscillating and departing from the assumed statutory standard. In fact, the establishment of a fixed ratio for the two metals, or a permanent double standard, is impracticable. It is a mere dream, like that for the discovery of a perpetual motion, or of the philosopher's stone.

It is easy to see how the estimate of the English

* As an example of the great wear and waste of silver coin, we may appropriately take note of the results of the experiments made in 1833, at the Royal Mint in London, when Lord Auckland was Master of the Mint, which showed that the average loss upon coin four years in circulation was £1 8s 7d. per £100 value for sixpenny pieces; 8s. 11d. for shillings; 7s. 2d. for half crowns; and the average loss upon coin 16 years in circulation was £5 11s. 11d. for sixpences £4 19s. for shillings: and £2 7s. 7d. for half-crowns, per £100 value.

sovereign, at $10\frac{1}{4}$ rupees, by the government of India, can be made out on the principle of comparative weight; whilst, as regards value, it is erroneous. The silver rupee contains 165 grains of pure silver, and the British and Australian sovereign 113·0016051 grains of pure gold. This, on the hypothesis of the proportion of 15 silver to 1 gold, gives a weight of $113·0016051 \times 15 = 1695·0240765$ grains of pure silver as the assumed value of the sovereign. Now the out-turn in silver rupees of such a number of grains is 1695·0240765 divided by 165, giving an exchange of 10·27287 rupees per sovereign, or a fraction of about $\frac{1}{3}$ of an anna above the 10 rupees and 4 annas at which the Indian government (with the view of avoiding fractions), have thus hypothetically estimated the sovereign at 10·25 rupees in decimal notation.

But the proportion of 15 to 1 which that government has used in its calculation, is unreal, imaginary, and infected with error at the outset. The proportion has always been disturbed by the differential rate of seignorage charged by the Indian Mint upon gold and silver bullion respectively, when imported into the mint for coinage. Instead of having been 15 to 1, it may be clearly shown to have been, and still to be, in the practical working, 15·15306 silver to 1 gold, or what we should call in England a price of $62\frac{1}{4}$d. per ounce of silver bullion.

The silver rupee, including the mint charge of 2 per cent. seignorage on silver bullion, has, since the year 1835, been equal, in purchasing power in India, to 168·367347 grains of pure silver bullion to each silver rupee, containing 165 grains only of pure silver. And the gold rupee, including the mint charge in India of 1 per cent. seignorage on gold bullion, has, during the same period, been equal, in purchasing power or value, to 11·11111 grains of pure gold bullion to each rupee of gold coinage containing 11 grains only of pure gold.

Then, dividing 168·367347, the value in pure silver bullion, of the silver rupee, by 11·11111, the value, in pure gold bullion, of the rupee in Indian gold coinage, we have the proportion of 15·15306 to 1, the relative value of the two coinages, as before stated, and as opposed to 15 to 1, their relative weights.

And as the intrinsic pure gold weight of each sovereign which comes into India, as it leaves England, free from seignorage, is 113·0016051 grains, that weight, divided by 11·1111111 grains (being the weight of pure gold bullion, of which the intrinsic weight of one rupee of gold coinage is the equivalent in value), gives a quotient of 10·170144 rupees as the proper estimate of the value of the sovereign in India, according to Indian laws and mint regulations as to seignorage, and not 10·25 rupees (or 10 rupees 4 annas) the amount at which the government of India has over-estimated the sovereign. Instead, therefore, of the notification giving such a value to the sovereign, its value should have been declared equal to 10 rupees, 2 annas, and 9 pies, that being the nearest expression to 10·170144 rupees in current coin, the exact decimal expression for this sum of current coin being 10·171875, an inconsiderable fraction of difference under the circumstances.

Taking it then as established that the mint ratio in India of silver to gold is 15·15306 to 1 in value, as compared with 15 to 1 in weight, the difference, of say 2 annas and 9 pies is, all that remains to be bridged over to make 10 rupees and 1 sovereign of its present weight identical in value, which is 1 anna and 3 pies less than the difference of 4 annas assumed by the government of India as the correct sum. This difference of 2 annas and 9 pies, upon 10 rupees 2 annas and 9 pies amounts to an alteration of 1·68971 per cent., to which extent the weight of the present sovereign would have to be reduced to bring it to the identical value in India of 10 rupees of gold, after allowance for 1 per cent. of seignorage.

Fortunately for the prospects of an international coinage for India, it may be considered in conjunction with the proposal of Mr. Lowe, the Chancellor of the Exchequer, to reduce the British sovereign to the extent of 0·87843 per cent., in order to make it identical with 25 francs of gold. Such a reduction would bring it into conformity with the coins of the Convention of December, 1865, including France, Italy, Switzerland, Belgium, Austria, and doubtless, by-and-bye, America, with which countries India has a very large amount of direct trade, and is consequently interested in improving the machinery whereby it is carried on and extended. The difference between 0·87843 per cent., to make the present sovereign international, and 1·68971 per cent., to make the future 10-rupee piece of India and the new international sovereign identical, is no more than 0·81128 per cent. The alteration in India and in England to attain this great object may be said to require no greater sacrifice in the one case than in the other. Moreover, the very amount of seignorage (1 per cent.) which is contemplated to be introduced into England and all other countries, parties to the Convention of December, 1865, is, as explained, already in force in India. And, as in India at the present time, the delivery of coin in exchange for bullion at the mint is attended with delay, whilst in an international system immediate delivery would have to be given, as it now is in England, the further reduction of 0·81128 per cent. in Indian present value of the sovereign would no more than represent a fair compensation to the Indian mint on the delay in delivery of coin for bullion being abolished.

The following sketch, subject possibly to some few modifications of detail, is therefore submitted as a method by which a gold currency could speedily and effectually be introduced into India, and which might, by concert with England and America, become a perfect international scheme in the sense of the Monetary Convention of Paris, of December, 1865:—

Article 1.—India to join the Monetary Convention of December, 1865, so far as regards the weights and standards of its gold coins, on the basis of $2\frac{1}{2}$ rupees of its gold coinage being made equal, in weight and pureness, to 5 francs of French gold coinage, 1 dollar of American coinage.

Article 2.—India to establish a temporary transitional double standard of gold and silver, for the discharge of debts, according to the debtor's option, in either of the metals, to cease absolutely at the end of five years.

Article 3.—India to stop all further coinage of 1 rupee pieces in silver for the next five years.

Article 4.—India to coin, during the next five years, all denominations of silver under the value of 1 rupee of the same standard and weight as the English silver token money, namely, at the rate of 62 half-rupees to each pound troy of silver of English standard fineness.

Article 5.—India to resolve, by legislative enactment, that, at the end of five years, gold alone shall be the standard, and silver coin legal tender to the value of 100 rupees only.

Article 6.—India to call in, at the end of five years, the silver coins, both rupees and lesser denominations, minted before the commencement of the period of five years, and to deal with them as was done with the sicca rupees in 1835-38, when it was ordered that from the 1st of January, 1838, they should cease to be a legal tender, though received by the collectors of land revenue, and at all public treasuries, by weight, and subject to a charge of 1 per cent. for re-coinage.

Article 7.—India to coin all fresh issues of rupees or lesser coins of silver at the end of the five years, at the rate of 31 rupees to one pound troy of silver of standard English fineness, *i.e.*, to make them of the exact weight and fineness of the English florin, two-shilling, or 100-mil pieces.

Article 8.—India to decimalise its coinage at the end of five years, by converting the rupees into 200 new pies, or half-mils English, instead of the 192 pies of which it now consists. The present inconvenient sub-

division of 16 annas to the rupee, and 12 pies to the anna, will thus be got rid of; and there would be ten new annas, of 20 new pies each, to the rupee, each new anna to be equal to 10 mils English, or $\frac{1}{1000}$th part of a pound; each new rupee to be one florin, or 100 mils; and each new pie, as a coin of circulation rather than of account, to be half a mil English, or $\frac{1}{2000}$th part of a pound. This minuter subdivision than in European countries is necessary for India, as a poorer country, with smaller wages, and lower prices of necessaries of life; and, as to any difficulty of the population in understanding the alteration, there is not the least ground for apprehension. The countrymen of the author of such arithmetical works as the "Lilawati" and the "Vija Ganita" are too clever as calculators to experience any feeling of hardship at adapting themselves to a change of greater benefit to themselves than any of the plans for consolidating the numerous kinds of rupees, both of silver and of gold coinage, and of various mintages and weights, which used formerly to circulate, and still do to some extent, in the British Empire in the East. *

It only remains to be noted that the weight of every gold coin, under the plan of the new currency, would be in simple and harmonious relation with the metrical system, and that the exact weight, in that system, of any number of rupees, could be ascertained by simply dividing them by 1,240. Thus, to ascertain the weight of 10 rupees, or 1 international new sovereign (or 5 dollars, when America joins the Convention), or 25 francs, we have but to divide 10 by 1,240, and the quotient is 8·064516 grams, the weight in gold nine-tenths fine, according to the stipulations and articles of the Paris Convention, of December, 1865. Similarly, 3,100 rupees of India, or florins of Austrian gold currency, would weigh $2\frac{1}{2}$ kilogrammes; 3,100 dollars, or 5 franc pieces, 5 kilogrammes; 3,100 gold francs of any country in the Convention, 1 kilogramme; 3,100 napoleons, 20 kilogrammes; and 3,100 new international sovereigns, or 25 franc pieces, 25 kilogrammes. All exchange tables, for the conversion of one coin into another at intrinsic par, would then be unnecessary, and the real values of the coins of all great commercial nations would be perfectly easy to understand, even by any child instructed in the first rules of decimal arithmetic, and of the metrical system of weights which it is the avowed intention of the government of India to introduce into that country as soon as practicable.

* The present system of coinage in British India is:—

$\frac{1}{192}$ of a rupee .... equal 1 pie.
3 pies .... „ 1 paisa, or piee, or $\frac{1}{4}$ anna.
12 pies .... „ 1 anna.
16 annas .... „ 1 rupee.
15 rupees .... „ 1 gold-rupee.
16 rupees .... „ 1 gold-mohur.

And the proposed new system of international coinage for India would be as follows:—

$\frac{1}{200}$ of a rupee .... equal 1 new pie, or $\frac{1}{2000}$ of £1.
2 new pies .... „ 1 new paisa, pice, or $\frac{1}{1000}$ of £1.
20 new pies, or 10 new pice ... „ 1 new anna, or $\frac{1}{100}$ of £1.
10 new annas .... „ 1 rupee, or $\frac{1}{10}$ of £1.
10 new rupees .... „ 1 new sovereign, 25 francs, or 5 dollars.

The following exhibits the scheme of the present British Indian monetary system:—

Rupees.	Anna.	Paisa, or pice.	Pie.
1	16	64	192
	1	4	12
		1	3

The following exhibits the proposed *new scheme*:—

New sovereign. (5 dollars international, or 25 francs.)	New rupee.	New anna.	New paisa, or pice.	New pie.
1	10	100	1000	2000
	1	10	100	200
		1	10	20
			1	2

Mr. Rowland Hamilton said he could not enter into the details of the remarks which had been made by Mr. Cassels and Mr. Hendriks. With regard to the more general point to which Mr. Cassels had alluded, he thought there could be little doubt that a gold currency was better than a silver one. It was more exact, and one which presented greater facilities for all operations of commerce. Whether a much larger aggregate amount of bullion would be required to carry on the increasing trade of India, did not appear to him at all certain. Improvements in the general monetary system would greatly tend to economise the use of bullion, and save all the waste of carrying it backwards and forwards. For some time to come, a large amount of silver coin would be required for the more ignorant dealers in the remoter parts of the country, who would not be satisfied without actually seeing the silver for which they sold their commodities. The most effectual means of saving waste of this kind, would be by the introduction of a note currency, which would, by degrees, be received, pass from hand to hand without expense, and thus, in fact, transfer the ownership of bullion without needless moving the bullion itself, which would actually be paid in coin only on the ultimate presentation of the note at its place of issue. The point, as it appeared to him, to which the attention of government should be chiefly directed was, to determine the equivalents of value that should be adopted as for gold and silver respectively. It is admitted on all sides that a gold standard is desirable, but it must be borne in mind that all monetary obligations, bills of exchange, taxes, mortgages, and the like were now expressed in a silver standard. What, then, in the first place, is to be taken as the value of the rupee. In the first instance, at all events, the quantity of silver required to make the rupee, not the weight of the rupee after deducting a seignorage and mintage of $2\frac{1}{10}$ per cent., should be taken; that is, rather more than $183\frac{3}{4}$ grains, instead of the tola of 180 grains, which was the weight of the rupee as issued from the mint, and this larger weight he had adopted in all the calculations he had made of the comparative value of the rupee and the gold coins proposed. He would remark, however, that the value given to a coin by such a seignorage is not of the same nature and stability as that which rests upon its weight in bullion, for the value of the seignorage depends on the utility of the coin as coin, circulating within comparatively narrow limits, and adapted only to its own special purpose. If coin be issued in excess, it could only be utilised by melting it down, but the value of the bullion depended on the far larger average afforded by the markets of the whole world. Such a proposition as that of the Chancellor of the Exchequer, to take a seignorage off our standard coin, certainly subjected it to new risks and conditions. Coming to the question of the equivalent in gold to the existing rupee; taking, as mentioned before, not the actual weight of the rupee itself, but the larger weight required to be given to the mint to get the rupee (viz., 183·861 grains troy), he could not arrive at the same conclusions as those stated by Mr. Hendriks, as regards the relative value of the two metals. He did not think much value could be given to the quotations of gold in the Indian markets, which would be much affected by the perturbations in international exchange. Silver being the standard fixed in India, could show no fluctuation there, but the enhanced price in Europe had been in a great measure owing to Indian demand. A high price of silver in

Europe, and a low price of gold in India, were in fact correlative. The primary idea of a currency seems to be this:—We have in bullion a commodity known throughout the civilized world, and which can be carried at far less cost and risk than any other commodity, from any one country to another. Thus a certain weight, say of silver, can be exchanged for a certain quantity of goods, that same weight of silver can be exchanged in Europe for different quantities of the same goods. Its purchasing power, or the quantity of merchandise it will procure, vary indefinitely, but this fixed weight of bullion does, as a matter of fact, afford the best basis of comparison between the value of commodities in different regions. Trade, however, consists, for the most part, of the interchange of commodities, and where these are of the same aggregate, value there is no necessity for the transport of bullion one way or the other; but when trade shows large differences of value as between imports and exports, bullion is resorted to as the only means of adjusting the balance. There is less cost and risk in transferring bullion than anything else. Thus, speaking broadly, England paid India for her cotton by shipments of manufactured goods, as far as they could be taken, but when this means of payment proved inadequate silver was sent out, and the demand, during the time of the war in America, being very urgent, the price of silver in England was much enhanced, and, for the same reason, the price of gold in India was depressed; for it was very much the same thing to the bankers, who carried on these operations, whether they paid more for the silver they bought, or got less for the gold which they received from Australia or elsewhere—the result was the same; the extreme quotations only serve to indicate a trade exceptionally stimulated or excited. But this large import of bullion was made to pay for cotton, and the cost of its introduction must be held to be paid for by the exporters of cotton; the whole matter being adjusted by operations, chiefly by bankers, in international exchange between the two countries, the question of the cost of transmission was settled within the limits of these operations, and the cost of transmission, of either silver or gold bullion, does not enhance their permanent value; and, in the case of the Indian standard, we must look still to the weight of the rupee, with no other addition than that for seignorage as the basis of the comparison between silver and gold. The best and safest way of arriving at equivalent in gold for the rupee was to go to the great markets in the world common to both. Owing to the difference between the English standards for the two metals, the figures required to show the exact calculation would be too lengthy to quote, and he would therefore simply give the prices as quoted for British standard silver and the equivalent in gold. Even taking 183·861 grains as the value, in silver bullion, of the rupee, it would require a price of over 5s. 3d. per ounce to make ten rupees equal to the sovereign, this price of 5s. 3d. of course referring not to the English silver shilling, which is merely a token, but representing the aliquot $\frac{63}{240}$ of a sovereign. But no one, in the face of the diminished demand for silver which must inevitably ensue on the introduction of gold on equal terms into the Indian currency, would venture to expect a higher rate than 5s. per ounce, or $\frac{60}{240}$ of a pound for British standard silver. A price a little over this would be required to make 10·8 rupees equal to the sovereign. As regards the probability of an advance in the price of silver, the probabilities were all the other way. The production of gold had been tested most fully—all the energy, skill, and enterprise of the European and American; all the patient assiduity of the Chinese, had been brought to bear on the fields of California, British Columbia, and Australia, yet these sources had yielded, since 1863, a diminishing supply, while the older mines of other countries showed some increase. The production of silver has been exposed to no such tests, though we know of large sources of supply, and also that quicksilver, which is a great requisite in its production, is the subject of great monopolies, which might, for aught we know, at any time be broken down. There seemed far more risk of a depreciation than of a rise in silver, and it would be most unsafe to put a high value upon it, in expectation of its becoming more scarce than at present. If a value of 10 rupees only were put on the sovereign, though no doubt any one would be glad to get the gold at the rate, no one would be found to give it; the option would be for payers to choose the means by which they could lawfully discharge their debts. The fairest equivalent of 10 rupees, taking all circumstances into consideration, was about 117 grains of gold, British standard; and if the sovereign (123·274 grains) were taken at all, 10 rupees 8 annas would be the nearest simple fraction at which it could be introduced with a fair chance of its remaining in the country, that is, silver at a little over 5s. per oz., British standard, and sovereigns 10 rs. 8 annas, will be found to be very nearly equivalents.

Mr. HYDE CLARKE said that, following the precedent of Mr. Hendriks in alternating an English view with an Indian one, he begged leave to make a few remarks, and he did so with greater confidence because he knew there were gentlemen present who had entered into the details of the subject, and who could correct him if wrong. He would not, like Mr. Hendriks, go into the political economy of the subject, but it did appear to him that the value of a coinage was affected by seignorage, and was regulated by the same influences which regulated other commodities. He did not, however, mean commodities which moved about so much as those which were stationary, like furniture, for instance. When we came to a different state of affairs, as international exchange, for example, then the coin became, like other commodities, of the value of the material, less the value of reducing that material to the useable condition. He took it that coin was fluctuating in its value, and that they were not justified in determining the value of a coin by solely limiting it to the value of the bullion. He made these remarks, because whether they took a standard of a decimal coinage for India really depended upon whether they could alter the coin without injury to the nation or injustice to the individual. If, on the other hand, they looked upon the coin as a fluctuating instrument, and as a fluctuating medium, then, he thought, they were justified in altering it. He could not agree with Mr. Hendriks with regard to a metrical coinage for India. What Mr. Hendriks said to them on the present occasion was rather an objection to than an argument in favour of his views. Mr. Hendriks had referred to the great advantages which would accrue from having a similar coinage to that of France and other countries where the decimal system existed; but so far as he (Mr. Clarke) could see, the relationship between India and France, and other countries, was an inferior consideration to the relations of India with Australia and England. He, however, said this with diffidence, because Mr. Hendriks had been a very active advocate of the system. He had read with great pleasure Mr. Hendriks' articles in the *Economist*, and still he must say that the more he heard from him the less he was convinced. With regard to getting rid of the anomalous arrangement of sixteen annas and twelve pies by substituting two hundred pies, why, that simply did away with the duodecimal system of an existing population to please a craving after decimals. It might seem all very well to alter to a decimal system, but he thought that the operations of a people were of much more importance to them than to the trade of other countries. He did not decry the value of any decimal system, but he could not see the advantage of introducing into India a decimal system which rested upon an artificial basis. In all these matters we should be governed, to a considerable extent, by practical considerations. Of course it was an object that, to some extent, there should be an uniform

coinage in Australia and England; but they knew practically from experience that, where they had coins circulating from another country, there might be a great scarcity of that particular coin, while at another time there might be a flood of it, disturbing the whole arrangement of the market. He was sure that, if they had an international system, the bullion markets of the world would be subjected to far greater vicissitudes than those they suffered from at the present moment. They sometimes found, in great cities, that they had not really any money to carry out business operations, and that at another time they had a quantity of coin poured upon them, not for any purposes of commerce, but simply for bullion broking. He repeated that, to a certain extent, that was an objection to an international gold coinage in England and Australia. He was aware that an international coinage had some advantages, but, on the other hand, there would be no real advantage to India commensurate to making all the operations in our own markets the same as the markets of Europe. They must not forget that India was influenced by its near relations with Europe, and its coinage must become nearer and nearer to the coinage of Europe. The time was approaching, whether they liked it or not, when they must have a gold coinage in India. Remembering that, the objections that had been made to a gold currency seemed to him to have still less force. Mr. Hendriks spoke of the silver coinage in India. He would support what Mr. Hendriks said by referring to Europe. It was within the recollection of most of those present when nearly all Europe had a silver currency, and at present they nearly all had a gold one. Under these circumstances, India could not be kept out of it. The present debt of India might appear a very large amount, and it might appear of importance to give the gentlemen of the present day the same amount of gold that was stipulated years ago; but he did not think that was of any real importance; and, as to the amount itself, he considered it comparatively unimportant, because he considered it a very small proportion when compared with what would be required to develop the resources of the country.

Colonel Smith said that he must confess his inability to take up all the points which had been touched upon by the various speakers, they were so numerous, and all of importance. They were all very much indebted to Mr. Cassels for the valuable paper he had read before them, and he thought that it ought to have the effect of bringing the question to the notice of the proper authorities. As Mr. Cassels said, they had been too indifferent. Things were referred from India to England, and from England back again, as if they were shuttlecocks, and this would go on for ever, unless some steps were taken to prevent it. He hardly agreed with what Mr. Cassels had said upon the value of the standard he would introduce. He would go further than Mr. Cassels; he would say there should be a gold coinage for India of the value of ten rupees to the sovereign. He would undertake to prove to any three gentlemen who understood the subject, and who would have patience to listen to him, that the sovereign was worth little, if anything, more than ten rupees. There was one point he would like to mention before he proceeded to criticise Mr. Cassels' paper, and that was one upon which every merchant would agree with him, namely, that there should be as little fluctuation in the exchanges between England and India as possible. Great fluctuations, however, took place in the Indian exchange. They have had the rate sometimes at 2s. 2d. and at others 1s. 10d., that was, 16 per cent. He considered it a monstrous thing that exchanges should be allowed to show such great variations, when, by the adoption of a gold currency, they would not fluctuate above one per cent. He thought it a very great mistake to say that the sovereign was worth 10 rupees 4 annas—he considered it worth very little more than ten rupees; and if we had a telegraph to Australia, as we soon should have, it would not be worth that. He could show them why this telegraph would make a difference. He was not a commercial man himself, but he had been informed that bankers in London received telegrams telling them the price of gold in India, and that they replied by return telegram to sell. Gold was then sent out, at a cost of two per cent., while gold could be landed from Australia without that cost, or two per cent. cheaper. Gold could, in fact, be landed in Calcutta at the same cost as in London, and, consequently two per cent. cheaper than when sent from London. This may be explained as follows:—Gold coming from Australia to England, on its way for sale at £3 17s. 9d. per oz. standard, may, on its arrival at Galle, be said to pass the door of India, as it is within a week's distance of Calcutta or Bombay, and the freight and charges for that short distance must be less than the expensive and tedious transit through Egypt and the Mediterranean. Hence it is that the cost of gold in India is not more, but rather less, than the same delivered in London; and hence, too, if there were telegraphic communication between England and Australia, gold would be supplied at a cheaper rate than at present. There were three different methods of calculating the relative values of silver and gold in India. One method was, taking the price of silver and gold in the London market, and calculating all the expenses of landing them in India. That was one way. This method applied to the average of prices of silver in London for the fourteen years, from 1853 to 1866, gives the value of gold as $\frac{1}{3}$ per cent. more than the rate of ten rupees for the bullion contents of the sovereign.* The second method is, to calculate the value of gold in rupees from its power of purchasing bills on London, according to the rate of exchange. A banker or a merchant having gold in Australia had two courses open to him with regard to his gold. He might send it to London, and there sell it for £3 17s. 9d. per ounce, or he might send it to Calcutta to buy bills with it, and what he would get there depended upon the rate of exchange. A sovereign worth of gold would be sold in London for 240 pence, while if sent to Calcutta and exchanged for a six months' bill on London, this would take a month to transport to England, and the loss of interest for the month would be one-half per cent. There would also be, on average, two per cent. for discounting the bill. On 240 pence these charges would amount to sixpence, and, therefore, if the merchant could buy in Calcutta a six months' bill on London for 246 pence at the current rate, he would just be on the same footing as if he sent his gold in the first instance to London. Now, when the current rate is 2s. per rupee, his sovereign would cost him $\frac{246\text{d.}}{24\text{d.}}$ or ten rupees four annas. When the current rate of exchange for a six months' bill is 2s. 1d., the sovereign is fully paid for by 9 rupees, 13 annas, and 5 pies. Hence, it will be evident that the value of gold in India is precisely determined by the rate of exchange. For the last ten years that rate had been two shillings and nearly four-tenths of a penny per rupee, and that rate showed the value of the sovereign to be, on the average, about one per cent. more than ten rupees. There was a third method, and that was based upon the average price of gold as sold for rupees in the Indian markets. The result was similar when the averages are stated in due proportion to the quantities imported into India, and allowance made for brokerage. It showed the value of the sovereign to be very little, only about $\frac{1}{10}$ per cent. more than ten rupees. He thought that now was the time to introduce the sovereign as a legal tender. The effect of such a regulation would be that, as exchange rose, sovereigns would come in to India, and they would circulate throughout the country with the same purchasing power as 10 rupees. If, on the other hand, the present measures of the government of India were

* "Remarks on Gold Currency for India," page 35, par. 38. Published by Layton, and Co., 150, Fleet-street.

persevered in, and ten rupees and a quarter were exchanged for as much gold as is contained in one sovereign, it is evident the purchasing power of rupees would be $2\frac{1}{2}$ per cent. less than on the first supposition; and, as the revenues of India amount to not far short of 50 millions sterling per annum, these measures involve a loss in the purchasing power of the revenue of about one million sterling per annum. That, he considered, was a serious thing. There was, however, one objection to introducing the sovereign at a high value, and that was, that the moment a turn of exchange took place, away would go the sovereigns, to be exported to England. That was true, certainly, but there was a remedy, and it was the only remedy, namely, stopping the silver coinage. There was one thing which one of the preceding speakers had said, upon which he wished to comment a little. That gentleman had said that his idea of a currency was the weight of gold, and that the comparative value of gold and silver ought to be reckoned with reference to the markets of Europe. This he thought a mistake. What we required to know, in order to establish an Indian gold currency, is the relative prices of gold and silver in India, not elsewhere. He was reminded of the argument of a friend of his, who said an ounce of gold was an ounce of gold, and then inferred that an ounce of gold in Europe was of the same value as an ounce of gold in Asia. He (Colonel Smith), however, did not agree with this inference. A ton of coals at Newcastle would be a ton of coals when it arrived in London, but there would be a considerable difference in its value compared with other commodities.

On the motion of Dr. Boycott, seconded by Dadabhai Narogi, Esq., the conference was adjourned to Friday evening, January 21st, 1870.

Sixth Ordinary Meeting.

Wednesday, December 22nd, 1869; Professor A. W. Williamson, F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Brown, Thomas, Grammar School, Grimston, King's Lynn.
Russell, John, Scotch School, New-road, Woolwich, S.E.
Witt, John Charles, Hamlet-road, Upper Norwood, S.E.
Worthington, James, Sale-house, Sale, near Manchester.

The following candidates were balloted for, and duly elected members of the Society:—

Bennett, Charles Fox, 55, Queen-square, Bristol.
Brand, Henry R., M.P., 70, Princes-gate, W.
Carter, C. R., 17, Carleton-road, Tufnell-park, N.
Farrant, R. E., The Limes, Lower Tulse-hill, S.W.
Greener, John Henry, 82, Lombard-street, E.C.
Hayne, C. Searle, 3, Eaton-square, S.W.
Hollebone, Frederick, Ravensbourne-park, Catford-bridge, Lewisham, S.E.
Langford, J. A., LL.D., Birmingham.

The Paper read was—

ON WINES, THEIR ORIGIN, NATURE, ANALYSIS, AND USES; WITH SPECIAL REFERENCE TO A NEW ALCOHOLIC DRINK MADE FROM TEA.

By J. L. W. Thudichum, Esq., M.D.

The Fable of the Asiatic Origin of the Vine—Wild and Fossil Vines.

Almost every treatise on wine or viticulture begins with the statement that the vine had been introduced into Europe from Asia. In this respect, the vine has shared the fate of many other cultivated plants, the origin of which was unknown to horticultural writers. The first error generally committed is the presumption that all varieties of vines which we know are derived from one primary species. Thereupon, the Asiatic paradise becomes at once unavoidable, and science and study are at an end.

Most botanical authors have fallen into the same error, and have assumed the existence of only one species of vine. The existence of wild vines they explained by the assumption of a degeneracy of cultivated species. Thus, in France and Germany, wild vines were generally declared relics of Roman settlements, and the very existence of vines themselves in those countries was ascribed to the Romans.

Gmelin, in his studies for the "Flora Badensis," observed that the wild vines frequently occurred in the dioic state. He described such plants botanically, and established a separate species for them, under the name of *Vitis sylvestris*. Those who copied Gmelin, destroyed the discovery by the addition that this was a degenerated *Vitis vinifera*.

This singular confusion of able botanists is the more astonishing, as the wild vines of southern countries, such as Italy and Spain, were well known to such authors as Crescentius, who lived in the thirteenth century, at Bologna, and to Clemente Roxas, a classical author on Spanish vines. The latter in particular declared the wild vines of Spain indigenous to that country, and to have consequently existed there long previous to the introduction or the origination of the cultivated species. His description of the vine thickets of Algaida, near San Lucar de Barameda, might be applied to the American fox-grape vines as found in the virgin forest.

The wild vines of the Rhine valley were first recognised in their true character by the late M. Bronner, an apothecary of Wiesloch, near Heidelberg. He studied them for years in the marshes, and then transplanted cuttings into his garden. In the autumn of 1866, I visited this vineyard, and was able at once to identify, from the description, several species. Leaves, fruit, and habit fell into the eye at once, particularly the barren varieties, and the varieties with inedible or very acid fruit were at once observed. The inflorescence of these wild vines shows three distinct forms. Some are males exclusively, and in place of the umbilicus, capable of fructification, have a small honey cup. These plants are usually covered with flowers, and perfume the air to great distances. They answer to the description which Pliny gives of the "oenanth." Other plants are hermaphrodite, like the cultivated vines; but the great majority of individuals as well as species of wild vines, is purely female, and the stamens are crippled and placed below the berry (*Stamina recurvata*). The American vines also occur in the polygamic as well as in the dioic state, and monographists do not admit this to be a characteristic feature, but hold it to be an accident to which any variety might be subject. However, in the department of the Ain, in France, is cultivated the "mescle." It has male and female plants only. The finger-leaved "mescle sterile" differs wonderfully to the eye from its female companion, the "mescle fertile." The vine-dressers know that they must have some of these "plantes craputs" in the vineyard, or they will get no fruit. They were as unable to explain the riddle as the French inspector of vineyards, M. Guyot, and talked superstitiously about it. I maintain that the dioic is the normal state of the mescle.

I count with Bronner twenty-eight species of wild vines of the Rhine. They are unlike any other known vines, unlike the cultivated varieties, and, in my opinion, are genuine children of the soil on which they stand, truly indigenous, and many perish when removed only a few miles from their natural habitation.

But suppose that my botanical argument were not recognised, then I would fall back upon the testimony of rocks. This proves that the wild vines existed in central Germany during the tertiary, and before the basaltic period. The specimens of coal which I have

pleasure in laying before the meeting, come from the mine of Salzhausen, near Frankfort-on-the-Maine. The shaft by which the coals are reached passes through 180 feet of solid basalt rock. Who can guess the age of the jungle which produced this coal? Who can estimate the time which the phonolithic and basaltic mountains from which a stream flowed over the coals, required to be formed; or who can estimate the time which the biggest of them, the Mountain of Birds (2,200 feet above the sea) may have required only to get cool? Here they are, the leaves, barks, and kernels, of the *Vitis teutonica.* By these specimens, no less than by the wild vines of the present day, the fallacy of the Asiatic origin of the vine stands corrected.

In Upper and Lower Austria, particularly between Vienna and Pressburg, there grow many wild vines on the shores of the Danube. Jaquin, in an article in the Austrian "Annals of Agriculture," showed years ago that there were growing on the islands in the Danube large numbers of wild vines bearing small grapes. Similar vines appear below Buda, and extend to Transsylvania. The borders of the Theiss are enlivened by their presence. The Save, where it issues from Croatia, waters many plants of this kind. On the Adige, in the Tyrol, there are true jungles, formed by wild vines, which creep over low shrubs of *Rhus cotinus* and wild fig-trees. In the valley from Meran to Roveredo and Trient, there are no wild vines whatever, but they appear where the Adige leaves the mountains, and runs through a low, marshy country.

From the foregoing, it is evident that all those European countries which possess the climatic conditions, have in their flora many species of the genus *Vitis* in a wild state, with such botanical characters as leave no doubt that the plants are indigenous, produced by natural selection, and not derived from imported cultivated races of vines, or degenerated by natural selection from previously cultivated races, the products of artificial crossing or human selection.

Probable Derivation of Cultivated Vines from Indigenous Varieties.

Each particular district producing a particular kind of well-characterised wine, does so by means of particular well-characterised varieties of vines. These vines, I now maintain, must be either indigenous to these districts, or be produced in them by natural or artificial selection from indigenous varieties; for, when transplanted to other districts, they change their character more or less, so as to produce a different wine, or they lose their peculiarities so completely as to be worthless for making wine, or they cease to be fructiferous, or, lastly, they do not succeed at all, and pine and die out.

The Aramont is commonly grown about Montpellier, on account of its extraordinary fertility. Its bunches are large, its grapes of the size of nuts. Transplanted to the south of Germany, the aramont begins to bear in the fourth year, and brings large and many grapes. But, year by year, its fertility decreases, and its berries become smaller, until the viticulturist is obliged to remove the barren plant.

Austria possesses four peculiar vines, which are probably indigenous to the banks of the Danube. They are the following:—

The Rothgipfler, of Upper Austria, a vine with very dark foliage, the ribs, nerves, and points of which are red. At first sight, it resembles the "Traminer," but its grapes are green.

The green Muscateller of Upper Austria is one of the most fertile vines in existence; its bunches are large, and bear small greenish yellow grapes. It is not cultivated in other parts of Austria.

The white one of Grinzing, a village near Vienna, is only met with in the country around Vienna, where it is cultivated after the head-knob fashion.

The red Zierfandler, of Vöslau, is cultivated only in the valley between Vienna and Baden, and not to any great extent. Its grape is light red, and is said to yield good wine. Bronner planted these four varieties in his vineyard at Wiesloch. During ten years he did not obtain a single grape from any of them, and after ten further years all the vines had died out.

The vines of Europe transplanted to North America do not succeed. Viticulture in that country is only possible with indigenous varieties or their crosses. On the other hand, American vines, which yield good wine in the United States, when grown in the Gironde, degenerate, and yield no drinkable wine. M. Boucherot, of Carbonnieux, near Bordeaux, has made this experience by plantations on a large scale, and it is from himself *in loco* that I have ascertained the circumstance. The varieties were fox-grape, Isabella, Catawba, Schuylkill or Alexander, Bland's, Ohio or "cigar-box," the two varieties of the summer grape, the Mexican mustang grape, the winter grape, Scuppernong, and mountain. I abstain from giving more exact botanical names and diagnoses, which I made in the Botanical Garden at Bordeaux, to economise space.

It is said that "Bucellas" is made from the "hock" grape, transplanted to Portugal. The "hock grape" which could be called by that name must be the Riessling. But nobody would recognise "Riessling" in "Bucellas," which proves that the vine so alters its character in the southern climate as to give an altogether different product. Sherry is, to a large extent, made from a grape called the Pedro Ximenes, said to have been brought to Spain from the banks of the Moselle by the man whose name it bears. If this be as related (and in view of the fact that the nature of the Xeres vines is not satisfactorily determined, I reserve my judgment), this vine could only be the "Albuelis" of the Romans, or "Elbling" (Elbe) of the Germans. In sherry this ingredient can be as little recognised as any sherry flavour can be discovered in moselle.

The vines of the Alto Douro differ in specific botanica character from all other vines, as port-wine differs from other wines. The Gironde produces the peculiar red wines by means of its "carmenet," "carmenère," its "malbec" and "verdot." Transplanted to Spain, these vines do not produce clarets any longer. In a climate less warm and less moist these vines so lose their fertility as to cease to be remunerative instruments of agriculture.

By these selected few examples out of many at hand, I intend to illustrate the following proposition:—Every uniform climatic region has its peculiarly-adapted varieties of wild and cultivated or cultivable vines, which cannot be so successfully cultivated in other regions, or cannot be cultivated at all anywhere else. But many varieties of vines, generally those of no particular qualities for wine-making, can be grown in a variety of districts, although in that case even, it is necessary that these districts should have some climatic features in common.

Now, as wines are everywhere rising in price, and will continue to do so, and as prices stimulate production, viticulture will no doubt experience great expansion in many parts of the world. This will mainly take place in new districts, for the old districts hardly admit of it. The viticulturists will have to find the suitable vines, particularly wild varieties, if there are any, and to plant, to graft, and to cross, and rear seedlings. New countries, therefore, must produce new vines and new wines, and should not endeavour to imitate any special product of the old world. I say this with reference to the efforts now making in Australia, Peru, California, and Virginia to cultivate vines on a large scale.

Modes of Cultivation of Vines.

We are an agricultural Society, and take notice of subjects and matters which may be applicable near home or in the remotest parts of the world. We evolve or discuss what others may employ elsewhere; but we are also interested more directly in having certain knowledge

of the manner in which the wines we drink are produced, or ought to be produced. My remarks on this subject will be based on personal experience and study abroad; they have the same object as the rest of my paper, namely, to contribute my share of agitation to produce for our population more, better, and cheaper wine, and to teach them how to produce, husband, and drink it.

Vineyards are planted in disorder, "quincunx," or in rows, *i.e.* lines. It is necessary to give to the sun the utmost opportunity for warming the soil, and, therefore, a rational viticulturist draws his lines parallel to the meridian, wherever other considerations do not determine a different course. As animal labour and machines are everywhere, in a measure, taking the place of human labour, the planting of vines in lines becomes more prevalent. The scientific reporter to the French government, M. Guyot, thinks that the future of viticulture belongs to the arm, as he expresses it, and that hand-labour will outdo animal labour. But what I have seen of French viticulture in particular, and heard of successful viticulturists, is all to the contrary effect. Certainly viticulture on a large scale requires the plough and horse, and the intermittent nature of the occupation forbids the accumulation of hands. In new countries labour would be naturally scarce, and therefore Australia and America should so arrange new plantations as to make them accessible to the plough. In Croatia, splendid vintages might be produced if the plough were more commonly used. Certainly such vineyards as Banyoul-sur-Mer, the rocky ridges of the Rhine, inclines like Johannisberg, and thousands of hanging mountain-sides will always require the hoe. The viticulture of the Champagne is, at present, disorder, and does not admit of animal labour. But the vine of the future will, like the great mass of the wine of the Gironde of the present day, be grown on soil ploughed by oxen or horses; and when enterprise and capital shall have everywhere made such rapid strides in the prosecution of a rational viticulture, as I have lately witnessed in the Gironde, the steam plough will do the tillage, and mineral sources will furnish the manure.

Vines are dressed according to certain types, of which I have observed about twenty. Many of these are merely traditional, and cannot be defended on any grounds, at least when the object is to produce grapes fit for wine-making. The grapes should everywhere be kept as near to the ground as possible, but out of the reach of the splashing earth, in order that they may be nearest to the heat radiation of the soil, and least exposed to cold winds. See how closely the viticulture of the Rhine, of the Champagne, of the Médoc, of Burgundy, Maconnais, of parts of Hungary, comes up to the ideal in this respect. These produce natural wines, requiring no spirit. But, wherever the grapes are allowed to rise higher above the ground, as in the South of France, or in parts of Spain, or where they are grown high in the air, as in Tyrol, in Croatia, most parts of Italy, in the Pyrenées, wine has to be simmered, or to be alcoholised, in order to impart keeping qualities to it. But the result is worse, for Italy, for example, owes the decadence of her production and exportation of wine to this erroneous viticulture. If she adopted generally the rational method, she could at once supply great quantities of good wine, and export, while now Italy (Sicily excepted) imports wine.

The several methods of cultivating the vine are best illustrated by views of the vines in spring, after they are cut, and before they have grown any branches; and, again, by their appearance at the time of the vintage. The following are the principal types:—

General Method.—Cultivation in low lines.

Médoc Cultivation.—Smallest development of permanent trunk; lowest lines practised.

Palus Cultivation. — Higher trunks. Intended for bearing quantity. Enormous growth and great harvests of this cultivation.

Graves or Sauterne Cultivation.—Grapes kept higher, to prevent rotting.

Côte-d'Or.—Disorder; lines.

Champagne.—Disorder. The vines are pruned every third year, consequently the vineyards always bear a youthful aspect.

Kammerbau. — Alsatia and Palatinate. Good for quantity; too shady and high for quality, except in hot seasons.

Rhenish Cultivation.—Low basket or bent rod.

Tier Cultivation of Moselle.—Now disappearing. Yields sour wine, but much quantity.

Hedge Vineyards.—On the Loire, in Hungary, the Nahe valley. Vines growing on shrubs like brambles. Suited for new countries. Require cutting only; no other cultivation. I have seen thousands of acres of vines, all lying on the ground, on rocks, stones, grass, and shrubs.

I do not consider the methods of growing grapes for eating, such as I saw in beautiful perfection at Thoméry, or such as are practised with so much success in our English vineries. I believe that, for the production of wine, the Médoc, Palus, and Rhenish cultivation meets all requirements, but their advantages seem united in the general method; this I have seen practised in the Palus and the Graves with similar success, and in Burgundy with much increase of produce.

With suitable vines, the general method might be practised in all parts of Central India. Where coffee and tea grow, wine will grow, and the whole of Central India is within the viticultural zone. The sea-board, and a belt of 200 miles all round Hindostan, are not suited for viticulture. Railways will remove the question of transport. Then India may send us wine in exchange for the thousands of barrels of beer which she consumes. The proposition of viticulture in India might perhaps be more closely considered in one of the Society's Indian Conferences.

Necessity of a New Study of the Fruit of Vines, with reference to their Capabilities for Vinification.

The Chaptal collection of vines at Paris was intended partly to meet this want. With the one man passed away the comprehension of the problem, and the Jardin du Luxembourg now contains only the ruins of a great idea. According to my collations, the upwards of 2,000 numbers of the Chaptal collection are reducible to less than 500 distinct varieties. These, in my opinion, contain the elements of much progress in viticulture, but the progress can only be made by the hand of science.

The different and the relative qualities of the various vines, as regards the quantity of sugar, tannin, acids, salts, colouring matter, essential oil and bouquet contained in their grapes, have never been studied. This study has only been initiated by Dr. A. Dupré and myself, with regard to some of the finest grapes of the Rhine valley, and soon after we observed, with great satisfaction, a similar study begun by M. Pasteur. Progress in vinification means much besides the improvement of bad harvests; a barrique of Chateau Margaux may be worth £5 in one year, and £80 the next year. The bad wine is prepared for the consumer by the process of "mettre dessus;" and, in fact, good wine maintains its price mainly as a drug for ameliorating much bad wine, but a scientific treatment of the £5 Chateau Margaux, while must, might avoid all subsequent mixing, and produce a much better product than the "mettre dessus." Cheap wines are too often incongruous mixtures of common growths, to which a nose has been turned by addition; they succeed if drunk within the fortnight. Now they might very well stand upon their own merit if their must had been properly treated; and this treatment of the must is the next improvement required in either chateaux or peasants' chais, in Rhenish cellars, or Spanish bodegas. Wine, which like that made in the Jura, contains from 12 to 18 per mille of acid, is un-

drinkable unless mixed with water; consequently, vines which yield permanently such must ought not to be cultivated; or, if their value as plants of cultivation is clearly established on particular grounds, then their must has to be treated so as to reduce the quantity of acid to the normal. Similarly, the alcohol of wines has to be kept near the normal. If chasselas yields wine with 2 to 3 per cent.; gamais, 5 to 7 per cent.; pineau, 10 to 14 per cent., it is clear that pineau must always be the most valuable wine, all else being equal. The little pineau which is grown is most used for falsifying gamais wine, and Burgundy is fast becoming a tradition. This deplorable fusion must be counteracted by progress in the treatment of gamais must and chasselas must, and pineau fermentation. If not, the Bourgogne is certain to lose its reputation. Common wines will never pay the agriculturist, or succeed as articles of trade, unless they are produced as scientifically, cleanly, and uniformly as beer; and this can only be done by the aid of the scientific chemist.

It has hitherto been assumed by agriculturists that the grapes, while unripe, accumulated acid, which during ripening was converted into sugar. But it is found that during ripening the acid, in 100 berries, either actually increases or remains stationary, while sugar rises from 2·6 parts to 19·8 parts. In fact, each variety of grape has it own laws in this respect, which differ greatly from the laws of almost every other. Grapes have to be considered as physiological individuals, and not their must as a liquid changing only in per-centic composition. It is the latter error which has led to so much fallacy.

The "Enfariné," English "black cluster," is a vine of the Jura; its fruit is the most acid and least sweet. In September its grapes contain from 23 to 25 per mille of acid, and from 154 to 160 per mille of sugar. At one period the unripe grapes contain less acid than the ripe ones. At a certain moment of maturation (when they become black), if not during the whole period of ripening, the amount of acid increases instead of diminishing, as has hitherto been supposed to be the rule for all fruit. Sometimes the sugar is found to diminish during ripening, and the disproportion differs in succeeding years.

The "Ploussard" is also a vine of the Jura, and yields delicate wines. When passing from green to red and black, its grapes simply take up sugar. When ripening more, its acid is diminished, but not in proportion to the increase of sugar.

In southern countries the grapes are mostly gathered at the time of greatest volume. This is the main reason of the little keeping powers of southern wines, and of the necessity of brandying. In the Sauterne, grapes are collected at from eight to eleven different periods, and berries are cut off singly, illustrating the extreme of expensive care. On the Rhine, the Riessling is gathered at the latest possible period, and allowed to rot, if possible, provided that the rot is what is called "sweet rot." This is correct for the Riessling, and it has taken hundreds of years to teach the principle to the people at large.

But although the must in southern countries is not treated as science would suggest, it is not, for that, left untreated, for Spanish, Portuguese, and French wines of the south are plastered, that is to say, plaster of Paris is dusted over the grapes immediately after they are gathered, or while they are on the press, or while they are in the state of must. Dr. Dupré and myself have been unable to find out the logic of that practice. If it is intended to make the wine stronger, it fails; for plaster unites with little more than one-fourth its weight of water, but the gypsum formed incloses mechanically a quantity of must, and reduces the total yield, so that 50 per cent. of plaster will retain fully half the juice, and raise the sugar in the remaining half from 13 to 15 per cent. only, and lesser quantities in proportion. But plaster will diminish the free acid of the wine, in proportion to its quantity, from 5 to 0·5 per mille. It will do more; it will decompose the tartrates, and form sulphates, and thus change wines into drugs. In fact, all sherries contain considerable quantities of sulphate of potassium, to which many varieties owe their bitter taste and their purgative action. I am quite open to instruction on the use of plastering, but have sought it in vain of some large producers or importers of sherry. No doubt the 20 per cent. of alcohol in sherry is a frequent cause of kidney affection, but the cause is at least doubled by the potassium salt. I vote for sherry without plaster acid, and less than 16 per cent. of alcohol; such sherry will require neither camomile nor nitric ether for a flavour. I vote for not changing ripe must into unripe by removing wine-acid, and leaving sour apple acid. I delight in a glass of Amontillado, or even cheap "vino de arenas," but I gladly leave the drink of tincture of Glauber's salts to the old gentlemen who, as the phrase goes, "cannot get anything dry enough."

Vinification.—Rational cleanliness is greatest in the Champagne. I have there seen press-houses clean and neat, like drawing-rooms, particularly those of the greatest houses. Some I have seen in cynical dirt. But generally in vintage time, in the Champagne, everything is brushed up, from the thousands of donkeys which carry the harvest, to the wandering crowds which gather it, to the sedate matrons who clean each bunch, and invite you to buy in daylight. In the result, the champagne maker turns even a very common wine into a delicate drink, and sells it at a very large profit. Uninterrupted rises the consumption and production of effervescent wine, because the motto of its life is "Care." A recent notice in the *Daily News* stated that the Champagne exported from Rheims alone has increased within a short time from three to nine million bottles. The whole of the Champagne districts produces about thirty-five millions of bottles. It does not turn bitter or sour, and, though it has vicissitudes, they are trifling compared to those of its brother Burgundy. Burgundy is made from the same pineau, but fermented with the husks. Bitterness, greasiness, or viscidity, fall of colour, persecute it; the English excise law had to be changed to enable this wine to be imported in bottles, because it would not stand transport in casks. If you seek for causes, go and see vinification in Burgundy. Feet in and out of boots, in and out of vats, alternating from boots to vats, and vats to boots; naked men up to their necks in vats of what might have become delicate wine, doing the "foulage," and almost dying over it, rotten "chapeaus" not removed, yielding the rotten egg flavour, which some profess to believe to be the sign of genuineness of Burgundy wine. No wonder, I thought, when I beheld such things, that Burgundy lacks qualities, or has too many; and I wondered still less when I had seen the people and their houses, villages, and hotels. Why do not they learn from their clean brothers in the Champagne? More cleanliness and less bluster about the generous qualities of their wine would bring them farther. I feel this all the stronger, as I believe genuine wine of pure pineau to be an unmatched treasure, an antidote to melancholy, of which a draught goes to the heart directly. But your gamais gives me morbid palpitation, from its butylic and valeric alcohol. Anyhow, I call to all who sell wines to us, the public, if we must drink gamais, tell us that it is so, and if we can have but little pineau from Macon, let us have that little pure. But always let us know what is wine from pineau, or wine from gamais, or what is mixed, and in what proportion.

On the Rhine, vinification is extremely clean and deliberately done, and the wines are, therefore, generally of clean and even taste. In the Gironde, vinification differs much, but all red wines are produced in the most simple manner. The large quantities of common red wine have been in contact with much dirt, and the makers always consoled me about this dirt by saying that it would be taken out by fermentation. I am certain that such dirt would not be allowed in any brewery, and had better be avoided in the chais as well.

The Champagne has the most splendid cellars (caves) which could be made, and these maintain the evenness of its product. But the rest of France has no cellars, and no means of controlling fermentation; vinification is there performed in sheds above ground. This want is the main reason why so much wine is tainted with acetous fermentation. If Languedoc had caves, its wines could be made so as to beat any others for drinking purposes; we now get them dosed with Gironde astringency, under the name of cheap claret; the same with Roussillon. The want of cellars in Spain is a principal reason why natural or unfalsified wines cannot be produced there. Such wines require slow fermentation, and that can only be attained in low temperatures. This same want of cellars it is perfectly astonishing to behold in a town like London. Thousands of barrels of beer (particularly stout) are annually spoiled in the warm so-called cellars of public-houses, after having received the first acetic crack in the large sand-covered, heat-exposed vats of the large brewers. Query—What connection has acetous, acetonic, and eely beer with epidemic diarrhœa? Could it be prevented by cool cellars, and keeping the oxygen out of the barrels? I maintain that much of it could so be prevented.

ORIGIN OF WINES AS TO SPECIES OF VINES FROM WHICH THEY ARE MADE, AND PLACES FROM WHICH THEY COME TO BE BETTER DEFINED.

In a book on geography for schools, which was put into the hands of some of my children to learn from, occur the questions—"Where is Germany situated? *A.* Between Austria and Prussia. *Q.* What is Germany remarkable for? *A.* Because hock grows there, and the glutton lives upon trees. *Q.* Where does hock grow? *A.* At Hockstadt, in Suabia." The interrogatory style of the catechism then changes to the commanding—"Describe the glutton!" The respondent does so at length, and one only regrets that he was ignorant of the manner in which the glutton cures himself of the effects of his habitual surfeits. I recommend the book (and similar productions by an Oxford graduate, under the title of "Stepping Stone," containing almost the same questions and answers), said to be composed by a lady, and stated to have passed through a fabulous number of editions, to the attention of the educational societies. My object here must be limited to the reality about hock. Hock, in this country, means Rhine wine in general. The word is an abbreviation of "hochheimer." This wine grows upon the banks of the Maine, but its character is that of Rhenish wine. But, then, Rhine wines ought to be distinguished from each other, according to the principles of the above title. The Riessling wine yields the most bouquetted wine, typical of grand things, such as Steinberg, Johannisberg, and, in general, the fine wines of the Rhine-gau are made from the Riessling. But the Rüdesheimer of repute, the Feuerberg, and a few others, are produced from the Orleans grape. The wine of the latter differs from Riessling as Sauterne from Pouilly or Chablis. A third predominant vine is the Traminer,* much grown in the best parts of the Palatinate; and, as regards the wine from this vine, all producers are proud to sell it as such. A fourth vine is the Sylvaner, which has the greatest expansion, and, with the Riessling, yields the great bulk of medium-quality Rhenish wines. Now, traminer wine has a slight peculiar bouquet, and sylvaner still less, but the latter is spirituous and fine. The red wines of Ingelheim and Assmannshausen are made from the red Burgundy or pineau grape exclusively, but differ somewhat from Burgundy wine. Now, if all these differences in Rhine wine were maintained and stated, I venture to say that the interest and pleasure of the consumer would be much greater, and the merchants much more successful.

* The traminer, supposed to come from Tramin, in the Tyrol, does not grow there, nor within fifty miles round: I maintain it to be indigenous to the Rhine-valley.

The red wine of Vöslau and Gumpoldskirchen, near Baden, about fifteen English miles from Vienna, comes from a particular black grape, called "the early blue Portuguese." This is an early-ripening, very sweet grape, of somewhat larger size than the Burgundy pineau. When properly matured, it is bluish-black, good to eat, and gives a wine of dark colour. Its Portuguese origin is not proved. Its extensive plantation in Austria was a great success, because but little red wine is made in other parts of the empire. The wines are much sought after and well paid, mainly because they are mild and mature for drinking within a year or two, while most other Austrian wines require from six to ten years of cellar before they are drinkable. From Vöslau the vine has been imported into Würtemberg, and vast quantities of red wine are there annually grown by means of it; this wine is also smooth to the taste, through the absence of tannin and excess of acid. When travelling in the Tyrol last autumn, with my friend Professor Carrière, of Munich, we had to abandon Tyrolese "schilcher" as too acid, red pineau from Botzen as unsound, *i.e.*, frisky, and our enjoyment was Vöslauer, which was sound, mild, almost fine, and cost but 1s. 8d. the quart bottle.

Croatia is particularly favourable to viticulture; there the large-berried vines thrive—the "blue cinnamon vine," "red Portuguese," "Grünhainer," "Heunisch;" also the white "Welschriessling," and "moslavina," or "furmint" (Tokay grape), are grown there. The latter will never yield good wine without much chemical treatment of the must. The same applies to Hungarian wines. The sweet Tokays will not have much demand in this country or in Germany, and the dry Tokays, which might have a great sale, are at present too acid. This applies to wines of good years—which have been from 10 to 15 years in cask; how much more would it be true of these wines in the third year. It is stated on good authority that the Hungarian wines now being sold could never have paid for cellarage; we must wonder, therefore, why the large landowners keep such "white elephants," or grow any vines at all. Perhaps most of them are tithe-wines of lords and convents; but, whatever they are, they can never be objects of that trade which it once was hoped would rise up for Hungary. The producers must plant and produce better vines; they must treat their must so as to depress acidity, and raise alcoholicity; they must cut out the faults which are termed earthiness; then the intermediate traders, who keep the wines in cellars for years, must rack it at least once a year, and not leave it upon the lees, even the first lees, as is now commonly done, for years. Only thus can the Hungarians hope to obtain that trade in wine with Germany and this country which the viticultural capabilities of their country invite them to hope for.

While the viticulture of Croatia resembles that of Hungary, that of Dalmatia is almost entirely Italian. Dark astringent wines are grown there. But one Hungarian vine is the blue Kadarka, and a white grape is the Orleans of the Rhine Valley. It is very curious that in the whole of Europe there are only two places where the white Orleans grape will grow. The Dalmatian wines go to Italy, Turkey, Thessaly, and Epirus. If they were not made in deal vessels, and had fewer faults, they might become objects of a much more extensive trade.

I should like to speak of Istrian Piccolo, or "hansel," of bower and chamber cultivation, but Istria reflects all Italy. The wine is a subsidiary crop. The blue refosco and and the malvoisie grape, and twenty other varieties, are unable to sustain their ancient reputation when grown high in the air. The lowest wine retailer in Germany or France would refuse to sell such stuff as is sold in some of the first hotels in Trieste, under the name of Istrian wine, particularly "refosco." And yet Trieste is a one-sided port, having more import than export, and its shipping would be glad to take good wine to many parts of the world.

The effervescent wine from the "Ribola" grape of Görtz deserves mention, as a subject for future enterprise. Like the Riessling wine of Botzen, its manufacture is in its infancy, but the quality of the material and of the grapes are all that can be wished. In the Tyrol, viticulture has hitherto been bad, because southern large grapes were grown, particularly the Vernasco, or Vernatsche, *i.e.*, the red Frontignan muscatel. There, however, is at home that celebrated, and to all growers in hot-houses or vineries, and particularly therefore to English viticulturists, most important vine, which they know under the name of black Hambro', whose true German name, however, is, from its evident fatherland, the "Tyrolinger," or "Trollinger." The French, who received it from the Palatinate, call it Frankenthal. This is, after the Chasselas, of all eating grapes the most perfect, on account of its having thin husks, small pips, tolerably solid, yet juicy flesh, and an agreeable acidity, never in excess, mixed with a sufficient amount of sugar and mild flavour. The bunches are never very large, and not so close that the grapes have not sufficient space to develop themselves. The vine is always fruitful, and even in bad years may be used though not completely ripe, on account of the moderate amount of acidity. When the grape gets ripe, and is allowed to hang a little beyond the period of its greatest volume, it yields a splendid wine. I should like to see this vine more commonly used for wine in warmer climates. There are two celebrated vines of this variety—one in a greenhouse in Hampton-court-gardens, and one in the hot-house at Windsor Castle. These should be visited towards autumn by anyone who wants to see the fertility of this vine.

Tyrol produces the finest fruit for eating. The white Rosemary apples are bought by the Russian traders at a shilling a piece. Its grapes are eaten by hundreds of sick persons, who flock there to use the so-called grape cure; but they are eaten too early. Meran, a climatic place of great reputation in Germany, is also the principal grape-cure place. But I think that, if this practice is to be maintained and extended, so as to develop its full benefits, a much greater variety and better selection of grapes must be obtainable at Meran from July to October, and they must be given in the fully ripe state.

Analysis of Wines.

It was my intention to add a few remarks on the analysis of wine, and these I must make extempore, not having had time to commit them to writing. The analysis of wine in this country requires a new standard, particularly as to its alcohol. We are in the habit of referring all measures of alcohol to a certain standard, which is called proof spirit. In that respect we differ from all other nations. This is highly inconvenient, and therefore I should propose, and I shall propose hereafter in a more extended form, that the standard of alcohol in this country should be made the same as it is in France and other countries, viz., the simple per-centage of absolute alcohol, measured by weight in volume, so that we shall hereafter speak of wine containing 10, 12, 15, or 20 per cent. of absolute alcohol, and not so much proof spirit, because that is an expression which does not at once, and without calculation, enable us to compare wines in this country with the wines we get from abroad; and the same applies to brandies and other spirituous liquors. This will involve a still further simplification, namely, that all instruments for measuring the strength of alcohol in different liquids, used by scientific men, the excise, and persons in the trade (alcoholimeters) shall be made centigrade, so that we may know at once what is the amount of absolute alcohol present in any liquid we experiment upon. The analysis of wine has been carried to the greatest perfection by my friend Dr. Dupré, who can tell you more about it than I can myself, and I hope you will presently have an opportunity of hearing from him some of the results he has arrived at. It appears that hitherto the analysis of wines has been too much of what I may call a *sycophantic* character; that is, its object has always been to find out whether wine was falsified and mixed, or whether it was natural. But these are really not the principal chemical questions; these are, what is the real nature and intrinsic composition of wine, and that, I think, has been pretty far advanced by Dr. Dupré. Thus, for example, it appears that wine may contain a great variety of ethers, amounting in some cases to twenty-five in number or more; that as wine ripens, it is found to contain more of these ethers, until it reaches a certain maximum, and that after that it falls off again, and the ethers decrease in quantity. So that we have a chemical confirmation of the judgment of the nose. Further, chemical analysis has taught us not to practise any error in the making of wine such as I have already referred to in the case of sherry. Sherry is treated with plaster of Paris; if we could learn the reason, and discover that it was a good practice, by all means let sherry be plastered, and let us find means to neutralise the effect of the sulphate of potash which results. But if, on the other hand, there is no good reason for plastering sherry, let us abandon it. Let us consult scientific chemists on the subject, as is done by the French government, which will not allow plastered wines to be supplied to its fleet or army, because it is advised they are injurious. There have been other supposed discoveries with regard to wines, particularly the Hungarian wines, showing that they contain certain phosphates and a little iron, but these are things of no great value; they vary considerably, and phosphatic food is sufficiently represented in what we eat daily; besides which, one small glass of beer contains as much phosphate as a bottle of wine, so that if anyone should require a phosphatic food he may drink beer.

Much has been said on the question whether or no we ought to drink fortified wines, *i.e.*, those to which brandy has been added. I consider that to be an unpractical question, for I think the judgment of this country on that point is perfectly settled. Since the new treaty of commerce with France, and the reduction of wine duties, the introduction of wines has no doubt increased to a certain extent, but the consumption of natural or unbrandied wine has not increased to the same extent as that of strong or brandied wines has, particularly the so-called sherries. How are we to explain that? I think the late Mr. Tennant, who wrote a very elaborate work against the reduction of the wine duties, was right on that subject. He said:—"You want to reduce the wine duties in order that natural wines may be imported, but I tell you these natural wines are of such a quality, that if you bring them here the English will not drink them." That is really the fact, and compared with the excellent quality and low price of beer of this country, the common wines of other countries cannot stand. Therefore, if in this country, where every man on the average drinks about three bottles of wine a year, we want him to drink a hundred bottles, we can only tempt him to do so by giving him a better drink.

Now, this can only be obtained from the natural materials by the aid of the scientific chemist; it cannot be done by any other machinery. I should say, therefore, if capital were embarked in that branch of industry, particularly in the south of France, in Languedoc, in the same manner as it has already been employed in the making of better sherry, I have no doubt that, with the guidance of persons acquainted with the English taste, the manufacture and importation of new wines might be greatly increased, and the consumption of wine in this country might conduce to the benefit of the population. A few days ago, I happened to be placed between an Englishman and a Scotchman, the latter of whom said the English drank too much beer, which made them stupid, while the Englishman retorted that

the Scotch drank too much whisky, which made them wild. I think a slight change in the quality of their drink might benefit both parties. If both the Englishman and the Scotchman had a little wine now and then, the evil effects which they so graphically described would be entirely avoided. Moreover, there is in wine great medical power, and that power belongs more particularly to natural wines—less to the sugared and brandied wines; and there can be no doubt that, in the progress of the world, natural dry wines will carry the day over the brandied wines. I should say, therefore, the wine hereafter to be prepared for this country should be made dry, clean, good, and cheap. That sort of wine could be made in enormous quantities in Languedoc, where there are nearly 300,000 hectares of land in one uninterrupted stretch, covered with magnificent grapes. In fact, we do drink a good deal of these wines now, only we do not know it. We get them from Bordeaux, where they are mixed and blended, and come to us under the name of the exporting harbour. What we want is the Languedoc wine, and the wine of each country under its own name, and particularly that each should be made on scientific principles, and then we shall be much better off than we are at present.

As to the mode of drinking wine, which I have alluded to in the title, I can only say a few words. I should recommend, as a physician, that the practice of drinking wine be changed a little more than it has been. Fifteen years ago, when I was in the habit of going to a good many dinners, I found nothing but very strong wines, containing always at least 20 per cent. of absolute alcohol; and men after dinner used generally to look rather uncomfortable, with heavy heads and small eyes, and appearing just able to hold their coffee cups. I have seen a great change since the treaty of commerce with France. Now, on going to a dinner, I see the table covered with nothing but light wines, white Burgundies, and particularly light clarets, so called; these every body drinks, and if there is a bottle of sherry here and there it is rarely touched. But there is one practice still maintained, although it is beginning to be abandoned, and the sooner it is so the better. We begin with light wines, then go to champagne, and generally wind up at dessert with an awful array of heavy bottles; and, to me at any rate, it is decidedly uncomfortable to be continually called upon to pass the bottle. I see also that a great many persons do not drink these wines, which are constantly put before them, but take only claret. I should recommend, therefore, that we adopt the French habit, of having on our tables not more than three wines altogether. One clean, good, sound, substantial wine, to drink to quench our thirst and take with our food; next, a good, fine, delicate wine, say Burgundy or Medoc, or champagne, or both, to particularly please our palate; and, for dessert, nothing but good port, in small glasses, and good mild claret. I think, if we confined ourselves to that, and did not drink so much heavy wine, we should be much better.

New Alcoholic Drink from Tea.

Now, in conclusion, I must say a word about the long array of bottles you see before you, which contain a variety of new liquids. They were made at the instance of a friend of mine, Mr. Adam Scott, who has been long connected with China. Some time ago, there was a great depression in the tea trade; an enormous amount of tea was accumulating in the London docks, and the merchants did not know what to do with it. I said I would try and see whether some drink could not be made from it; and Mr. Scott sent me several varieties of tea, such as Congou, orange flavoured Pekoe, Kaisow, Oolong, and a variety of other fine teas. They were tried one after the other. Decoctions were made, sugar was added, and a certain amount of yeast, and fermentation began. By adding more or less of one or the other—more tea, more sugar, or different kinds of sugar—we were ultimately successful in producing what you see before you, six varieties of wine, which are open to inspection and taste. Nos. 3 and 4 are natural tea wine, with nothing added but sugar, and the yeast to ferment the tea, the samples before you being about a year old. There are two varieties, one being made from orange Pekoe, and the other from Congou, flavoured with Oolong. Each gallon contains the extract from $\frac{1}{2}$ lb. of tea. Nos. 3*a* and 4*a* have had a little alcohol added, and whereas the natural wine contains 9 per cent. of alcohol, these contain about 11 per cent. This was done to suit the taste of some persons who thought the other was not strong enough. Then, again, others said, this is too dry; it is a very good stomachic, but I like something sweeter. We therefore added two to four per cent. more sugar, and four per cent. more alcohol, and that gives you a wine which is six per cent. below strong sherry. Then I have made a different kind again, in another manner. I have taken natural wine, which itself was worth nothing, and could not be drunk, because it was fermentescent, and mixed with that a certain quantity of tea, whereby the whole fermentability of the wine was at once destroyed; then I added acid and alcohol up to 9 per cent., the acid being 4 per mille, and a little colour, and the products of that process are Nos. 5 and 6. Then, last, I tried an experiment which I myself consider the most successful of any. I made an effervescing wine in two ways. First in the soda-water way, by pumping in carbonic acid, and the second method was by putting tea liqueur into wine previously made effervescing, according to a scientific method. The tea liqueur being put in, it was allowed to deposit; the deposit was disgorged according to the rules of the art, and you have on the table the product which I call effervescing tea *par excellence*. It is dry, but all these wines I have kept dry, according to the prevailing taste, which is, I think, correct in this respect. Of course, if the experiment were carried out on a large scale, sugar could be added to any extent, to please the taste of the consumer. I maintain that, as wines are still dear, and are getting dearer every year, and as they lack certain keeping qualities, particularly champagne, which cannot be sent, for example, to China or Japan, because it would ferment a second time, and as these tea wines are so unfermentable that if you even put yeast and sugar into them and keep them at a temperature equal to that of the human body for six weeks, you will not get more than one bottle in a hundred to ferment, it is certainly useful to have an unfermentable effervescing wine which can be transported anywhere, and considering the great use which effervescing wines are, and the great boon which they would be considered by many persons abroad who are at present unable to obtain anything of the sort, the experiment is certainly worth trying. I shall be happy for any one present to taste these wines. The tea makes them a good stomachic, and as alcohol is present in small quantity, the exhilarating effect is unaccompanied by any evil consequences, while, at the same time, no one can drink half, or even a quarter, of a bottle without feeling unmistakably that, in ordinary phrase, he is "the better for it."

DISCUSSION.

The Chairman said the subject which Dr. Thudichum had treated was one of such general interest, that he had no doubt many members would give the meeting their knowledge and experience on the subject. Certainly, the very wide-spread habitat of the vine, and its indigenous character in this part of the globe, seemed incontestibly proved. Amongst the processes of treatment to which it was commonly reported that wines were frequently subjected, there was one which he happened to hear mentioned some time ago, in Germany, as being exceedingly prevalent there, and this process, although, no doubt, like any other, it might be carried to excess,

did not seem in principle to be at all unreasonable. He alluded to the addition of glycerine. It was, no doubt, known to many of the members that a very illustrious French chemist demonstrated, some time ago, that glycerine was always present in fermented liquids, so that the addition of this substance had only the effect of increasing the quantity of a normal constituent of the wine. Another process which he was informed was carried on in Germany, and which, from a scientific point of view, would certainly appear exceedingly legitimate, was to enrich the juices of poor grapes, which were peculiarly deficient in sugar, by the addition of sugar before fermentation. This certainly seemed a reasonable direction in which they might hope for an improvement in the manufacture of wine.

Dr. Ellis wished to ask the reader of the paper if he knew of any other use that wine had, except those mentioned. He (Dr. Ellis) had been for twenty-five years studying the question, and had not been able to discover that wine, used as a beverage, was of any value to man. He contended that wine was chiefly drunk for the stimulating effects produced by the alcohol which it contained, and that therefore it was a mistake to speak of it as quenching thirst, since what he considered the essential and characteristic constituent of wine—its alcohol—could no more quench thirst than could spirits of turpentine, oil, or any other inflammable substance. He never prescribed alcohol medicinally, as he was unable to discover that it ever did any good in cases of disease. For his own part, he hoped that the result of the paper would be to induce a more thorough investigation of the value of wine, either as a beverage or medicine.

Mr. Botly said he could not at all agree with the views of the last speaker, his own experience having taught him the contrary; and he mentioned several instances which had come under his own observation, in which the use of wine under medical advice had been productive of immediate and lasting benefit.

Dr. Dupré said there was not much left for him to add, after the admirable paper of his friend Dr. Thudichum; but he might say, in reference to what had fallen from the Chairman, that it was a general practice to add glycerine to light wines, because while it was one of the natural constituents of wine, and gave a slight additional sweetness, it also had the property of being unfermentable, and it removed the harsh tasto which some acid wines possessed. There was another process in common use, which was as follows:—If the must contained too large a quantity of acid, it was reduced, by means of the addition of water, to what was considered the normal standard; by this means, however, the proportion of sugar was also considerably diminished, and it had to be brought up again to the proper standard of about 25 or 26 by the addition of sugar. This process would be a very rational one, if the sugar added were of the same kind as that present in the must. This, however, was a kind called invert sugar, and consisted of two kinds of sugar in equal proportions, fruit sugar and grape sugar. It was a very general notion that grapes contained grape sugar only, but this was not by any means the case, and therefore the addition of grape sugar only gave one-half of the sugar which ought to be present in the wine. In consequence, this addition did not bring up the must to the original natural standard. The proper addition would be cane sugar, which, by the action of the acids, would be converted into the identical sugar present in the grape. Unfortunately, however, cane sugar was rather too expensive, as it was only the cheaper kinds of must which were treated in this way, and therefore grape sugar was used, which was made from starch and sulphuric acid. This kind of sugar often contained many impurities, which were thus transferred to the wine, and sometimes gave it an unpleasant taste, and it did not keep so well as naturally prepared wine. As to the alcoholic strength of natural wine, it was very rarely found to exceed 12 or 13 per cent., which was equal to about 26 per cent. of proof spirit, which was the standard fixed by the present law, below which wines were admitted at the one shilling duty. An agitation was going on at the present time, for the purpose of having the stronger wines admitted at the same duty, and it was said that it was very unjust to charge 1s. for wine with 25 per cent. of proof spirit, and 2s. 6d. for a wine with 26 per cent. There could be no doubt, however, that wine was never fortified to so small a per-centage as 26 per cent., except for the purpose of smuggling it in as natural wine, when it was too poor to keep of itself. Any wine which was treated as a genuine fortified wine, was rarely fortified to less than from 32 to 36 per cent., and very frequently it was found to contain as much as 42 per cent. Now, to bring wine of 26 per cent. strength up to 42 per cent., would require the addition of about 28 gallons of proof spirit to every hundred gallons of wine. Now, if that were imported as proof spirit, it would have to pay a duty of about 260s. or 270s., which, with the 100s. on the original wine, would bring the whole duty up to about 3s. a gallon. Of course, if wine were brought up to this strength, a similar duty should be imposed, and as it was not practicable to analyse every sample of wine, it was perfectly just to charge a general duty of 2s. 6d. per gallon for fortified wine. It would evidently be very unfair to the English distiller if he had to pay 10s. duty on every gallon of spirit, while the foreign wine-merchant was allowed to import, with every 100 gallons of wine, 28 gallons of proof spirit, at an almost nominal duty. It would be as reasonable to say that any man who chose to add spirit to his wine here, ought to have the duty returned. Dr. Thudichum had alluded to some of the ethers of wine, upon which he (Dr. Dupré) had made many experiments, but these being merely chemical investigations, he could not indicate the effect which the wine produced on the consumer. It would be very desirable, therefore, for medical men, when they recommended a particular wine, that they should previously ascertain its chemical constitution, and afterwards note the physiological effects. At present, a chemist was almost incapable of forming an idea of the marketable value of a wine, one at 1s. a bottle sometimes giving a result almost identical with another at 15s. The chemical constituents were, however, to a great extent within the reach of the chemist, and they consisted chiefly of alcohol, sugar, acids, mineral salts, and ethers. All these things were within reach of the chemist, though at present we had but little knowledge as to their action when combined in various proportions. Medical men, too, often appeared to recommend a wine because they liked it themselves, without knowing anything of its composition, which was very important, because the taste alone was a very imperfect guide. A wine might be sweet, and at the same time very acid, for the acid would mask the sweetness; again it might be strong and very sweet, and the sweetness would mask the strength. Sometimes it might be of importance to the patient that no sugar should be given in the wine, but if the wine was of an acid character a great deal of sugar might pass unnoticed. Moreover, the acids of wine varied considerably. Some contained chiefly tartaric acid, in fact it was the general superstition that this was the prevailing acid of wine, but this was by no means the case, for port and sherry contained scarcely any. Port, being of too great alcoholic strength, the alcohol precipitated the acid in the form of tartrate, and sherry, because the plastering to which it was subjected, nearly without exception, removed nearly all the tartaric acid, and replaced it by sulphate of potassa, a very active saline agent, which, like most salts of potassa, had a very depressing action on the heart. Now wine was very frequently given for the purpose of keeping up the action of the heart, which, as all physiologists knew, was often of extreme importance, and could be effected in no way so well as by the ad-

ministration of alcohol or wine; but it might often happen, in the case of sherry, the slight stimulating action produced by the alcohol would be entirely counteracted by the contrary effect produced by the sulphate of potassa. In such a case it might be very advisable to substitute madeira for sherry, as it contained very little sulphate of potassa, and was in other respects a wine of much the same character. All the compound ethers found in wine had a strong physiological effect as stimulants, particularly the volatile ethers. They differed very much in different wines, but abounded principally in natural wines, to which they gave flavour and bouquet. All fortified wines, however, with the exception of port, sherry, and madeira, contained little of these volatile ethers, but a greater proportion of fixed ethers, which had not nearly the same flavour and bouquet, nor the same stimulating power. In some cases the administration of alcohol would be decidedly injurious, while it was at the same time necessary to apply a stimulant, and in such cases it would be desirable to select a wine combining the minimum amount of alcoholic strength with the maximum amount of volatile ethers, and in this way a stimulating effect would be produced without the depression which frequently followed the administration of alcohol. For instance, they all knew that champagne was not a strong wine, but at the same time it was very stimulating, and this property it owed to the large proportion of volatile ethers it contained, as well as to the carbonic acid. As he had said before, however, comparatively little was as yet known of the effects of different wines, and he had thrown out these hints in the hope of inducing physicians to take up the subject and investigate it, for he believed that in this way only would a real knowledge of wine be advanced.

Dr. Thudichum then proceeded to show and describe a number of photographic slides, illustrating the different methods of viticulture practised in various parts of Europe.

The Chairman proposed a cordial vote of thanks to Dr. Thudichum for his very able paper, which was carried unanimously. Various descriptions of wine, described by Dr. Thudichum as made from tea, were then tasted, and the meeting separated.

SCIENCE COLLEGES.—MEETING IN MANCHESTER.

A meeting, called by the Council of the Society of Arts, was held on Friday, the 17th instant, in the Mayor's Parlour, Manchester, "to discuss the best means by which scientific instruction may be promoted, and to establish an organisation which will keep an influence at work to accomplish what is so urgently needed." The authorities of Owens College, and the members of the Society of Arts, especially those in the locality, had been invited by circular to attend. The Mayor (Mr. John Grave), presided; and there were also present—Sir J. Whitworth, Bart.; Mr. John Platt, M.P.; Professor Greenwood, Professor Williamson, Professor Reynolds, Professor Jack, and Professor Roscoe; Dr. Crace Calvert, Dr. R. A. Smith, Dr. John Watts, Dr. Pankhurst, and Dr. T. E. Thorpe; Messrs. Edwin Chadwick, C.B.; Councillor Joseph Thompson, Councillor Bailey (Salford), Joseph Catterall (Preston), James Worthington, Hugh Mason (Ashton), Thomas Ashton, John Plant, W. H. J. Traice, W. Boyd Dawkins, William Richardson (Oldham), John Walsh, Peter Spence, J. A. Bremner, Alfred Neild, John Rylands, William Hartley, &c.

The Mayor, in opening the proceedings, said this was a meeting called together by the Society of Arts, and those interested in Owens College had been invited to attend, the object being to endeavour by all means in their power to promote scientific instruction in this and other large centres of industry. Anything of that nature always received encouragement in Manchester, as it was always found that the more highly educated people were in technical matters, the better for the community. It promoted their interests, it elevated their position, and it was such a movement as must command the attention of the chief magistrate of the city.

Apologies for non-attendance were received from Sir Thos. Bazley, M.P., Sir W. Bodkin, Colonel Sykes, M.P., the Lord Chancellor, Sir Wentworth Dilke, M.P., Mr. G. Dixon, M.P., the Archbishop of York, Sir John Lubbock, Mr. Laird, M.P., Mr. James Howard, M.P. (Bedford), Mr. Snowdon Henry, M.P., Major-General Eardley Wilmot, R.A., Sir W. Tite, M.P., Mr. Alderman Rumney, Mr. Pease (Darlington), and Mr. Bremner. These gentlemen, while regretting their absence, agreed that their names should be placed upon any committee which might be formed.

Mr. Le Neve Foster, Secretary of the Society of Arts, read the following statement authorised by the Council:—

1. The Council of the Society of Arts have received a communication from Owens College Extension Committee, Manchester, asking their co-operation in the extension of technical education, or, more properly, Scientific Instruction; and it affords them much pleasure to do whatever lies in their power to advance this important national object. With this view, the Council have invited the members of the Society, and especially those resident in the locality, as well as the authorities of Owens College, to meet them in Conference on the subject, to discuss the best means by which scientific instruction may be promoted, and to establish an organisation which will keep an influence at work to accomplish what is so urgently needed.

2. The necessity and importance of improved scientific instruction for the people of the United Kingdom, in order that they may be placed in a favourable position in the race of industrial competition with other nations, has, for some time past, been forced upon the notice of the Society of Arts, whose chartered objects are the Promotion of Arts, Manufactures, and Commerce.

3. The great international displays of industry in 1851, 1855, 1862, and 1867, have shown unmistakably that, if this country is to maintain her position as a commercial and manufacturing power, the people (and in this term are comprehended not only artisans, but also persons of higher position in the social scale) must have at their command the means of education improved in its general character, and embracing, if not based upon, science to a far greater extent than has hitherto been the case. The official jury-reports at all the exhibitions abound in declarations of this character, and the country can no longer afford to ignore the fact, but must earnestly set to work to bring about a change. These reports, as well as those of the artisans who were sent to the Paris Exhibition of 1867 by the Society, one and all point out the great educational facilities which are available for all classes, and especially the artisan class, upon the Continent.

4. The Council are of opinion that existing schools and colleges, where science has hitherto been all but excluded, should adopt some means for its being taught; and that where such teaching already exists, measures should be taken for extending the usefulness of the institutions, and rendering them more easy of access to the great body of the people; whilst in localities where no such facilities exist, means should be taken to secure their foundation. The localities must themselves stir in this reform, and their efforts should be aided by pecuniary assistance and countenance by the State.

5. The nation must set itself earnestly to work to bring about the sought-for change in the education of the people. The evils have been so often pointed out, that it is unnecessary to enter into detail; our duty is to supply the remedy. This the Council believe to be by the localities setting themselves heartily to work, and when they have shown themselves in earnest by raising funds and organising establishments for the teaching of science, they should be entitled, as of right, to aid from the State.

6. In order, however, that such establishments, colleges, or schools should be of value to the mass of the people, so that they can take advantage of the facilities which would then be offered to them, it is absolutely necessary that elementary education, commonly known as primary education, should be extended far more widely than at present. To an ignorant population the establishment of colleges and schools for the teaching of science will be of little avail, and unless the blessings of an ordinary elementary education, *i.e.*, reading, writing, and arithmetic, at least, can be more diffused, so as to place our people on a par with those of Switzerland, Prussia, Saxony, &c., the attempt to extend the teaching of science will be in vain. Again, not only must we have improved elementary education, but these elements must themselves be taught by improved methods and organisation, so that less time may be occupied in acquiring them, thus leaving free for the learning of elementary science some of those years which are now unnecessarily taken up in mastering the mère rudiments of knowledge. Abroad, it is the custom of the state only to deal with this and many other matters of public concern, but such is not the case here. The Council do not recommend state interference as of choice, but of necessity. This work of education must be done, and it will have to be done wholly by government if not otherwise. Experience proves that it can be done by a combination of voluntary efforts, with government aid, as in the existing system of primary education, and in the instruction aided by the Science and Art Department. The Council think that the work is to be done in part nationally, in part voluntarily, but not upon a hap-hazard system.

7. Adam Smith, the earliest, and, perhaps, the first English writer on political economy, as well as Mr. J. Stuart Mill, its present most able exponent, recommend scientific instruction as profitable to the nation. Her Majesty's Government must not plead economy as an excuse, for the highest and wisest economy comes out of wise expenditure.

8. The Council believe that this is the feeling of the country, which the government will regard with respectful attention. Government must be urged to co-operate with Owens College and other bodies, either existing or to be established. Parliamentary grants are now made to the old universities of England and Scotland, and to the Queen's Colleges in Ireland, and there is no reason why the same principle should not be extended, and grants made to modern educational establishments in the great centres of industry. The Council are of opinion that a government resulting from a wide representation of the whole people ought adequately to represent the highest intelligence and aspirations of that people for improvement, and not limit its responsibility and its labours to matters of police. There can be no more profitable investment of national capital, drawn from taxes paid by the whole nation, than in promoting the best education among all classes of the people, and the widest extension of sound knowledge, on which the Arts, Manufactures, and Commerce of a kingdom rest.

(By order)

Henry G. Lennox, *Chairman.*
P. Le Neve Foster, *Secretary.*

Professor Jack moved :—"That in the opinion of this meeting the best interests of the country demand the establishment of a complete system of primary instruction, the extension of a system of science classes under a responsible department of the government, on a definite plan, and especially the establishment of science colleges in the principal industrial centres of the United Kingdom; that such colleges ought to be established and maintained partly by local efforts and partly by liberal assistance from the State, and that existing institutions, such as Owens College, ought to be made available for this purpose." He said it was scarcely necessary for him, in moving the resolution, to say a word in disclaimer of any personal motives on the part of the authorities of Owens College. They had been put forward, partly from the circumstance of their being the only college in the district, and partly from the action of gentlemen who had interested themselves with a view to extend the operations of the college. The fact that by their efforts they had already realised the sum of £90,000, sufficiently showed that they were asked by public opinion to take a prominent part in connection with the development of science. But of course the resolution did not speak of this locality alone; it required the government to come forward and support the efforts made in other localities. From the first the promoters of the extension of Owens College had taken this necessity into consideration, and they were met by the government of the day with the statement that it was impossible to recognise their claim without recognising a general principle; and they came there, not supporting a personal claim, but supporting the claims for the establishment of a great general principle. They asked the government of the day to organise Scientific Instruction for all. Perhaps, in one sense, science could not be organised. The man of science, like the poet, *nascitur non fit*, and this would refer to such men as Watt, Faraday, and Joule; it was impossible to organise a system for the production of men of genius. Perhaps this country had, more than any other, men of genius who had not been organised by any government or by any system. But, notwithstanding that, it was possible for them to organise, and it was necessary for them to organise, a broad system for carrying scientific instruction to the mass of the people. The men of genius could not be increased by the action of the government; but, on the other hand, they might be asked fairly whether a system of organisation would not be found to warp and stunt the development of men of genius. In the early history of this country they had a sufficient answer to this statement. Watt, who was one of their greatest men, commenced by assisting Black; and Faraday commenced by assisting the professor of natural philosophy, Sir Humphry Davy; and it was precisely by increasing the regular inter-communication between organised teaching and the ability to teach that they could expect science to be carried from the higher mountain peaks, upon which light would always shine, down upon every man in the country. They did not suppose that they should raise more men of genius, but it was necessary to organise some system for the regular diffusion of science. In that way they ought to accomplish two things. They ought to find out who were the men of genius, and who were the men of talent in the country, to a greater extent than at present. He thought they could point with pride to the men of genius and talent whom England had been able to put forward; but he believed many more had died "mute inglorious Miltons," and that the nation, glorious as its past history had been, would write a nobler record upon the history of the future. He believed, further, though it might appear to be a lower aspect of the question, that to diffuse scientific knowledge among the mass of the people had another and more material object. He should not, however, say anything about the matter in a commercial point of view, as there were gentlemen present who could speak on this aspect of the subject much better than he could; but it was obvious that the system would prove one of the highest agencies of civilisation. At this time, when so many questions were disputed, and science questions among the rest, there was one principle which underlay the efforts of every man of science which made them hopeful; and that was, that while their conclusions might be disputed step by step, and point by point, there was certainty at the end of them. The knowledge of science was a great civilising agent, and he believed that, by making Owens College the great university of the north of England, they should not only be promoting their own commercial prosperity, but the general welfare of the country.

Dr. CRACE CALVERT, F.R.S., said he had sincere pleasure in seconding the resolution, being convinced that it would be for the interests of Manchester, and of the people at large of this country, if such an institution as that proposed should be established. During his career in Manchester, he had frequently had occasion to go into many large establishments in Manchester, and there he had found plenty of practical knowledge, but not many traces of sound scientific training, and it was impossible that the manufacturers of the present day in this country could hope to maintain their position, if a better system was not adopted. As it was stated in the document put forth by the Council of the Society of Arts, it was impossible for the manufacturers of this country to keep their position, unless their workmen and those connected with them—managers as well as directors—were well acquainted with the elements of science. He had met with much dogmatic ignorance. Those who, like himself, had been connected officially with the Exhibitions of 1855, 1862, and 1867, must have been struck by the wonderful progress which many of the manufacturers on the Continent had made, compared with those of this country, and the only possible explanation was the great care and trouble which continental governments had taken to establish science colleges, where the artisan, as well as the better educated classes of young men, could get a thorough knowledge of science. If they were to take advantage of experience, none was of more importance, and none was more instructive to them, than that of continental nations. If they went into large manufacturing towns in France, such as Rouen, they would find schools of science supported by government and by local taxation. They would find schools for art, for science, and for the practical application of science; and any one who, like himself, had had to do with manufacturing processes for a quarter of a century, must be convinced that it was to the interests of this country to carry out the objects of the resolution which had been proposed.

Mr. JOHN PLATT, M.P., supported the resolution. He said he had for years taken a deep interest in the matter of technical instruction, and he had assisted in the formation of a school of art in his own town of Oldham. The result had been most satisfactory, not only to the place, but to himself, as an employer of labour. Many deficiencies had existed, more especially in drawing and chemistry. Formerly they could not, in his establishment, meet with persons who were capable of taking a sketch, for instance, of a machine, and of working and carrying out the details; but since the school had been in existence they had found boys very apt and ready to take up technical knowledge, and matters connected with the manufacture of machines. The question to employers of labour was one of immense interest, as they found they had to compete with a great many parts of the Continent, where the artisans were very carefully trained. It was a singular fact that, although we had more practice than any other country in the world, still we had been dependent to a large extent for scientific instruction, particularly with reference to manufactures, upon the Germans and the Swiss. He did not say this in disparagement of his own countrymen, as he believed it was a department of instruction which had never been brought under their notice, and they were only beginning to realise the value of this kind of instruction. But since it had been established, and more particularly in his own place, they found that they had English people who had attained such an amount of knowledge of this kind that they were practically independent of either the Germans or the Swiss. Coupled with that, the boys in their manufactories had a much better practical knowledge of the manufactures in which they were engaged, so that all that was required to give a position to our own manufactures was simply that a system of scientific instruction should be largely developed and encouraged throughout the country. Although many employers of labour had taken up the subject, it was one which they could not be expected to carry out on their own responsibility. They could not sustain schools of science and art in many of the large manufacturing towns without the aid of government. Notwithstanding Professor Calvert's experience, he (Mr. Platt) did not intend to be a "croaker." He did not endorse many of the expressions which had been used with regard to the Paris Exhibition. Although in that country they had progressed in machine-making, still, if they came to examine their productions critically, they would find that there was no novelty in them. The manufacturers there were mere copyists of the best makers in this country. So that although they were anxious that all the faults of the English people should be exposed, still he did not see any good in making this country to appear worse than it was. The difficulty they had to contend with was the selection of good masters; but that difficulty would in time be overcome. He heartily welcomed the gentlemen from the Society of Arts. He was glad that they were interesting themselves in this subject, and he knew of no place where their efforts would be more highly appreciated than in Lancashire.

Mr. E. CHADWICK asked, for the information of the meeting, how many persons Mr. Platt was accustomed to employ.

Mr. PLATT said at one time they had altogether 7,000 engaged in that particular branch. At present the number was about 5,000.

Mr. HUGH MASON said he rose to cordially support the resolution, but he did so in order that he might add an explanation which he felt justified in making. He had held the opinion that the needs of any particular locality for educational purposes ought to be supplied by the locality which would have the advantage of the system established, provided the locality should be able to do so. He might say that he personally had supported the movement for creating a new building for Owens College; but he had hardly felt it his duty to support the movement for dipping pretty deeply into the public purse. He had done so because he felt that South-east Lancashire, of which the great city of Manchester was the centre, was rich enough to do all that was required, but he had found in the course of this movement that although South-east Lancashire was rich enough—and he thought no one would dispute the statement—it had not been willing, and he was afraid the unwillingness was to be attributed to ignorance and selfishness. It seemed hardly fair that where there was, should he say, a minority in this district who were willing to do what they could, and who saw that the district required greater educational means, they should suffer through the ignorance and selfishness of a certain number. He was afraid that the work they had set themselves to do was beyond the means of individuals who might be willing to contribute and to work for the prosecution of the movement. But, in seeking increased grants from government, he could wish those grants not to be so partial as they had been. For instance, he should like Lancashire to have a fair share. He should like this for two reasons—because Lancashire contributed a considerable sum to the means which were distributed in other parts of the country, and because he thought Lancashire would benefit, and be the means of distributing benefit, by any grants which might be made by the government. He should hope that the whole of the money would not be absorbed, say, by the metropolis. One's own ideas and the experience of government grants had been that they were not altogether free from jobbery, and he believed that the best means to prevent any suspicion of jobbery was to impose certain conditions upon the localities which government should aid. He thought that by the union of a department of government and the localities themselves, not only would these grants be free from the suspicion of jobbery, but the grants themselves would be much more usefully applied than they might have hitherto been.

Dr. John Watts feared we had receded in the last 20 years in this locality, through the influence of the revised code, which gave the primary schoolmaster no interest in teaching anything but reading, writing, and arithmetic; though lately the department had a little encouraged higher teaching. One of the points in the resolution was, that the science classes which were already at work ought to be extended upon a definite system. A gentleman in the room had lately said at the Society of Arts that the only stable thing at South Kensington was instability. He fully adopted that sentiment, and he would, in the presence of Mr. Cole, bring a very serious charge against his department. In September of the present year, a minute was adopted which would have the effect of knocking aside nearly one-half of the remuneration of the science teachers of the present session. This had been done, not only without consulting the teachers, but after they had arranged for their classes upon the understanding of the old minute. He did not know how sufficiently to express his feeling upon this subject. He could not understand how men like Lord de Grey and Mr. Forster, for whom he had the highest respect, could play such a trick—he could call it by no other name. If the science classes were to be extended, it must be done upon a plan which the teachers could understand and have faith in. Twelve months' notice ought to be given of any intended alterations, so that class arrangements might be relied upon. To interfere with teachers' means of living in this way was not fair, and the Department ought to reconsider the matter, so far as this year was concerned. One of the best things government had done was the establishment of these science classes. The resolution also affirmed that it was for the best interests of the country that we should establish science colleges, for the complete scientific education of our youths, and the utilisation and development of the best intellect in the land. The benefits of such a system to the country would be inestimable. He sympathised with Mr. Hugh Mason's desire for complete local government, and we could not have this so long as we went to the public treasury; but we were not in a position to work perfect theories of society; we were a bundle of compromises, and must be content with the greatest good we could get at the present time. It would not be desirable to withdraw government grants, considering the amount of ignorance and apathy in the country upon this question. There was not a college in the world that was self-supporting. Dr. Watts proceeded to enlarge upon the absolute necessity of government aid, and to enforce the claims of Lancashire to a share in it.

Mr. Boyd Dawkins also supported the resolution, which was then put, and carried unanimously.

Mr. Joseph Thompson moved—"That the gentlemen present be requested to form themselves into a committee, to promote the objects stated in the foregoing resolution, with power to add to their number."

Mr. W. H. J. Traice seconded the resolution, and contrasted the Exhibition of 1851 with that of 1867. Looking down the catalogue of the former, they would not find in the list of French exhibits any that stood in rivalry to English manufactures; while, in 1867, they would find the catalogue crowded with mechanical objects, the work of the French themselves. This might be accounted for partially by the fact that, in 1851, the French had to cross the Channel, while, in 1867, they were at home; but other causes had been at work, and much must be attributed to the causes mentioned by Professor Calvert, who spoke with authority on the subject. It was an egregious error to say that Lancashire did not already derive some benefit from the Department of Science and Art, as they had classes established and prizes and certificates distributed. Still, the system ought to be greatly extended.

Dr. Pankhurst supported the resolution, which was passed.

Mr. Edwin Chadwick, C.B., in proposing a vote of thanks to the Mayor for the part he had taken in the proceedings, observed:—It has been, and will be objected in some quarters, that the present, being a period of manufacturing distress, is the period for reduction rather than the augmentation of expenditure. To which I answer, that we propose expenditure as means which, if properly applied, are the best for the relief of the long-continued distress of this great district, and, in illustration of this policy, I cite the experience of the district itself. The late Mr. John Kennedy, of Ardwick-hall, who was called the "father of the cotton manufacture," was accustomed to say that he never knew any improvement in that important manufacture adopted except on "threadbare profits." Coming here when there were loud complaints of bad times, I have seen old mills in course of alteration and extension, and have said, on the first impression, to my relatives and friends here, "Why, you are saying how bad trade is, and yet you are building new works." "Yes," was the answer, "we are extending our works because trade is bad, and because we do not get on with the old ones." The fact is, they were reducing the proportion or pressure of establishment charges by spreading them over a wider basis of production—they were rearranging their machinery, and reducing the cost of production by enabling two men to do the work of three; and they were doing this by an economical application of expenditure, by which they reduced the cost of production, and by lower prices they stimulated consumption, extended their sales into new markets, and placed consumption, or the manufactures, thenceforward on a wider basis. Now, the present depressed condition of manufactures is one that not ignorance but the science teaching we propose will retrieve. Foreign manufactures are undoubtedly making way, and advancing against us in neutral, and may be in home markets, and they are doing so by science and by labour, improved in quality by education. Thus, in Switzerland—at least in the Canton of Zurich—of which I may speak, the superior secondary and scientific education, based upon superior primary training and instruction, is providing superior foremen and leaders, not only for their own places, but for other places abroad, and some of them may be expected over here to occupy places which the neglected training of our own population does not enable them to fill. France has got advancing rival manufacturers. Amongst the foremost leaders of them are to be found men of the highest scientific training, obtained from what I may call the great Owens College of France, the Ecole Centrale des Arts-et-Métiers of Paris. As against them, the old "rule of thumbism" will no longer avail, and we propose expenditure for science instruction as the best means of relief. A recent minute has been referred to as one of discouragement to trained teachers, who are certainly needed to effect any advance. I have not seen the minute, but if it be so, it will be one that will have to be retrieved; for "as is the teacher" so will be the school, or the college, and a high order of teaching power is an economy and indeed a necessity. I have recently been in Holland, where I found that the government was improving secondary and scientific instruction most successfully, on the half-time principle of three hours of daily instruction, given at night, as is done here in the Owens College. But, to do this, they were improving their primary instruction, and to do this they were improving the quality of the teaching-power—they were carefully improving the position of the trained school teachers, by giving them securities against the caprices of ignorant and irresponsible burgomasters; they were making the school teachers only removable on cause shown, before competent and impartial judges, superior school inspectors; they were promoting or conciliating the removal of old and inferior teachers, by giving them suitable retiring pensions, and replacing them by trained teachers, whose competency was tested, and jobbing and favouritism prevented, by competitive

examinations, and by probationary trial under competent judges. All the proper expenditure for this is a a proved means of economy, under conditions which we have to imitate; for nothing is so wasteful as ignorance, whether of teachers or of populations.

Mr. T. Ashton, in seconding the resolution, expressed a hope that the movement for a general system of scientific education would not delay or prejudice the claims of Owens College.

The resolution was passed unanimously, and having been briefly acknowledged by the Mayor, a vote of thanks was also passed to the gentlemen representing the Society of Arts, on the proposition of Professor Greenwood, seconded by Dr. John Watts.

Mr. Le Neve Foster, in reply, said that the Council did not intend to rest where they were, but to continue to agitate the question until they obtained what they wished. They intended to hold meetings in other large centres of industry throughout the country.

This concluded the proceedings.

PRINTS AND THEIR PRODUCTION.

Those who were present when Mr. Davenport read his paper before the Society, on the 8th instant, need not be reminded that the collection of prints shown on that occasion (and still on view), produced by various processes, is of an historical character. In arranging it, it has been the object of its originator to illustrate the results attained by each of the processes employed, rather than to point attention to the works of any particular masters or schools of art growing out of the processes employed.

The series of specimens commences with examples of prints from wood or metal blocks, either simple or compound, and of plain as well as coloured impressions obtained by their means, but by a single operation of the printing press. A series of impressions from the blocks cut by Bewick illustrates the degree of perfection to which wood engraving was advanced at tho close of the last century.

Prints from engraved copper plates follow next, and they illustrate the results attained by simply cutting away portions of the surface of the metal plate by the graver; the action of acids, as applied in the production of etchings; and the results of a combination of etching and engraving, as those arts were practiced at the period when Hogarth began his career. The results obtained by means of the line, chalk, mezzotint, and aquatint processes, are each in their turn exhibited, and attention is directed to the fact that, in the early history of reproductive arts, the illustrations of our literature were not only pictorial but decorative. Tinted prints and prints in colours, produced at a comparatively early period of the art, are also exhibited, as showing the desire which has always existed to get rid of the coldness of effect due to the use of black ink.

The art of engraving on steel next claims attention. With its introduction the character of the illustrations of our literature became entirely changed. It was necessary, in order to supply the increased demands of commerce, to employ a metal of greater durability, and from the period of its introduction, greater security and identity of product was effected in the manufacture of bank-notes, by means of the siderographic process of Perkins and Heath, the same process which is now used in the production of our postage-stamps, prints of which, from the original engraving by Heath, are exhibited.

The attention is next directed to the process of lithography, and the results which have been attained under its present development as a chromatic art, this process and wood engraving, as at present employed, having superseded and practically destroyed the older arts of engraving.

Following the lithographic examples, is a large series of prints in carbon obtained by a variety of photographic processes. It is curious to remark that the past, the present, and the future, of our print-producing powers have each been based upon entirely distinct principles. As greater facilities for producing prints was demanded, a weaker and apparently less durable source of production has been, and appears in the future to be likely to be still more resorted to. Thus, in the past period, engravings were executed, and prints obtained from copper and steel plates. At present, wood blocks and lithographic stones are employed; but the future of our art-producing power appears likely (so far as we at present know) to rest on what are apparently still less durable, viz., gums, resins, and gelatine. The series is brought to a close by juxtaposing the works of Doo, Cousins, Landseer, and others, engravers of our own times, as published by Mr. Graves and others, with various photographic processes, the principal of which are those of Mr. Pouncy, Herr Paul Pretsch, Mr. Swan, of Newcastle, the Autotype Company, of London, and Mr. Woodbury, as well as the fine examples by M. Tessier du Motay, of Paris (the publisher being now M. Arosa), and Herr Albert, of Munich.

The collection consists of about 300 examples, and presents a sort of panoramic view of prints and reproductive art during the past century and a half, and it is interesting as showing the direction in which we must look in the future.

WORKMEN'S INTERNATIONAL EXHIBITION, 1870.

The Council of the Workmen's International Exhibition, to be opened on the 7th of July, 1870, at the Agricultural Hall, Islington, has arranged to hold a conference of delegates from the towns of the United Kingdom, and of other countries, on the 10th of January next, at the house of the Society of Arts, by permission. The day's business will begin at ten a.m., and will be distributed as follows:—

1. Statement and discussion of the proposed method of arrangement.

2. Statement and discussion of the proposed system of prizes and appointment of jurors.

3. Discussion on the opening of workshops in the exhibition.

4. Reports, statements, and suggestions from local committees.

5. Statement and discussion as to the means to be adopted to make the exhibition promote the interests of technical education.

Mr. Mundella, M.P., and Mr. S. Morley, M.P., will successively occupy the chair during the day's sitting.

The conference will be brought to a close at four p.m., and all the delegates are invited to meet the Council at dinner (Mr. T. Hughes, M.P., to preside), at 5.30.

In the evening, a public meeting will be held at 8.30 p.m., at Exeter Hall, at which Professor Huxley will preside, if it should be impossible for the President (the Right Hon. W. E. Gladstone, M.P.) to be present.

The following resolutions will be moved:

1. "That the principles laid down in the prospectus of the Workmen's International Exhibition of 1870, which require the worker's name to be attached to the article produced, are both just and useful, as tending to give the workmen their share in the credit of production, and to increase the pride and interest which attaches to skilled labour."

"2. That it is of the highest importance to develop amongst all the people a true perception of what is beautiful in colour and form, and a scientific knowledge of the machinery and material employed in existing industries; and this meeting pledges its best exertions to promote the success of the Workmen's International Exhibition of 1870, as a valuable instrument to this end."

3. "That the trade knowledge and aptitude for combination shown by workmen who can produce, for a

workmen's exhibition, an article requiring many different kinds of labour, deserved the encouragement of every class as the first steps towards greater and more important kinds of co-operation."

4. "That it is in the interest of all nations that each should stimulate the other in the development of their highest productive powers, the prosperity of every people requiring continual progress in the cultivation of human faculties, and that perfection of method and machinery which yields the largest return to the day's labour."

The following gentlemen will be present at the conference and at the meeting:—The Marquis of Clanricarde, K.P., Mr. John Walter, M.P., Mr. W. H. Smith, M.P., Mr. Winterbotham, M.P., Mr. Andrew Johnston, M.P., Sir D. Salomons, Bart., M.P., Sir John Lubbock, Bart., Professor John Tyndall, Mr. Henry Cole, C.B., Captain J. Selwyn, R.N., Mr. George Dawson, of Birmingham, Sir George Young, Bart., Mr. Norman Lockyer, Professor Leone Levi, Mr. C. J. Roundell, Mr. Allen (Sec. of Amalgamated Engineers), Mr. R. Applegarth (Sec. of Amalgamated Carpenters and Joiners), Mr. T. J. Dunning (Sec. of Bookbinders' Trade Society), Mr. G. J. Holyoake, Mr. Geo. Howell, Mr. Geo. Odger, Mr. R. Coningsby, Mr. Walker (Sec. of Foremen Engineers), Mr. W. R. Cremer, Mr. Geo. Potter, &c.

The council strongly hope that all towns in this and other countries will lose no time in calling together a public meeting and appointing delegates to attend the conference. Such delegates must be appointed by public meeting, and the honorary secretaries will be extremely glad to receive, as early as possible, the names of those who will attend. The council are specially desirous that co-operative, trade, benefit, and other societies, and workmen's clubs and institutes, and large workshops, should also send delegates on this occasion. They request that all such societies should put themselves in communication with the secretaries, and assure them that their representatives will be gladly welcomed. The council will provide accommodation, for the night of the 10th of January, for those delegates who wish them to do so, and will otherwise do all in their power to facilitate the attendance of their visitors, on receiving communications on the subject. They urge all those who are interested in the carrying out of a workmen's international exhibition to take immediate steps for calling together a meeting of their fellow-townsmen, for the purpose of making better known the character of the undertaking, and appointing committees, where they are not already in existence, to increase the number of intending exhibitors.

The honorary secretaries are the Hon. Auberon Herbert, Mr. Thomas P. Paterson, and Mr. J. W. Probyn, and communications should be addressed to them at 150, Strand.

INSTRUCTION IN SCIENCE AND ART FOR WOMEN.

In the concluding lecture of his series, Professor Huxley pointed to the connected chain of numerous existing records which unanswerably proves the great antiquity of the world. This chain, at the lowest calculation, extends over a period of 280,000 years; and its clearly defined continuity must greatly impress all with a sense of the consistency and grandeur of the whole system of nature. Professor Huxley declared that there could be but little doubt that, at some period, the earth possessed no crust, and was merely a globe of gaseous vapour.

The educational benefits which the audience of these lectures have, it is hoped, derived, cannot be over-estimated. They tend to enlarge the capabilities of thought, and to render every day occurrences in nature more comprehensible.

Professor Guthrie commences his course on "Elementary Physics and Chemistry," January 18th, 1870.

The following are the notes of Professor Huxley's last three lectures:—

Lecture X.

1. The climate of the basin of the Thames, and of Britain generally, is influenced by all the conditions which have been mentioned.

2. Animal and vegetable life can be maintained only within certain limits of temperature and moisture. Hence, the climate of Britain is one of the leading conditions of the existence of its living population.

3. The native animals of Britain are all found on the Eurasiatic continent. Some may have reached Britain by emigration, but it is impossible that all should have done so, under the present geographical conditions.

4. The human inhabitants of Britain have the same linguistic and physical characters as the people of the adjacent parts of the Eurasiatic continent. It is possible that Britain was peopled with men by migration under the present geographical conditions.

5. At the earliest period recorded in history the animal population of Britain was the same as it is now, and the human population lacked only the Roman and Teutonic elements.

Lecture XI.

1. The gravel which lies at the surface of the Thames basin is, for the most part, river gravel. It contains the remains of elephants, rhinoceroses, oxen, bisons, and musk sheep, with flints worked into implements by man.

2. At the time this gravel was formed, the British Islands were united with the continent of Europe, and the Thames flowed into an estuary common to it and to the Rhine.

3. Some of the gravel of the northern half of the basin of the Thames is drift gravel. It consists of fragments of rocks from distant localities, which have been brought into their present position by ice.

4. At the time the drift gravel was formed, Britain, north of the Thames, and all the northern regions of Eurasia and America, were covered by ice, or an icy sea.

5. The London clay is the mud of the estuary of a great river. It contains the remains of palms, of crocodiles, turtles, and other animals found only in hot climates.

6. The chalk is the mud of the bottom of a deep sea, which overspread the site of what is now a large part of Europe, Asia, and Africa. Neither the Pyrenées, nor the Alps, nor the Himalayas, were in existence when the chalk was formed.

7. The chalk was formed and upheaved into dry land before the river which gave rise to the London clay existed. The London clay was (at any rate in part) converted into dry land before the drift gravel existed. The river gravel is more recent than the drift gravel.

8. The climate of England during the deposition of the London clay (eocene period) was much hotter than at present; during the formation of the drift and river gravels (glacial and post-glacial periods) it was much colder than at present.

9. The animals and plants of the chalk, were, for the most part, very different from those which now live in the British Islands, or the adjacent seas, or, indeed, exist everywhere. The likeness of the eocene forms to existing animals and plants is far greater; while many of the glacial and post-glacial animals are identical with those which exist in or near the British area.

Lecture XII.

1. The gravel, the clay, and the chalk of the Thames basin record a vast period of time, during which the operations of denudation and reparation, and the general circulation of this matter of the world, went on as at present.

2. The series of deposits in the Thames basin is exceedingly incomplete. Superimposed upon the London clay, elsewhere, are the nummulitic limestones which were once formed at the bottom of a great ocean, nearly as extensive as that of the chalk.

3. Upon the nummulitic limestones again, the great series of deposits called miocene rest. They contain the remains of great numbers of terrestrial animals and plants closely related to, but for the most part different from, those which now exist. During their formation, France was as full of volcanos as Iceland is at present.

4. Subsequent to these, in various parts of England and of Europe, are great masses of pliocene deposits, the animal remains in which are still more like those of the present day.

5. The drift, represented by the beds of gravel in the Thames basin, consists elsewhere of great thicknesses of clay, sand, and gravel.

6. The post-glacial period has been of very great duration.

7. The stratified deposits, from the chalk upwards, which are alone accessible in the Thames basin, constitute a mere fraction of the total series of such deposits; consequently, as there is no reason to believe that the processes of denudation and reparation were, on the average, more rapid when the oldest of these deposits were formed than they are now, the enormous period of time recorded by the floor of the Thames basin can be but a fraction of that recorded by the whole series of stratified rocks.

8. At the oldest periods of which any record exists, the earth had a solid crust, which was the product of the aqueous denudation of some pre-existing solid crust; and, from that remote period to the present day, the matter of the earth has circulated from form to form, as it is now circulating in and around the basin of the Thames.

Fine Arts.

Statue to Lamartine.—A subscription opened for this purpose by the ministerial papers of Paris, met with very moderate success, but the people of Mâcon have furnished 52,200 francs for the purpose. It is decided that the statue shall be in bronze, and placed in the Place d'Armes, the largest public square in Mâcon.

Manufactures.

Manufactures in the Philippines.—Various stuffs called "pina," sinamais," and "nipis," are manufactured in the islands of Panay and Luzon. Pina, made from the fibre of the pine-apple leaf (*Ananassa*), when worked with silk, costs 3 to 4 dollars the piece of five yards; gauze, from 5 to 6 dollars the piece. Tinampipi, a texture made from the filaments of the abaca, or so-called Manilla hemp (*Musa textilis*), fetches from 10 reals to 2 dollars the piece. Guinaras, coarse textures, made also from the fibres of this plant, and worn by the poorer class of people, cost but 1½ reals the piece of 5 yards. Many of these native manufactures being anything but durable, and, moreover, very expensive, are becoming rapidly superseded by the cottons and silks from Europe and China.

Commerce.

The Madeira Vintage.—The following is from the report of Messrs. Rutherford, Drury, and Co.:—"It is expected that the quality of this year's vintage will be very good; but, as there was a little oidium, not so clean as that of 1868; there is, however, in such a regular climate as Madeira's, very little variation in the quality of the vintages (and therefore it is that the wines of each year are not kept separate); the best years, however, since the re-planting of the vineyards, were 1868, 1865, and 1863. The old sources of cheap wine in the north of the island have not been re-planted, the soil there being more suitable for cereals, &c. The quantity (estimated) this year is about 8,000 pipes; last year it was also about 8,000, *i.e.*, almost a third of the old average. Then (1868) the vines were an extraordinary sight, owing to the great number of bunches hanging from them from end to end, and every vineyard produced half as much again as was expected. Hitherto there has been a continued increase in the production, the quantity in 1867 having been about 4,000 pipes; in 1866, 3,000; in 1865, 2,000; in 1864, 1,500; in 1863, 1,000; and in 1862 to 1860, 500 pipes per annum. The vines in most vineyards on the south side are now from seven to ten years old, and look healthy; there are also a few of the old vines remaining. Therefore there need be no doubt now that the quality of the wine is as good as of old, though possibly it is not so alcoholic and potent; but this, for England at least, is an advantage. Our statistics for 1868 show an increase in home consumption in the United Kingdom of 25 per cent. over that of 1867. The manufacture of (so-called) wine from apples, &c., still continues, principally for consumption in the island, but it must enter more or less into the composition of any wines offered under £34."

Spruce Beer is a Dantzic speciality. It is a black liquor, made of a fermented decoction of the leaves and small branches of these trees, and properly sweetened. It is used for mixing with other beverages, and also for medicinal purposes, and exported exclusively to London. In 1867, 26,000 barrels, valued at 7s. 6d per barrel, free on board, were shipped.

Colonies.

Tasmanian Medical School.—An important movement has been revived for the re-establishment of a medical school in this colony, for the training of pupils both belonging to the colony and to the neighbouring provinces. Something like an institution of the kind was commenced some years ago, when several professional men connected with the Hobart Town General Hospital moved in the matter, and obtained from the authorities in England concessions entitling Tasmanian pupils to a time allowance, on their presentation of colonial certificates of having passed through a certain curriculum of study. As the interest created by the proceedings of the Council of Education in connection with the A.A. degree and the English scholarships has led to a revival of this project, the chances are that some active steps will at last be taken to give effect to it.

Notes.

Telegraphic Money Orders in France. — The French Council of Ministers have adopted a proposed plan of money orders by telegraph. The maximum for a single order is fixed at 5,000 frs. (£200). The despatches are to be charged at the same rates as ordinary telegraphic messages, and the charge for the order is to be 2 per cent., or twice the rate charged by the post-office.

Exhibition in the Argentine Republic.—The government have received a communication from her Majesty's Minister at Buenos Ayres, with a copy of the rules and regulations for a National Exhibition to be held at the city of Cordova, in the Argentine Republic, on the 15th of October, 1870. These rules and regulations may be inspected on application at the Board of Trade, Whitehall-gardens.

Scholastic Registration Association.—The Right Honourable Sir John S. Pakington, Bart., M.P., will preside at the meeting in support of the Endowed Schools Bill (No. 2), which will be held at the Society's House, on the 11th January, at 7 o'clock, p.m.

Copyright in Newspaper Articles.—Vice-Chancellor Malins, in a case of alleged infringement, which came before him on the 21st instant, decided a point of great interest to proprietors of newspapers as well as the public. The Vice-Chancellor held that the proprietor of a newspaper had a copyright in the contents of his paper, and that, in order to entitle him to sue, it was unnecessary to register at Stationers' Hall under the Copyright Act.

Seaweed in Cooking.—The Chinese import large quantities of dried seaweed from Japan, and use it in cooking in the place of salt. They also employ it as a vegetable, and thicken soups with it like tapioca. It is collected on all the coasts of Jesso, and in the inland sea in the environs of Nagasaki and Simonosaki. It is an important article of export at Nagasaki and Hakodadi. The price is 2½ to 4 dollars the picul.

Correspondence.

Communication with Wrecks.—Sir,—In justice to the Society which has done so much in the matter of the communication between the shore and the wreck, I think it may be as well to call attention to the notice of a supposed new invention for the attainment of this object, now running through the papers. It is said that a professor, somewhere in Central Germany, has made the discovery that a line may be thrown, by means of a small mortar and shell, and that the professor further states that the line will not break, because the velocity is so small at the commencement of the flight of the shell. It is many years now that this mode has been in general use in all our ports and harbours, in fact, all round our coasts, and the line is only prevented from breaking by the proper disposition of the coil; that is, that the part running out shall never be overlapped by any other part of the line. In regard to this subject, I beg to add that I never understood how it happens that masters of vessels are seldom, if ever, provided with any means of communication with the shore in case of shipwreck, seeing that in every case both wind and sea must necessarily set in to shore, and, therefore, adverse to all shore attempts. Neither have I ever heard that Danscy's kites have ever been used, notwithstanding they can be set up on board in a few minutes, with a couple of boat-hooks and a spare boat's sail; they are certain to go on shore, and anchor themselves securely.
—Yours &c., Henry W. Reveley.

MEETINGS FOR THE ENSUING WEEK.

Tues ...Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)
Thur ...Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)
Sat ......Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)

Patents.

From Commissioners of Patents' Journal, December 17.

Grants of Provisional Protection.

Alum—3525—J. B. Spence.
Animals, shearing or clipping—3476—A. C. Henderson.
Bags, &c., fastenings and locks for—3506—J. and S. Loebl.
Bale ties—3535—B. J. B. Mills.
Blankets used by calico printers, material for—3513—J. Walker.
Boilers—3347—G. Betti.
Bread and biscuits—3540—J. Childs.
Breakwaters—3511—S. Alley.
Buckles—3539—F. A. Harrison.
Caissons—3488—A. Mitchell.
Calendering machinery, &c., rollers used in—3487—J. B. Wilson, J. Higginbottom, and I. Royse.
Capsules or packages for containing tea, &c.—3528—W. Geeves.
Cartridges—3533—G. Dowler and W. Pursall.
Churns—3482—H. C. Ash.
Cotton, &c., machinery for opening and breaking hard waste rags of—3496—W. Tatham.
Crucibles, &c.—3541—J. H. Johnson.
Drying machines—3469—R. Milburn and T. Browning.
Electric telegraph apparatus for continuous printing—3537—J. Watson.
Elevators for raising and stacking straw, &c.—3530—S. Lewin.
Engine and pump, revolving—3499—J. C. Wilson.
Figured muslin, &c., ornamenting—3552—A. M. Clark.
Fire-arms—3486—H. C. Pennell.
Food, &c., portable apparatus for carrying and cooking—3546—E. Weldon.
Furnaces—3536—W. Scott.
Furnaces and flues—3493—J. W. and E. Whittaker.
Gas burners—3554—E. Walker.
Gates, &c.—3551—A. L. Bricknell.
Glass—3549—B. F. Stevens.
Harness—3518—W. R. Lake.
Hinge joints, fastening objects capable of rotating on—3502—E. V. Neale.
Horse-shoes—3544—J. S. Robertson.
Iron tubes, &c., joining the ends of—3524—H. H. Murdoch.
Kitchen ranges, &c.—3478—W. Bennett and J. Currall.
Life-boats, &c.—3508—C. W. Petersen.
Liquid meters—3558—J. Loader and W. H. Child.
Looms, &c.—3442—B. Oldfield.
Malt, &c., desiccating—3474—J. Forbes.
Organs, &c.—3514—H. Alexandre.
Paper-cutting machinery—3510—H. M. Nicholls.
Paper-cutting machines, &c., apparatus for taking up, carrying, and laying sheets of paper delivered by—3498—J. M. Macintosh.
Paper pulp, straining of—3484—R. N. Slight and W. F. Denholm.
Paper, &c., substance to be used in a similar manner to alum, &c., in the manufacture of—3526—J. B. Spence.
Photo-mechanical printing, &c.—3543—E. Edwards.
Pipe wrench—3517—A. Ripley and J. Wormald.
Placards, &c., apparatus for exhibiting—3560—C. Sipriot.
Potassium, sodium, &c., producing—3505—H. Larkin and W. White.
Powdered fuel, burning—3504—T. R. Crampton.
Printing, lithographing, &c.—3500—W. MacLean.
Public conveyances, registering the number of passengers travelling by—3183—A. Grothe.
Rails for railroads—3521—J. L. Booth.
Rotary engines—3512—J. Knowles.
Safety lamps—3532—J. Swift.
Sausage-making machinery—3431—W. C. S. Percy.
Sawing machinery, &c.—3480—J. Peirce.
Screw propellers—3545—M. Kolb.
Sewage, treating—3550—M. F. Anderson.
Soda crystals—3472—W. Spence.
Spittoons—3490—A. P. Stirling.
Spring mattresses—3491—J. H. Johnson.
Steam engines, &c., packing glands for—3516—T. Macguire.
Steam engines, &c., working and reversing the valves of—3497—J. Smith and T. Eastwood.
Steam fire-engine pumps, &c., valves for—3495—E. Field.
Submarine telegraphic cables—3489—F. C. Webb.
Sulphuric acid—3494—P. A. S. Langlois and L. S. Thomassin.
Tea, &c., packing and consolidating—3534—J. Jonas.
Tobacco, spinning—3492—H. H. Mayden.
Umbrellas and parasols, covers for—3519—T. Clark.
Valves, self-acting escape—3520—S. Chatwood and J. Crompton.
Vessels, propelling and steering—3380—J. E. Crocé-Spinelli.
Vices—3562—W. R. Lake.
Water-closets, &c., regulating the supply of water to—3548—G. Preston and J. Prestige.
Worsted, &c., machinery for twisting—3547—M. Stell.
Yarn or thread, winding upon conical surfaces—3507—J. Boyd.
Yarns or threads—3566—J. Ballantyne.

Inventions with Complete Specifications Filed.

Animal carcases, &c.—3597—W. R. Lake.
Fire-resisting safes, &c.—3564—R. A. Ballon.

Patents Sealed.

1879. W. R. Lake.	1959. C. L. V. Yon.
1885. A. S. Harington.	1977. A. Walker.
1886. H. Bauerrichter.	2064. H. H. Murdoch.
1894. W. Pidding.	2218. G. T. Abbey.
1895. A. J. Glas.	2997. N. Washburn.
1897. A. Manbré.	2999. E. Roe.
1922. H. A. F. Duckham.	3009. J. W. Robinson and T. Murray.
1945. F. Wohlgemuth.	

From Commissioners of Patents' Journal, December 21.

Patents on which the Stamp Duty of £50 has been paid.

3199. V. Vandroy.	3305. W. Campion.
3276. J. H. Grell.	3321. J. M. Gray.
3289. A. V. Newton.	3428. F. Leonardt.
3290. A. Woods.	68. J. Silvester.
3291. T. Berney.	3331. G. Davies.
3307. C. E. Brooman.	3354. W. E. Newton.
3337. S. and J. J. Perry.	3357. C. Lungley.

Patents on which the Stamp Duty of £100 has been Paid.

3394. I. Holden.	3397. W. S. Longridge.
3392. S. C. Lister.	

Journal of the Society of Arts.

FRIDAY, DECEMBER 31, 1869.

Announcements by the Council.

OFFICE ARRANGEMENTS.

The Council have decided to create a new office, that of Inspector of the Educational Department, and have selected for this appointment Mr. Critchett, who has been, for thirteen years, Assistant Secretary. The latter office will not be filled up.

COLLECTION OF ENGRAVINGS AND PRINTS.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, "On Prints and their Production," read on Wednesday evening, the 8th instant, will be open for the inspection of members and their friends, between the hours of 10 and 4 o'clock, up to Saturday, the 8th January, 1870, inclusive.

Lichtdrucks.—Some examples of prints produced by a process described as Lichtdruck have been added to the collection, a brief account of which will be found at page 134.

DONATIONS TO THE LIBRARY.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors :—

The Elements of Building Construction and Architectural Drawing, by E. A. Davidson ; presented by the author.

Report of the Educational Congress held at Manchester, November, 1869; presented by the National Education Union.

R. Museo Industriale Italiano. Illustrazioni delle Collezioni. Didattica. Parte Prima: Libri Scolastici e Pedagogici, nonche per uso di premio relazioni relative all' insegnamento cenni relativi all' istruzione ne' singoli paesi ; by Cav. G. Jervis ; presented by the author.

The Illustrated Farmer and Gardener's Almanack for 1870.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

SILK CULTIVATION IN ENGLAND.

By ALEXANDER WALLACE.

Public attention was directed to the cultivation of the mulberry silkworm in this country by the paper recently read before the Society of Arts by Thomas Dickens, Esq., President of the Silk Supply Association. Allow me to add a few remarks on this most important subject, which I trust will at once be thoroughly investigated by practical experiment over extended areas in Great Britain. It is needless to remark that could such an industry as that mentioned be introduced, it would confer an enormous benefit on our agricultural and manufacturing population, especially on women and children; we may, therefore, find it worth while to reopen the subject, which has lain dormant for the last forty years, and reconsider if the experiment, which was then abandoned as only partially successful, may not now be revived with more chance of success. Referring to the last experiment in mulberry silkworm culture, we find it stated in Dr. Lardner's "Cabinet Cyclopædia," "Silk Manufacture," page 40, published in 1831, that "In 1825, a company was formed, under the title of the British, Irish, and Colonial Silk Company. This undertaking was supported by characters of the highest rank and respectability, many of whom were induced to give their countenance to the project by a patriotic desire to ameliorate the condition of the Irish peasantry, by adding to their profitable sources of industry. A royal charter was obtained; about eighty acres of land in the county of Cork were planted with nearly 400,000 white mulberry trees. The whole proved unusually successful, very few trees having died, and many, in the first year of their transplantation, put forth shoots twenty inches in length. A small but complete building for rearing silkworms was adopted on the plan of Count Dandolo. The experiment was repeated on a more limited scale in England. Between 70,000 and 80,000 mulberry trees were planted in nineteen acres of fine rich soil, near Slough. The trees flourished here as well as in Ireland. But the attempt to rear silkworms has been ultimately abandoned by the company. Its managers now turn the whole of their attention to an establishment in the island of Malta. The experience of the company leads to the conclusion that if our moist and variable climate do not in itself offer a sufficient obstacle to the success of attempts at rearing the silkworm, there would still remain another objection, viz., the high price of labour. Silk requires so much care and attention for its production, and so great a number of persons must be employed in an establishment for rearing silkworms, that it is only in countries where the poorer class is great in proportion to capital, and where, consequently, labour must be extremely cheap, that the silkworm can be reared at an expense which offers successfully to compete with other regions. Even then the superior skill and knowledge of people to whom the silkworm has long been an object of attention will always ensure them a superiority over novices in the art. The ignorance and awkwardness of the Irish peasantry in bestowing the necessary attention upon the silkworms afforded sufficient reason for rendering their employment unprofitable to the growers." But since 1825, great changes have taken place in this country and its people. 1. Land has been more thoroughly drained, woods and trees cut down or greatly thinned, and the result is a warmer, drier atmosphere, of which the last item is the most important in mulberry silk culture. 2. The general intelligence of the country has increased. We have now no difficulty in finding skilful and intelligent hands among the working classes. 3. Interchange of ideas, and of communication between distant countries, as also among ourselves, is now effected with rapidity and certainty ; the most approved methods of cultivation, the most skilful treatises, the healthiest eggs may easily be obtained from serici-

culturists of repute in all parts of the world. Even now a Japanese pamphlet, on the culture of their mulberry silkworm, printed in August, 1869, at Yokohama, has just been published in the "Guide to Sericiculture," issued by the Silk Supply Association. We approach, therefore, the practical part of the subject with much greater facilities than we possessed in 1825. The objections raised by Dr. Lardner are easily disposed of. 1. With regard to climate—In a magnanerie (or house for rearing silkworms), properly fitted up with modern appliances for regulating the temperature, ventilation, and hygrometric properties of the air, the thermometer and hygrometer may easily be maintained in our climate at the required point, in the months of May, June, and July, without in the least interfering with the necessary amount of ventilation required, and entirely independent of external atmospheric influences. Forty years ago, this, I apprehend, was impossible. 2. The high price of labour, and the number of persons required in a magnanerie, is cited as an obstacle. The rate of wages of the present day in agricultural districts cannot be pronounced high, especially that of women and children, who would be largely employed in tending silkworms; the price, moreover, of silk is relatively now much higher than it was forty years ago. Recent improvements have also greatly minimised the labour required, not merely in reeling the cocoons by aid of machinery, but also in feeding the worms. 3. The third objection, viz., the ignorance and awkwardness of the peasantry of that day, is worth but little now; owing to educational and other changes; the intelligence of the peasantry is far greater now than then, and the fact that there is no lack of skilful and intelligent hands in the manufacturing districts, will go far to prove that awkwardness and ignorance need not now impede the culture of the silkworm. Furthermore, Mr. Dickens's position with reference to the culture of the silkworm in Great Britain is fortified by the opinion of French sericiculturists of known repute. M. Taurigna has stated that we have many localities well suited for the production of seed (eggs), and that we ought to take the highest rank of all European seed-producing countries, our cool climate being especially favourable to the development of sound and healthy races. Mons. Guérin-Méneville, Inspector General of Sericiculture in France, writes to me as follows:—"Aujourd'hui il est reconnu que l'elévage des vers à soie peut se faire avantageusement dans des pays tempérés, et même froids, et non exclusivement dans le Midi; et l'on commence à développer cette riche industrie dans les départements du Centre et du Nord, dont le climat est peut-être plus rigoureux que celui de' l'Angleterre. Je crois que vous parviendriez facilement à développer cette industrie chez-vous et qu'elle y donnerait de très bons resultats. Pour cela il-faut que quelques proprietaires aises et riches donnent l'exemple à fin que les gens des campagnes le suivent." This opinion, coming from a man who has devoted himself entirely to sericiculture, has published most valuable writing on the subject, and who travels, by virtue of his office, yearly, during the silkworm season, over all the silk districts of France, and reports thereon to the Ministre d'Agriculture, seems to me the strongest *à priori* authority that could be cited for again experimenting in silk culture in England. But, fortunately, we have additional evidence that, so to speak, clinches the matter. For the last three years, Captain Mason, in the vicinity of Farnborough, has, in his magnanerie, reared a thoroughly healthy stock of silkworms of the *B. mori*, obtaining cocoons and silk equal to the best Italian produce. Those which were exhibited at the meeting have been deposited at the offices of the Silk Supply Association, 3, Castle-street, Holborn, and were pronounced most excellent by the members of that association, who were well fitted as manufacturers to express an opinion thereon. When submitted to the judgment of the working men at Macclesfield, the only regret heard was, that there was not enough of it to work in the loom. Capt. Mason has not hitherto been able to furnish us with statistics of the quantity that can be produced from an acre of ground; for this we must wait another year or two, but he informed me that as far as he could judge, from his experience of the last three years, after all expenses had been paid, a profit of £10 per acre, on a plantation of 100 acres, might easily be realised. Captain Mason is a thoroughly practical man, who has, without enthusiasm, tested the feasibility of silkworm culture on about three acres of ground, planted with the white mulberry-tree; his magnanerie is a model of cleanliness, and his devices for preserving the requisite ventilation and temperature are perfect. Were he to turn his attention to the production of healthy seed, instead of cocoons, he could easily make a large profit thereupon. It is chiefly in this direction that I advise that the first efforts of experimenters in sericiculture should be directed. The scarcity, and consequently the high price, of sound eggs (owing to the ravages of the epidemic disease during the last fifteen years), has brought it to pass that in all countries silkworm eggs are eagerly sought for. In Japan, four years ago, cards of eggs, weighing on an average 5-6ths of an ounce each, sold for 1s. 6d. a-piece; then a rush was made to Japan for eggs. In 1865-6 2,000,000 cards were sold; in 1868-9, 2,500,000 were sold, at prices varying from 12s. to 15s. per card. This season, as I learn from a friend in Japan, has been unusually bad, and the quantity of cards is 500,000 only. The natives are holding out for long prices. The cards this year have reached 5 dols., or 21s. 8d. each. At 5s. per oz., which ought to be the normal price, it would pay to grow eggs for sale; at 21s. per oz., the profit would be very great. Of course this price cannot be upheld as soon as competition comes into play, but for beginners in sericiculture it will be a great encouragement to get a good price for their eggs. I could urge further reasons for upholding Mr. Dickens's proposition to attempt a new sericiculture of the *B. mori* in Great Britain, but I think I have stated enough for the present purpose of promoting inquiry and experiment. I will now conclude with a few remarks on a portion of the subject not referred to in Mr. Dickens's lecture. Other races of silk-producing insects have been introduced into Europe with a view to a trial of their produce and acclimatisation. Of these, the ailanthus silkworm, and two or three kinds of oak-feeding silkworms, are all we have made trial of. The ailanthus silkworm may be dismissed from present consideration, for, though easy to rear, and thoroughly acclimatised, the cocoon cannot at present be easily reeled in a remunerative way. The oak feeders from China and North America have been tried only for one or two seasons, and we cannot yet speak confidently about them. The oak feeder from Japan, the *Bombyx yama mai*, which was at one time monopolised by the Royal family, and considered so precious, that the penalty of death was threatened on any one exporting its eggs, was introduced into Europe in 1863, and though a considerable check has been experienced in its culture, one individual, most successful from the first, has achieved a marked success. M. le Baron de Bretton, of Vienna, beginning five years ago with a few eggs, has this season reared the *Yama mai*, in the oak woods on his estate, to such an extent, that 27,000 cocoons were set apart last autumn for the production of healthy and acclimatised eggs. In reply to an inquiry as to his method of rearing this valuable silkworm, he stated that he was the possessor of certain secrets which enabled him to rear the worm with certainty, but which he declined to part with, except for a pecuniary consideration. Specimens of his cocoons and silk will shortly be in my possession, and will be submitted for inspection at the offices of the Silk Supply Association. In England, the experiences of raising this silkworm, in 1868, resulted in failure, chiefly owing to the hot summer. In 1869, failure again ensued, chiefly from the cold months of May and June. In both

years cocoons were obtained only from worms that had been reared indoors. The experiences of the past three years seem to prove that the comparatively cool and moist climate during June and July of our western and northern coasts, are better suited to the culture of the *Yama mai* than the dry hot temperature of the southern and eastern counties. Thus, in the south of Ireland, in Wales, Herefordshire, and western part of Scotland, a much greater amount of success has been recorded than elsewhere. It is also found by experience that they do best in a freely ventilated room, shaded from the sun, the temperature about 70°, equable, and rather moist. Sunshine and a dry heat of 80° seem highly injurious. Great cleanliness is essential. I incline to the belief that the experience of a few more seasons will indicate to us the limits of temperature and locality wherein the worm may be successfully acclimatised, and that it eventually may become a denizen of Great Britain.

SOUTH KENSINGTON MUSEUM.

Many changes have been taking place at this museum recently, and certain classes have been re-arranged and brought into a better state of arrangement for purposes of study. All the electrotypes which, from time to time, have been produced, are now collected at the upper end of one of the south courts, and form an excellent display. At the other end of this same court are the musical instruments, of which a learned catalogue is in the press, and will be shortly issued. Under the cloisters, and near the refreshment corridor, some interesting bits of wood-carving, removed from certain old houses which were demolished to make way for the Carey-street law courts' site, are erected. A cabinet of inlaid work, the design of which is ascribed to Holbein, and which was possibly the property of Henry VIII., is placed in this section. Lower down, and nearer the art library, is a court devoted to textile fabrics, of all nations and times. This collection includes the famous cope of the abbots of Lyon. In the great north court, new plaster casts have been erected, viz., of P. Visschers' shrine, at Nuremburg, and of a monument of St. Peter the Martyr. In the Oriental courts, the disposition of the cases has undergone revision. The collection of enamels, lent by the Rev. J. O. Stephens, is especially worthy of notice. Some of the shapes of the utensils are very unusual and remarkable. Two tall, dark blue vases, with a floral design almost Persian in character, are very fine.

In a corner of the Oriental courts, near the eastern staircase, has been erected a small decorated room of the Louis XVI. period. This boudoir contains specimens of the works of the principal decorative artists of that period. At the commencement of 1869, it was scarcely anything better than a series of very dusty panels and lunettes, finding the meanest of shelter in an outhouse of the shop of a Parisian art-dealer. Previous to his possession of it, or rather inheritance of it from his father, it had formed a portion of the house of Madame la Marquise de Serilly, to whom it was presented by Marie Antoinette. The attention of the South Kensington direction was called to it, and finally negociations resulted in its passing into the hands of the British nation upon the payment of £2,100. It was found necessary to clean it, and carefully revivify the gold mouldings, &c., before it could be exhibited. The extreme length of the boudoir, from the recessed window to the recessed door, is 14 feet, while its width, from the mirror to the window opposite, is 10 feet. In the painting of the panelling throughout the room, are choice examples of Boucher's and Fragonard's work. The figures about half-way up the panels are in relief, and are gilt. They are in pairs, and form a series typical of the four seasons of the year. At the sides of the panels, above the figures, are imitation candles, also in relief. The surface generally is covered with elegant arabesques, and wreaths, and garlands of fruit and flowers. The mouldings are very good. Panels of carved circles, turning one into the other, run round the boudoir, and are painted over with garlands of grapes, or corn, or flowers, according to the season of the year represented in the decoration. The panels of the recesses contain representations of "Endymion" and "Diana," "Venus," and "Mars," most likely the work of Boucher. The centre of the ceiling is filled by a circular painting, by Natoire, of "Jupiter;" over the windows, door, and mirror are lunettes of "Juno" and "Neptune," "Pomona" and "Vulcan," also by the same artist. The mirror stands upon the mantel-piece. Two caryatids, composed of bearded old men drawing a many folded cloak over their heads and shoulders, are fine pieces of white marble sculpture by Clodion. The brass mouldings and frieze of holly leaves are the work of Gouthier.

At present, temporarily, are placed inside the boudoir some Sèvres vases, lent by Lord Dudley; and some Louis XVI. furniture.

Upon the other side of the south courts of the museum will be found an interesting, though small, collection of drawings, bequeathed, in addition to the extensive library of most valuable dramatic publications, by the Rev. Alexander Dyce, to the museum. The drawings are arranged, at present, according to schools. The Italian school comprises sketches by Leonardo da Vinci, Caracci Parmeggiano, Raffaelle, Titian, Zuccaro, &c. The Dutch and German schools contain works by Vandyck, Albert Durer, Vander Meulen, Eckbout, Rembrandt, Rubens, &c. The French school is not so well represented; there are but a few works by Boucher, Claude, and Greuze. In the English section will be found paintings and drawings by Cozens, Stothard, Gainsborough, Flaxman, Turner, &c.

Before concluding, some mention must be made of the collection of peasant jewellery, now placed in the gallery of the South Court. This collection grows continually, and the French fisherwomen's crosses and earrings make good suggestions for light jewellery. The ancient enamels and crystals, and other objects closely allied to these classes, are now shown in what is called the Prince Consort's Gallery, running the length of the centre of the South Courts.

CHINESE INDUSTRIES.

Great interest has been excited by a work published in Paris, with the title of "Industries Anciennes et Modernes de l'Empire Chinois;" it is the joint work of a man of letters and a man of science. M. Stanislaus Julien, professor of Chinese at the college of France, has selected and translated all the most interesting passages relating to manufactures that he could find in Chinese works; and M. Paul Champion has visited China, and, by dint of perseverance and tactics, has succeeded in witnessing many of the most important or most curious manufactures of the country in operation. He made his way, after much trouble, into a manufactory of gongs and a foundry; he saw the elaborate processes of manufacturing and applying the famous Chinese green, produced from the bark of the buckthorn. and he witnessed the production of cloissonné enamels, and many other special Chinese manufactures.

In one respect, M. Champion's opinion differs from that of most visitors to China. He believes that the power of producing nearly all objects of art is the same as it ever was; although he admits that it is not in all cases, as in that of cloissonné enamels, carried on to any extent. M. Champion, however, says nothing of the porcelain manufacture, which he does not seem to have seen, probably on account of the jealousy of the authorities. He brought back to France with him samples of the various kinds of metallic alloys, bronzes, &c., in use in China, enamels, and other productions, and the careful analysis of these at the mint and in other public establishments, supply very interesting information.

The subjects which are most fully and satisfactorily

treated in the work are:—Fuel; colours, mineral and vegetable; metal working; varnishes and lacquered work; agriculture; paper, printing, and cognate matters. From the last-named division, we propose to make a few extracts.

The oldest known records are inscribed on very thin slips of bamboo, carefully dried by artificial heat. Many of these are preserved in the pagodas. At a later period, the Chinese made use of a peculiar kind of silk, called silk paper; and, finally, both were replaced by an inventor named Tsaï-lun, who made use of the bark of certain trees, hemp, rags, old nets, &c., which he boiled down to a pulp, and thus produced paper proper. The results of this invention were presented to the Emperor of China, about the year A.D. 153.

The principal materials employed in the production of paper in the various provinces of China, are hemp, the young shoots of the bamboo, the mulberry tree, the rattan, sea-weed, rice, and wheat straw, silk cocoons, and the bark of the *Broussonetia papyrifera*.

Bamboo paper seems to be the most important of all, and its manufacture is thus described by M. Champion. In the month of June, the bamboos, which are on the point of producing new shoots, are cut down and divided into lengths of six or seven feet each. These pieces are placed in a pit dug in the earth, and kept constantly full of water, and remain there for one hundred days or more; they are then beaten with a mallet, to remove the green bark which covers their surface. The bamboo, thus prepared, is boiled in a large wooden vessel full of water containing slacked lime, and placed within a metal boiler. The fire is generally kept up for eight days, and at the expiration of that time, the fibres are taken out and carefully washed; they are afterwards plunged in a lye made from wood ashes, and then laid in a boiler covered an inch thick with ashes from burnt rice straw, when water is added, and the whole is boiled; these last operations are repeated in rotation during ten days. By this time the fibres begin to rot, and they are then pounded in large mortars, the stampers or pestles being generally moved by water-power in a very simple manner. When reduced to pulp, it is placed in vats, and a liquid added, which is supposed to contain chlorine, to whiten the mass.

The sheets of paper are formed in the same manner as in Europe, but the frame is composed of woven fibres of the bamboo instead of wire; when formed, the sheets are laid one upon another upon a table, till a heap of about a thousand is produced, when a plank is laid on the top, and pressed down with great force by means of cords passed round the table, and the paper is left to drain. The drying is achieved by placing the sheets, one by one, by means of a brush, on the outer surfaces of a hot stove built of brick.

After bamboo paper, the most important kinds are:—Yellow hemp paper, used since A.D. 715, for imperial decrees; paper for the sacred Boudhist writings, covered with the juice of the *Pterocarpus* flowers, to preserve it from insects; paper in sheets twenty feet long and very thick, supposed to be made by spreading the pulp on tables covered with felt, or some other absorbent material, a method followed in Japan; Corean paper made of silk cocoons; white hemp paper, used for edicts and other documents; corean paper made from pine bark; paper made from silk waste, much esteemed; from the roots and bark of the mulberry-tree; and, lastly, silk paper, made from the bark of the *Broussonetia*. This last-named paper is made from the bark of the young shoots, mixed with 40 per cent. of bamboo fibre, and boiled in water mixed with lime, until entirely disintegrated; rice straw is also sometimes added, from which fact has possibly arisen the name in use in Europe; the bark of the *Hibiscus rosa sinensis* and of the mulberry is also used in the same way.

Some of the Chinese, and especially the Corean papers, are smooth on both sides; this dress is produced by first polishing the surfaces with dried leaves, and afterwards pressing it by means of heavy rollers moved by hand.

The sizing of the paper is managed in various ways, but some of the papers made from the bark of trees, or from resinous plants, require no addition of size. One mode of sizing is to steep gelatinous rice in water for twelve hours, then to crush it, and to add to the syrupy liquor produced a certain amount of the flour of oleaginous peas (*Dolichos*), containing 16 per cent. of oil. When the mixture is thoroughly homogeneous, a little yellow wax and alum is added, and it is then laid on the paper with a brush, and left to dry in the shade. Sometimes the sizing is produced with the black seed vessels of Chinese bean (*Mimosa fera*), which are steeped in water for twelve hours, and then boiled; the liquor thus obtained is filtered, and then passed over the paper, which is dried in the open air; finally, a solution of alum is added, to cause the paper to take colours. Other vegetable juices, mixed with alum, are used for the same purpose.

The paper used in place of glass for windows is mostly made in the Corea, and is often of large size, and as strong as a thick fabric. It is generally rough, but sometimes well-glazed, in which case it is worth sixpence or more per square yard. This paper is submitted to the action of steam, and then dressed with a mixture formed of oils of *Sterculia tomentosa* and of hemp seed, mixed with white lead and castor-oil seeds. The paper used for covering umbrellas is prepared much in the same way, and resists the effects of rain and sun for a long time. Finer sorts are made of the *Broussonetia*, or silk paper, and are light as well as durable.

The Chinese understand the use of rags in making paper, and have practised it in certain districts when other materials were scarce; they also collect and use up waste paper.

It is to be remarked that, for eighteen centuries, the Chinese have used in paper-making various fibrous materials which we have only sought for during late years, as a substitute, entirely or in part, for rags. It must be remembered, however, that the Chinese are far less particular as to the colour or even the texture of their paper than we are.

Educational Notes.

A London branch of the National Education League has been formed, of which Sir Charles Dilke, Bart., M.P., is chairman. Communications to be addressed to the Honorary Secretary, Mr. Herbert Fry, 24, Suffolk-street, Pall Mall.

An abstract of the Education Bill, proposed by the League, is given in another column, but its provision may be briefly summed up as follows:—

1. Local authorities shall be compelled by law to see that sufficient school accommodation is provided for every child in their district.

2. The cost of founding and maintaining such schools as may be required shall be provided out of local rates supplemented by government grants.

3. All schools aided by local rates shall be under the management of local authorities, and subject to government inspection.

4. All schools aided by local rates shall be unsectarian.

5. To all schools aided by local rates admission shall be free.

6. School accommodation being provided, the State or the local authorities shall have power to compel the attendance of children of suitable age not otherwise receiving education.

With reference to the provision for compulsory attendance at schools, in a discussion at a recent meeting of the Manchester Education Bill Committee, it was urged by Mr. Francis Taylor and by Mr. Jacob Bright,

M.P., that although the course formerly adopted, of framing these provisions as amendments to be introduced into their Bill in committee, might lead the House to believe that the promoters regarded them as of secondary importance, no such objection would lie against introducing them in a separate and parallel Bill. In the possible event of the government announcing an education measure in the Queen's speech, it was thought that no other Bill could be seriously pressed, while a separate compulsory measure might still be urged on the House, and a general discussion taken on the policy of compulsion, sufficient to show the government what was the real feeling of the country.

Mr. J. S. Mill, in a letter which was received too late to be read at a recent meeting of the Greenwich branch of the League, says that "the education movement is going forward with a rapidity which justifies the most sanguine hopes, and the two great principles of the League, that elementary education should be compulsory, and that State education should be undenominational, are striking root deeply into the mind of the nation." Having held the first opinion for many years, and the last always, Mr. Mill heartily rejoices at the progress both are making towards general recognition.

On the occasion of the distribution of prizes and certificates to art-students in the Westminster-bridge-road, Mr. R. Applegarth pointed out "the impossibility of English workmen getting as good a scientific education as foreigners, because they had not the same means of obtaining elementary instruction. It was this want of education which placed the English workmen at a disadvantage as compared with foreigners, and this was the real cause why trade left this country, and why we were unable to compete with foreigners. Even now, all that the Science and Art Department was doing only touched the adults, and it was most important that means should be adopted for giving scientific education to lads. To attain this, we must establish a system of compulsory elementary education; and then children, as they grew up, would be ready to receive a scientific training, and might pass from one grade of school to another, until they reached the highest position which they were qualified to fill."

A belief in the paramount importance of the study of science, and other matters of a practical character, as compared with the old routine in which classics formed the main element of education, is certainly gaining ground rapidly. Mr. H. B. Sheridan, M.P., in a recent speech at Dudley, says that, in his opinion, a high classical education is not necessary in order to secure success in life. He thought the study of modern languages would be a great deal more useful to the young men of the present day. He quite concurred in the opinion that sufficient attention was not paid to the writing of the rising generation. At the great schools especially, little attention was paid to it.

It appears that the religious difficulty in schools, which seems gradually vanishing in this country, has been recently revived in the United States. The Roman Catholics insist that the Bible shall be excluded. The Protestants refuse to yield to this demand, and the *New York Tribune* thinks that a religious agitation is to be apprehended, "which will far exceed the pro and anti-slavery war; an agitation which will rock our fabric of popular government to its foundation." In the hope of averting this calamity, the *Tribune* recommends the remitting all religious "inculcation" to the parents and pastors; very much the plan recommended by the Education League.

The education of women is now receiving increased attention in various quarters. Some distinguished members of the University of Cambridge, feeling that that town offers exceptional facilities, have formed a committee of resident members of the University engaged in tuition, and have adopted a scheme of arrangements for lectures to women during the ensuing Lent Term. This committee comprises Professors Adams, C. C. Babington, Cayley, Liveing. and Maurice, and about twenty gentlemen, fellows and tutors or lecturers of their respective colleges. The lectures will comprise:—English History, English language and literature, Latin, Greek, German, French, algebra, and the principles of arithmetic, practical arithmetic, geometry, logic, political economy, botany, geology, and physical geography, chemistry, harmony, and thorough bass, and the theory of sound in its application to music. The fee for a single course of lectures will be one guinea, and any women having attained the age of 17 are eligible for attendance.

The movement for female education also extends to India, and in spite of the difficulties attendant upon the establishment of female schools in that country, the progress made in the Bombay presidency is full of hope for the ultimate success of the work. According to tables recently published, the following comparison between the results of the two past years is obtained:—

Schools.

	1867-8.		1868-9.
Government	97	..	141
Aided	15	..	22
Inspected	30	..	33
	142		196

Scholars

	1867-8.		1868-9.
Government	3,458	..	5,427
Aided	1,393	..	1,874
Inspected	1,413	..	1,297
	6,264		8,598

Especially worthy of notice is the establishment of twenty-two girls' schools in Scinde, where last year there were none.

Special provision is made for the scientific instruction of women in the Massachusetts Institute of Technology at Boston, which has now been in operation for several years, and includes a technical school, or school of applied science, where instruction is given in mining and metallurgy, mechanical and civil engineering, building and architecture. Besides these professional courses, there is a general course in science and literature. The course of study is four years, the requisites for admission being, as to age, sixteen years, and a satisfactory examination in arithmetic, algebra up to quadratic equations, plane geometry, English grammar, and geography. There are also free annual courses open to either sex, and this is believed to be the only school in the United States, and probably in the world, whose laboratory is open to both sexes, for systematic courses of chemical manipulation and instruction. There are 52 desks or tables in the laboratory, more than half of which are said to be commonly occupied by females.

Lord de Grey has selected Sir F. Sandford, Under Secretary of State in the Colonial Office, to succeed Mr. Lingen, as Secretary to the Committee of Council on Education.

NATIONAL EDUCATION LEAGUE.

The following is a synopsis of the Education Bill prepared by the Executive Committee of the League:—

1.—School Districts and School Boards.

Boroughs and towns locally governed to be formed into school districts. Local governing bodies, if elected by ratepayers, to appoint School Boards, partly or wholly from their own bodies, to carry out the Act.

In rural districts and places where there are no local governing bodies elected by ratepayers, unions or groups of unions to be taken as the area of school districts, and School Boards to be elected by ratepayers in parishes, in the same proportion as guardians of the poor.

Boundaries of school districts to be altered, or new

districts created in counties, by sanction of the Committee of Council, on memorial from inhabitants.

2.—Powers of School Boards.

School Boards to see that a sufficient number of efficient schools are provided in their districts. To have compulsory powers for the purchase of school sites. To establish and maintain ordinary day schools, and, where necessary, certified industrial schools. To enforce the Industrial Schools Act in regard to vagrant children. To make and keep registers of all children of school age in their district, such register to be founded upon the register of births, and to be periodically revised. For these and all other purposes of the Act, School Boards to have power to levy rates for education, to be collected by overseers with the poor-rate on precept of School Board.

3.—National Rate Schools.

To be managed by School Boards, or by committees appointed by them. To be of various grades, provision being made to enable children to pass from lower to upper grades, but no provision to be made out of the rates for the maintenance of scholars. National Rate Schools to be free to all.

No creed, catechism, or tenet peculiar to any sect shall be taught in any National Rate School; but the School Board shall have power to grant the use of the school rooms, out of school hours, for the giving of religious instruction, provided that no undue preference be given to one or more sects, to the exclusion of others. But the rooms shall not be granted for purposes of religious worship. The School Board shall have power to permit the reading of the Scriptures in schools, provided that no child shall be present at such reading if his parents or guardians disapprove; that the time for giving such reading be immediately before the commencement or immediately after the ordinary school business, and that it be so fixed as that no child be thereby in effect excluded directly or indirectly from the other advantages which the school affords. All books used in the school must have the approval of the School Board.

4.—Compulsory Attendance.

All children to be required to attend school from six to 14 years, subject to provisions of Factory Acts. Number of attendances to be fixed by the Committee of Council, but not to be less than 200 yearly of two hours and a half each for full-timers, and of 100 of two and a-half hours each for half-timers.

In rural districts (to be defined by Committee of Council) attendances to be at such times as may be settled by School Boards, with consent of Committee of Council.

Children to be deemed to attend school if they attend (1) a National Rate School, (2) any school receiving government grants, (3) any private school or private tuition considered satisfactory by School Boards, (4) Reformatory School, (5) certified Industrial School, (6) or a parish (workhouse) school. Any private school not considered satisfactory to School Board to have right of appeal to Committee of Council.

All schools, whether under government inspectors or not, to keep registers of attendance, to be open to inspection by a visitor of the School Board, or by the government inspector of the district.

School Board to appoint a school visitor, or visitors, to examine attendance-books of National Rate Schools, and report to School Board cases of total omission or irregular attendance.

School Board, or committee appointed by the Board, to sit at stated times to receive reports and hear complaints; to have power to excuse absence or irregular attendance in cases of sickness, or on such other grounds as may be satisfactory to them.

If the reasons assigned for absence are unsatisfactory to School Board, the school visitor shall serve upon the parents or guardians the notice A in the schedule of the Act. If, after 14 days' interval, the order of the Board is not obeyed, the school visitor shall serve a second notice, in the form B in the schedule, summoning the parent or guardian to appear before the School Board, or a committee appointed by them, to explain the cause of neglect. Such Board or committee may dismiss the offender with a caution, or may direct the school visitor to summon him before a justice of the peace for infringement of the Act. On a second summons before the School Board they shall direct a prosecution at petty sessions, such prosecutions to be conducted by the school visitor.

The justices may caution or fine the offender on a first conviction. On a second conviction they shall inflict a fine, without costs, of not less than 1s. nor more than 5s. On subsequent convictions such fines may be increased by addition of 5s. to not more than 20s. The fines to be paid to the School Board, to the account of the school fnnd, and expenses of prosecutions to be defrayed out such fund. Persons convicted by justices to have a right of appeal to quarter sessions.

5.—Existing Schools.

School Board to have power to negotiate with trustees and managers of existing schools for purchase and transfer of buildings to School Board.

Managers or trustees of existing schools may apply to have their schools converted into National Rate Schools; and if such conversion is approved, and the managers undertake to fulfil all the requirements of the Act, the School Board may appoint such managers to be the school committee.

In places where there is sufficient accommodation provided by existing schools receiving government grants, the School Board shall have power to send children, provided the managers are willing to receive such children, and to undertake that no creed, catechism, or tenet peculiar to any sect shall be taught to them, unless the parents or guardians have signed a form desiring that such teaching shall be given. And whenever the Board shall send children to the existing schools receiving government grants (subject to the above-stated provision as to religious teaching), the Board shall pay out of the school fund a proportion of the total expense of the school, equivalent to the proportion which the children so sent bear to the total number of scholars, provided that such number in no case exceed one-third of the number of the whole. Schools receiving this payment shall receive the present allowance from government on the remaining children.

Existing schools under government inspection admitting all children free, and arranging their religious teaching in such a manner that it may be at a distinct time, either immediately before or after ordinary school business, and the attendance at such religious teaching shall not be compulsory, and that there shall be no disability for non-attendance, shall receive two-thirds from government. But any portion not exceeding one-half, may be withdrawn if the inspector reports unfavourably.

6.—Provision of Funds.

Expenses of School Boards to be defrayed in the proportion of one-third by local rate, and of two-thirds from the Consolidated Fund. Government grant of two-thirds for maintenance of schools to depend, as in the case of existing schools, upon the results of examination by government inspectors.

Whenever the inspector appointed by the Committee of Council shall report unfavourably of the condition, management or efficiency of any National Rate School, the Committee of Council may withhold any portion of the government grant, not exceeding one-half of the whole, until such time as the school shall be placed in a satisfactory condition and so reported by the inspector. And in such cases the amount withheld shall be pro-

vided by the District School Board out of the rates for the year, and the School Board shall, if necessary, levy an additional rate for this purpose. But if the School Board disputes the justice of the report of the inspector, they may demand a second inspection, which shall be conducted by a special inspector, who shall be appointed for such purposes by the Committee of Council, and shall be called the Inspector of Appeals.

Borrowing powers to be conferred upon School Boards, with consent of Her Majesty's Treasury. Accounts to be audited yearly by government auditor, and published.

7.—Powers of Committee of Council.

In school districts where no School Board is elected within three months after the passing of the Act, the Committee of Council shall appoint a Board to act as the School Board.

If the School Board of any district fails to provide sufficient school accommodation within a reasonable time, the Committee of Council shall require the School Board to provide such accommodation within a specified time, being not less than six months from the date of such precept. If the School Board fails to comply, the Committee of Council shall lay before Parliament a minute voiding the election of the School Board; and unless this minute is disapproved by Parliament within 40 days, the Committee of Council shall declare the election void, and shall appoint a new Board.

8.—Miscellaneous.

Committee of Council to establish and maintain normal schools, for the training of teachers for National Rate Schools. No creed, catechism, or tenets of any sect to be taught in such schools.

Government school inspectors to assist in carrying out the provisions of the Act, and to report to Committees of Council on the efficiency of every school in their district. Copies of such reports to be furnished to School Boards.

Committee of Council report annually their proceedings under and in reference to the Act."

CERTIFIED REFORMATORY SCHOOLS.

THE PHILANTHROPIC SOCIETY'S FARM SCHOOL, REDHILL.

By George C. T. Bartley.

The class of schools considered in the following paper is one very closely allied to the certified industrial schools, of which an account appeared in the *Journal* of the 27th November last, the essential difference being, that the reformatory school is for children who have been convicted of an offence punishable with penal servitude or imprisonment, whereas the industrial school endeavours to rescue those who are bordering on crime, but who have not yet been convicted.

These schools are under the direction and inspection of the Home Office, and are now based chiefly on the Reformatory Schools Act of 1866, which was passed on the same day and as a companion to the Certified Industrial Schools Act of that year. The same inspector visits both sets of schools, and his two reports are issued in one blue-book, prepared annually by the Home Office.

Any reformatory school, established for the better training of youthful offenders, may apply to the Home Secretary to become a certified reformatory school. After it has been inspected by the reformatory school inspector, and reported on as fitted for the reception of youthful offenders, the Secretary of State may grant a certificate, and the school is then eligible to receive children under the 1866 Act. When thus placed under the Home Office, alterations and changes in the rules require the sanction of the Secretary of State, and the certificate may be withdrawn, should it be considered that the regulations are not properly carried out.

The conditions of the commitments of children to reformatory schools is laid down in the act above referred to. By this, any offender, who, in the judgment of the magistrate or court before whom he is charged, is under the age of sixteen years, and who is convicted of an offence punishable with penal servitude or imprisonment, and is sentenced to be imprisoned for at least ten days, may be sent, at the expiration of the period of imprisonment, to a certified reformatory school, for at least two, and not more than five years. Children under ten years of age are, however, not to be sent to such a school, unless they have been previously charged with some crime punishable with penal servitude or imprisonment, or unless they have been sentenced in England by a judge of assize or court of general or quarter sessions, or in Scotland by a circuit court of justiciary or sheriff. This is to prevent very young children, who have been led astray for the first time, from mixing with older and more habitual offenders.

Regulations in the act provide for children being sent, as far as possible, to schools conducted in accordance with their religious persuasion, and, where this is not practicable, ministers of persuasions different from that of the school may visit the children, at specified and convenient hours, for the purpose of imparting instruction in the principles of their religion.

The number of these schools, up to the end of 1868, was 64, that is, 36 for boys and 14 for girls in England, 8 for boys and 6 for girls in Scotland, containing 6,248 children, made up as follows, viz.:—In Protestant schools, 2,967 boys and 694 girls in England; 781 boys and 187 girls in Scotland. In Roman Catholic schools, 1,052 boys and 186 girls in England; and 272 boys and 109 girls in Scotland.

The number admitted, during the year 1868, to all the schools was 1,649; that is, 1,319 boys, and 330 girls; and the per-centages of the ages of these children was as follows:—

	Boys.	Girls.
Under ten years	1·28	·60
From 10 to 12 years	15·69	15·15
,, 12 to 14 ,, ...	39·27	39·09
,, 14 to 16 ,, ...	43·74	45·15

The criminal status of these children is shown by the number of previous convictions. It stood thus:—

Per-centage.

	Boys.	Girls.
Not before convicted	48·82	77·27
Once ,, ,, ...	34·34	17·87
Twice ,, ,, ...	11·06	3·03
Three times ,, ...	4·09	1·51
Four times ,, ...	·83	·03
Five times and upwards....	·83	—

From this, it would appear that the average age of the girls is greater at entering the schools than that of the boys, but that, nevertheless, their criminal status is considerably lower. It is an interesting fact to note the difference in the criminal status of the children admitted in 1868 with those admitted in 1858, as shown by Mr. Sydney Turner's interesting report:—

Category.	Number actually committed in 1858.	Number in each category which would have been admitted in 1868, if the scale of 1858 had been preserved.	Number actually admitted in each category in 1868.
Not before convicted ..	395	646	899
Once................	311	508	512
Twice	148	242	156
Thrice	70	114	59
Four times and upwards	85	139	23
Total	1,009	1,649	1,649

There can be no doubt, therefore, that the intensity of the crime in the juvenile offenders has decreased, though, unfortunately, the total number of such reprobates under sixteen years of age has considerably increased since 1860, as will be seen from the following table, giving the number of juvenile offenders under 16 years of age:—

Years.	England and Wales.	Scotland.	Total.
1860	8,029	1,062	9,091
1861	8,801	1,212	10,013
1862	8,349	1,120	9,469
1863	8,459	1,075	9,534
1864	8,857	1,036	9,893
1865	9,640	1,041	10,681
1866	9,356	1,061	10,417
1867	9,631	1,070	10,701
1868	10,079	1,186	11,265

In England and Scotland together, the number of criminals under sixteen, to that of adult criminals, is about in the proportion of one to fifteen; but in England and Wales alone, it is as one to thirteen, whilst in Scotland, but one in twenty-two. It is much to be regretted that, of these 11,265 criminal children under sixteen, only a little over half, that is, 6,248, are in a reformatory school.

The regulations concerning the license system at the reformatories are similar to those in force at the industrial schools. In 1868, there were 749 boys and 78 girls thus satisfactorily disposed of.

The remarks made concerning the advisability of combining industrial schools into larger institutions apply equally to these reformatory schools. Comparatively few provide for more than 100 children; the largest, that at Redhill, containing 280. The average number of children to each officer is a little over nine, but in many places this is largely increased. The fluctuations in the staff show that a more complete organisation would be desirable and economical. Thus, for instance:—

Schools.	Number of children.	Number of officers.	Number of children to each officer.
Monmouth	19	3	6·3
Dorset	42	3	14·
Hants	54	7	7·7
Liverpool Farm	111	9	12·3
Kingswood	125	11	11·3
Brook-green	131	11	11·9
Wandsworth	134	14	9·5
North-Eastern	157	13	12·
Market Weighton	211	18	11·6
Mount St. Bernard	258	23	11·2
Redhill	280	33	8·4*

In a similar manner the fluctuations in the cost per head vary quite out of proportion to the expensiveness of the locality, being as low as £11 6s. 6d. at Toxteth-park, Liverpool, with 48 girls, and as high as £37 18s. 9d. in Glasgow, with 129 boys. Even deducting the somewhat exceptional loss on the industrial work of £5 7s. 1d. per head, the charge of this latter institution is still as high as £32 11s. 8d.

Considering that the large part, if not all, the cost of these schools falls on the public, as the income is derived in a similar way to that of the industrial school, and as the children are not liable to be removed when once convicted, it would seem clearly advisable to concentrate these establishments in cheap and healthy neighbourhoods. It is reasonable to suppose that, if at Toxteth-park with 48 children, each costs but £11 6s. 6d., large institutions of 1,000 children or more might be done at the same, or even at a slightly less cost. The average cost for all the reformatory schools is £18 19s. 10d. per head, and were this, by some better organisation, reduced to, say, £11 19s. 10d., which is considerably more than Toxteth-park costs, a saving of no less than £43,736 would be effected, sufficient to provide for 3,740 more children than are at present benefitted.

* It should be stated that in this every official is included, even a messenger.

The results of the schools, as indeed is found invariably the case with institutions combining mental and physical training, are highly satisfactory. Of the 11,402 children discharged up to the end of 1868, only 554, or 4·8 per cent., were re-convicted. Here, again, great differences exist in different schools. Thus:—

Of the boys—

At the Monmouth school 16·6 per cent. were re-convicted.
,, *Clarence* ship.... 15 ,, ,,
,, Parkhead school 14·6 ,, ,,
,, Leeds .... 11 ,, ,,
,, Glamorgan .... 10·2 ,, ,,
,, Berks .... none ,,
,, Sunderland .... none ,,
,, Hants .... none ,,
,, Leicester ...... none ,,
,, Northampton .. none ,,

Of the girls—

At the Dalry school 12 per cent. were re-convicted.
,, Paisley .... 8·8 ,, ,,
,, Rescue .... none ,,
,, Ipswich .... none ,,

It is also found that fewer girls are re-convicted than boys, the figures being:—

	Boys.	Girls.
England	4·41	2·96
Scotland	8·37	5·5

And also that the Scotch schools are not so successful as the English, nor do the Roman Catholic institutions have equal results to the Protestant ones, as 7·3 per cent. of the children of the former are re-convicted to 4·2 of the latter.

During the year 1868, exactly 1,300 children were discharged from the 64 reformatory schools, that is, 1,032 boys and 268 girls. Their immediate occupation was as follows:—

	Boys.	Girls.
For employment	31·10	47·01
Returned to friends	29·74	40·67
Emigrated	9·88	—
Sent to sea	15·79	—
Enlisted	1·26	—
Discharged on account of disease	1·26	2·61
Discharged as incorrigible, or to penal servitude	·58	1·49
Transferred to other schools	1·74	1·49
Died	3·10	3·35
Absconded, and sentence expired	5·03	3·35

The reformatory school at Redhill must be taken as one of the best, as it is the largest institution of this description. It was founded in St. George's-fields, Southwark, about the year 1790, its principal purpose being to take charge of the children of the criminals executed at the Old Bailey. In those days, it must be remembered that a large number of people were hung for comparatively trivial offences, and consequently the number of children left absolutely destitute was considerable. Of late, the school has been somewhat changed, not only by being moved and converted from an ordinary industrial train-

ing institution, into one where farming is the chief occupation, but also in the nature of the children provided for. These are now all, with two or three exceptions, criminals themselves, and not merely the children of such.

The school farm consists of 300 acres, of which 40 are hired, in a beautiful situation, about a mile and a-half from the Redhill Junction Station, and comprises the chaplain's house, chapel, hall, infirmary, laundry, bakery, and five distinct houses, named Queen's-house, Gladstone's-house, Garston's-house, Waterland's-house, and Gurney's-house. Two of these have been added, by private liberality, since 1849, when the school first commenced work here. Each of these houses contains accommodation for about sixty boys, and is quite a distinct school, having a separate master, and complete accommodation, so that, except for general superintendance and collection at church, the whole institution must be considered as comprised of five different schools.

The mental training of the boys is not gone into very largely, three hours every alternate day being devoted to it; the rest of the time being entirely taken up in industrial occupation. Of the 99 boys admitted in 1868—

47 could neither read nor write.
13 could read only very imperfectly.
23 could read and write imperfectly.
13 could read and write fairly.
3 read and write well.

The occupation of the boys is as follows:—

Field	194	boys.
Cow-house boys	14	"
Shepherds	2	"
Stable	3	"
Garden	10	"
Brickfield	16	"
Tailors	13	"
Stonemasons	11	"
Carpenters	3	"
Blacksmiths	3	"
Bakers	2	"
Bricklayers' labourers	1	"
House-boys	13	"
Laundry	3	"
Cooks' boys	2	"
Total	290	"

The work is done in gangs of boys, under an industrial trainer, who reports every week to the master of the house to which each boy belongs, as to how he has worked, and a payment, varying from 2d. to 4d. is accordingly allowed to each juvenile labourer. This money is kept in a separate account for each boy, who is allowed to spend it on certain articles. He is not permitted to have it in his possession; in fact, so strict is it necessary to be, that no boy may have any money in his possession at all, but must, on pain of forfeiting all his earnings, give up to the master any sum which may be presented to him by friends or otherwise, his account being credited with all such items. Postage-stamps, hair-oil, gloves, treacle for puddings, and expense of holidays, are the usual items of expenditure, the boys' balances varying in amount from a shilling or two to as much as a sovereign. The total amount thus paid the boys for labour was, in 1868, no less than £180 5s. 11d.. On leaving the school for employment, this becomes the property of the boy, but it frequently remains in the hands of the chaplain for some time, being drawn upon as occasion requires. By this means the after history of each inmate is often known for some years. In addition to this pay, an allowance of 1d. a-week is made for each good-conduct stripe. These stripes are awarded to those who, for a certain number of months, are without bad marks, and their names, with the number of months they have been on the good list, is printed on a board, placed over the fire-place in each school. The honorary pay for high-standing, in 1868, was £23 12s. 9d.

The shoes of all are made, and the repairs are done, on the premises, as also the cloth clothes. The socks are purchased, but entirely mended by the boys. The boys do all the washing, the baking, the whitewashing, painting, and repairs, both to the premises as well as to the tools and implements employed on the farm; and every boy, with but very few exceptions, is taught to milk easily and quickly. In all these branches of work the same plan of payment as in the farming is adopted, and works with great success.

Punishments are not so numerous as the class of boys might lead one to imagine; they consist of confinement in a cell, and, in extreme cases, of which seven occurred last year, flogging is resorted to. One great temptation to boys, on their first joining the school, is that of desertion. They have been confined in prison with bars and walls, and when they see the perfect freedom of the open country, they are tempted to run away. To prevent this by supervision would be both difficult and costly; but a simple method of interesting all in stopping anything of the sort answers excellently. If a boy runs away, every one in the school is fined fourpence, and all the costs incurred in recapturing the fugitive are borne by the school to which he belongs. It is argued that no one runs away without his friends knowing of it, and consequently, by each having an interest in preventing desertion, all do their best to stop its occurrence. In 1868, only five cases occurred, which put the boys in the different houses to a cost of £5 5s. 11d.

Fines are also imposed for bad conduct, and the holiday of two days, which is granted to each boy who earns a position by good conduct, and who has respectable friends, is liable to be stopped altogether, or reduced or increased by a day, for bad or good conduct marks. No boy, unless he has a good conduct stripe, is allowed to go off the premises for a message; and by such encouragements, warnings, and appeals to the pocket, which latter are usually the strongest, the discipline of the school is largely maintained, without resorting to severer measures, even with these rough natures. A systematic drill is carried on twice a week, and a good band has been formed among the boys, both of which measures conduce greatly to the improved discipline of the establishment.

The health of the boys is remarkable, the infirmary being used but for eight cases in the year, and no death having occurred among the three hundred children for over three years. The entire drainage is now on the dry-earth system, which answers admirably. When the schools were first started, an elaborate plan of water drainage existed, but this was found so deficient as to lead to the adaptation of the buildings to the earth method, the whole refuse being applied directly to the farm lands.

The cost of the institution is certainly high, amounting to £19 7s. 5d. per head, with but about 4s. 8d. for rent, as the premises, except 40 acres, are free, and after allowing for the profits on the industrial work of £5 1s. per head. The food per week is 3s. 4½d., and the clothing 8¼d., leaving the large sum of over £8 10s. per head for other expenses. The industrial pursuits are all remunerative, but more particularly so that of brickmaking, which is carried on only during the summer months, at a profit, in 1868, of £94 7s. 4d., on nearly 250,000 bricks.

The chief point to consider with these schools, is, after all, their results. Considering all the children have been convicted, some, indeed, many times (in one instance, a boy from London, of from 12 to 14 years of age, who could neither read nor write, no less than ten times), it may fairly be stated that, practically, all the children would, if left alone, be permanent criminals, and be to their deaths at least unproductive burdens, if not destructive agents to society. Consequently, it is

not too much to say that all who turn out well are so many thieves converted into useful citizens. In 1865, 1866, and 1867, at the Redhill school 234 children were discharged; 76 emigrated and 158 were disposed of at home. Of these:—

	Emigrants.	Home Disposals.	Percentage on the whole 234.
Had not been re-convicted up to 31st Dec., 1868	93·42	75·95	81·60
Had been re-convicted	5·26	22·15	16·67
Not known..........	1·32	1·90	1·71

Every effort is made to induce the boys to emigrate. In the case of orphans, the difficulty is not great, but of course it is necessary to get the parents' consent when there are any, and in most cases these feel that, by sending their children away, all hope of assistance from them is at an end; the per-centage of failures above given shows that the temptations to boys with their relations are more than four times as great as when removed, in a foreign land, from their evil influences.

The numbers as they stand above, show that 80 per cent. are really reclaimed; and, as the cost per head in the school is nearly £20, the cost of each reclaimed one, so to speak, is £25 a-year; and, as the term at the school averages three years, it follows that each reclaimed lad costs the country £75. Had he been left alone, the best thing that he could have done for the community would have been to remain in the workhouse for, say twenty years, at a cost of at least 7s. per week. He would, therefore, have cost £365; but, in all probability, he would, as a professional thief, have wasted ten times that amount. The reformatory schools, though doubtless capable of improvement and better organisation, are, therefore, evidently effecting a great and most lasting benefit to the community.

Fine Arts.

Prints and their Production.—Members may be interested in knowing that some additional examples of prints produced upon an analogous principle to that described by Mr. Davenport under the title of the "Albert Type," have been added to the colllection which is still on exhibition at the Society's House. The examples added are called "Lichtdruck," or a new mode of photographic printing, introduced by Messrs. Ohm and Gropman, of Berlin. The process is stated to be "capable of yielding any number of impressions, which can be printed upon unprepared paper with equal effect to copper and lithegraphic prints in distinctness of colour, outline, delicacy, and indestructibility." The process is simple. A plate for printing can be prepared in a short time upon common glass from a negative. The outlay is not costly, as neither gold nor silver preparations are needed. One penny will cover all the expenses in materials to prepare a common-sized plate, and if an impression be taken in the morning, several hundred Lichtdrucks of the finest finish can be ready by evening. The outlay for the peculiarly constructed printing press, and a few minor utensils, is very moderate, and within the reach of any photographer. Any description of paper is adapted for this kind of printing, while for highly-finished prints the inventors use another class of paper, specially prepared by themselves. They are now establishing an academy to teach their new system of Lichtdruck to a select number of pupils at Berlin, and intend to do the same in this country, where Mr. C. F. Jessen, Allemannia-offices, 6, Ship-alley, Bradford, has been appointed agent for the sale and licensing of the process. The seven examples received from Mr. Jessen consist of portraits, architectural and pictorial subjects, a physical map, and an osteological specimen.

Manufactures.

Employment of Girls in French Factories.—Great complaints are made of the severe labour to which children are subjected in the silk-winding establishments of Lyons and other parts of France, and the government is now occupied with a plan of reform. In order to stimulate public opinion on the subject, Dr. Ducaisne gives an account of the regulations of a silk-spinning establishment in Paris, where the labour of children has been carefully adapted to their powers. The following is the doctor's account of the distribution of the day in these works:—The children, girls, are not admitted till they have attained the age of twelve. They rise at five o'clock, make their beds, the elder girls dressing and combing the younger. Prayers in the chapel at half-past five. After the prayers, the elder girls remain for a time in the chapel for meditation. The little ones are taught in classes, and the rest are employed either in house-work or sewing. At half-past six, breakfast, followed by play. At seven, needlework for half-an-hour, the catechism being read aloud, and the girls questioned upon it. From half-past seven to a quarter to twelve they are employed in the factory, after which they have a second meal, listening to a reader during the time, then play again till a quarter to one. Needlework for the elder and reading classes for the rest, till a quarter past two, when they go to the factory again and work till seven o'clock, when evening-prayers take place in the chapel; supper is there served, reading taking place during the time, as at dinner. The day finishes with recreation, in summer, or needlework in winter. The day is thus employed:—

Silk-winding	9	hours.
Needlework	1	"
Primary instruction	1½	"
Household work	1	"
Meals and play	2½	"
Sleep	9	"

The meals are arranged as follows:—Morning, soup and bread; ten o'clock, a piece of bread in the factory; twelve o'clock, soup, meat, and vegetables; three o'clock, bread in the factory; evening, soup and vegetables. Most of the girls are orphans; they are engaged by agreement with a relative, or some one answering for them, till the age of twenty, when they receive a trousseau and a sum of money, varying from £12 to £26, being the amount of the prizes distributed at the end of each year, for industry and good work.

Commerce.

Customs-house Frauds.—For some years past shipments of cases with tobacco linings, and filled up in the interior with rubbish, to make up the requisite weight, have been received in Melbourne from New York, and although these dummy shipments have been consigned to certain firms, the consignments have in every instance been repudiated, as they have been sent to them without their knowledge and consent. The reason of these strange shipments is thus explained:—In New York there is a drawback allowed on tobacco, and in order to obtain it from the Customs of that city, this ingenious plan is adopted. A thin layer of tobacco is sufficient to mislead the American Custom-house officers; and that the swindle on the United States revenue is still perpetrated is evident from the fact that, although the Customs authorities at New York have been communicated with, the shipments still continue to arrive.

TOBACCO CULTURE IN BAVARIA.—Bavaria produces about one-fifth of the entire quantity of tobacco grown within the limits of the German Customs Union Territory, as will be seeen by the return of the tobacco produced in each of the different States in 1866:—

Baden	243,740 cwt.
Prussia, including the newly-annexed States	222,324 „
Bavaria	135,659 „
Hesse Darmstadt	36,402 „
Wurtemberg	6,760 „
Saxony and Thuringian Duchies	18,533 „
Total	663,418 cwt.

MADDER IN HOLLAND.—There are in the province of North Brabant 23 stores and manufactories of madder, employing 300 workmen. That of Steenbergen produces 350,000 kilos. of madder pulverised, and 84,000 of roots. In the furnaces there was dried, in 1865, 800 kils. of stripped madder and 36,000 kils. of roots. The manufacture of garancine furnishes annually 42,000 kils. for exportation. The four furnaces in Zevenbergen furnished 170,000 kils. of dry products, and 64,000 kils. stripped bark. The preparation of madder and garancine in Thiel employs only 25 workmen, who are not in a very prosperous position. In South Holland there are 26 manufactories, employing about 207 workmen. In North Holland there are 12 drying stoves; one at Beverwick, which supplies 500,000 kils. of roots; one at Amsterdam, which makes garancine, and which at the same time distils alcohol. It has two steam engines and three boilers, with heating-pipes, which employ 50 workmen; one at Zeipe and one at Schotin, which produced, in 1865, 477,000 kilogrammes, dried in five furnaces. They have tried for the first time to dry madder by steam, and to grind it by millstones, moved by a steam-engine of 10 horse-power. There are in the 44 communes of Zealand 74 furnaces, employing 700 workmen. This province furnishes the principal part of the madder and garancine. There is prepared there annually 10,000 barrels, and 150 kilogrammes of ground madder. The annual yield in Zealand is 6,600,000 kilogrammes of madder roots. It is in the islands of Schowen and Duiveland, and in the zone of land comprised between the mouths of the west Escouit and the confines of Belgium, that they cultivate the best roots, and those most in esteem for their colouring matter. The mean estimate of the yield per hectare is, for the bi-annual plant, 2,000 to 3,000 kilogrammes; for the triennial, 3,500 to 5,000 kilogrammes. Seventy-eight machines, moved by steam, pulverise the madder or dry and beat the roots in Zealand. In 1863, there was delivered 11,000 casks, of 500 or 600 kilogrammes, of pulverised madder, and 1,500,000 kilogrammes of roots. They also make garancine at Middelbourg, Zienkzee, and Goes, where 100 workmen are employed when all the machines are in motion.

MANILLA HEMP.—This is obtained from the wild plantain, which is cultivated in many parts of the Philippines, but more especially in the provinces of Albay and Camarines, in the south of Luzon. It is planted in the rainy season, and is propagated with ease in the same manner as the common plantain. A hundred plants occupy about 1,000 square yards of land. The method of preparing the fibre is as follows:—The plant, after having reached the age of between two and three years, is cut down, and stripped of its folds. These are then divided into pieces of three or four inches wide, and the pulpy or fleshy part separated by the process of drawing them under a knife fixed for the purpose. The fibre is thus laid bare, and is then placed in the sun to dry. If the plant be left on the ground for any length of time after it has been cut down, the fibre made from it assumes a reddish tinge unsuited to commerce, the sap changing and discolouring the fibre. Fifty trees produce about 25 pounds of fibre. The total production of this misnamed "hemp" in the Philippines, in 1867, was about 400,000 piculs.

INDIGO IN THE PHILIPPINES.—This plant is grown in the provinces of Pangasinan and Illicos. It is sown in November, and the crop gathered in June. Its quality being inferior, owing in a great measure to a want of knowledge of the process of its manufacture, and the profit to the grower being exceedingly small, few care to employ their time in its cultivation. The total annual production of indigo is seldom in excess of 5,000 quintals.

Colonies.

DIAMONDS IN NEW SOUTH WALES.—The *Australian* states that an extensive area of ground has been taken up on the Cudgegory River, New South Wales, the only locality as yet on which diamond mining has been prosecuted on a large scale in that colony. The Australian Diamond Company have so much confidence in their enterprise, that they have resolved on working their gem manufactory by steam, and not long since they despatched a steam-engine to the spot. A diamond, stated to weigh three carats, was discovered at Sebastopol by a party of mariners. Diamonds have also been found along the greater extent of the Reedy Creek, at Eldorado woolshed, and higher up, at Woorage. Precious stones have also been discovered in New Zealand, and it is expected that some important discoveries will be made.

THE CANDLE-TREE IN AUSTRALIA.—Dr. Schomburgk, Director of the Botanic Gardens, South Australia, writes as follows:—I have at last secured and received per mail from Mr. W. Bull, F.L.S., F.G.S., in London, a packet of the celebrated candle-tree *(Parmentiera cerifera)* of Panama. If I succeed in growing the seed and acclimatising the plants, it will probably prove an introduction of importance. This tree is confined to the valley of the river Chagres, Isthmus of Panama, and was discovered in 1866, and introduced by Dr. Siemann to England. He says:—"On entering a forest of these trees, a person might almost fancy himself transported into a chandler's shop. From all the stems and lower branches of these trees hang long cylindrical fruits, of a yellow wax colour, so much resembling a candle as to give rise to the popular appellation, "palo de velas" (candle-tree). The fruit is generally from two to three, but not unfrequently four feet long, and about an inch in diameter. It has opposite bifoliated leaves and large white blossoms, which, in its native habitat, are grown throughout the year, but are in the greatest abundance during the rainy season. Previously, only one species of *Parmentiera pendulus* was known to exist, the fruit of which, called "quamxilotte," is eaten by the Mexicans, while that of *Parmentiera cerifera* serves for food to the numerous herds and cattle.'" Dr. Schomburgk believes there is little probability of success in the open air, except in the moisture of a tropical climate, but in conservatories, where there are the requisite appliances, there will be no difficulty in getting the plants to grow.

Obituary.

THOMAS CRESWICK, R.A.—The Academy has lost another of its members, whose works have become universally known to the frequenters of its exhibitions. Thomas Creswick was born at Sheffield, in the year 1811. He was educated at Hazelwood, near Birmingham, whence he proceeded to London for the purpose of studying art. Mr. Creswick became first known as a landscape painter by his pictures of Welsh streams, which, by their exquisite combination of rock, foliage, and river, excited universal admiration. In 1842, he was elected an associate, and, in 1851, became a Royal Academician.

After this period he produced his greatest works, amongst which may be classed his "England," "The London Road a Hundred Years Ago," and the "Weald of Kent." In 1848, he produced his "Home by the Sands," and "A Squally Day;" and, in 1850, his "Wind on Shore" and "Over the Sands." His "Evening on the Banks of the Thames" was produced in 1867. Some of his works were engraved for Marshall's Annual. Mr. Creswick took an active interest in the early efforts to resuscitate the Society of Arts, and was a member of the Council several years. He died on the 28th inst., at The Limes, Linden-grove, Bayswater, in the fifty-eighth year of his age.

Notes.

Patent Laws.—At a meeting of the Manchester Institution of Engineers, to be held on Tuesday next, the 4th of January, in the Town Hall, Manchester, the subject of the "Patent Laws" will be discussed. Mr. T. Aston, barrister-at-law, will read the opening paper, and the chair will be taken by Mr. John Platt, M.P., at three o'clock. The reading of the paper will be followed by a discussion on the important questions relating to the granting patents for inventions, and the amendments that are needed in the existing laws.

MEETINGS FOR THE ENSUING WEEK.

Mon......Entomological, 7.
Medical, 8.
Victoria Inst., 8. The Rev. J. H. Titcomb, M.A., "On the Origin of the Negro."
Tues ...Pathological, 8.
Anthropological, 8.
Syro-Egyptian, $7\frac{1}{2}$. Mr. W. H. Black, "On the Suez Canal."
Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)
Wed ...Pharmaceutical, 8.
R. Society of Literature, $4\frac{1}{2}$.
Obstetrical, 8.
Thur ...Royal Society, $8\frac{1}{2}$.
London Inst., $7\frac{1}{2}$.
Royal Society Club, 6.
Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)
Fri ......Geologists' Assoc., 8.
Sat ......R. Botanic, $3\frac{3}{4}$.
Royal Inst., 3. Prof. Tyndall, "Light." (Juvenile Lectures.)

Patents.

From Commissioners of Patents' Journal, December 24.

Grants of Provisional Protection.

Bookbinding, sewing apparatus used in—3598—J. G. Tongue.
Bottles, &c., closing and stoppering—3565—C. A. McCalla.
Candle lamps—3606—R. W. Bernard.
Carding machines, &c., feeding—3600—P. C. Evans and H. J. H. King.
Cartridges—3577—W. Downing.
Casks—3561—J. Hamilton and R. Paterson.
Castors for tables, &c.—3608—T. Moore.
Cements—3373—J. Thomlinson.
Door knobs, &c.—3586—T. Moore.
Door knobs, &c., fastening—3287—P. Koch.
Earth closets, &c.—3634—J. Heap.
Electric telegraph cables, &c.—3587—W. A. Marshall.
Electro-magnetic circuits, making and breaking—3620—W. R. Lake.
Fibrous materials, doubling and winding—3612—W. and W. McGee.
Fire-arms—3557—W. Tranter.
Fire-arms, breech-loading—3589—W. C. Green.
Flax, &c., machinery for preparing—3392—S. Cotton.
Friction, apparatus for reducing—3633—J. H. Johnson.
Furnace bars and furnaces—3611—W. Hepple and M. Stainton.
Granaries—3622—E. Johnson.
Hair, tubular apparatus for brushing and wet-rubbing—3531—H. P. de Meyrignac.
Horse shoes, &c., machinery for forging—3523—W. Shanks.
Iron and steel—3604—R. J. Carpenter.
Laths, &c., machinery for cutting timber into—3590—H. Wilson.
Liquids and fluids, forcing and projecting—3529—D. Robertson, W. L. G. Wright, and J. More.
Looms—3609—J. Barlow and E. Pilkington.
Looms—3623—W. K. Stock.
Looms, harness for—3615—W. E. Newton.
Lubricators—3594—J. and J. Turner.
Metals, cutting and boring—3602—W. Asquith, G. Booth, and G. Pickersgill.
Motive-power engines—3585—W. I. Hetherington.
Motive-power engines—3642—J. Outram.
Net machines—3603—H. E. Newton.
Organs, apparatus for blowing—3601—A. Barr.
Packing hoops, &c., connecting the ends of—3567—H. Whittaker and W. Bradbury.
Paper-cutting and folding apparatus—3582—W. E. Newton.
Pipes and conduits—3618—W. C. Homersham.
Portfolio for filing music, &c.—3584—E. Simcoe.
Pumps—3619—N. P. Burgh.
Railway chairs—3553—H. S. Rush.
Railway rails, connecting—3572—T. S. Sarney.
Railway signals and switches, &c.—3574—W. Baines.
Railway wheels—3640—G. Wilson.
Refrigerators—3613—R. Morton.
Rotary engines—3446—G. B. McFarland.
Rotary engines—3616—W. E. Newton.
Rotary sieves—3599—E. A. Cowper.
Screw bolts, manufacturing untapped nuts intended for—3593—P. Koch.
Screw nuts, &c., cutting—3614—P. Parkes.
Seed-sowing machines, &c.—3627—J. H. Sams.
Shell brooches, &c., ornamenting—3573—A. M. Clark.
Ships, propelling—3626—J. Outram.
Ships, propelling and steering—3007—S. Barber.
Ships, propelling and steering—3579—G. White.
Ships, undulating propellers for—3563—J. F. Alexander.
Ships, &c., constructing—3631—G. Seymour.
Ships, &c., raising above the surface of the water—3610—B. B. de Morell.
Shuttle sewing machines—3576—W. Yeoman and J. Gilbert.
Shuttles—3559—D. Clayton.
Sliver or yarn, putting twist into—3592—T. Rawsthorne.
Smoke, &c., consuming—3569—G. F. Logan.
Steam boilers—3588—H. and F. C. Cockey.
Steam boilers, preventing incrustation in—3617—G. W. Honeyman.
Street tramways, &c.—3607—J. Livesey.
Submarine railway tunnels, &c.—3591—W. Williams.
Sunshades and umbrellas—3571—J. Willis.
Tramways—3575—R. J. Ransome, J. Deas, and R. C. Rapier.
Velocipede carriages and vehicles—3638—S. Johnson.
Velocipedes—3570—W. E. Gedge.
Velocipedes, apparatus connected with—3542—C. Wyndham.
Veneers, cutting—3605—J. Gardner.
Waggons, &c., drags for—3629—T. Parry and J. McHardy.
Weaving apparatus—3596—G., J., and M. Oldroyd, jun.
Weighing machines—3644—F. E. Duckham.
Wood-moulding and panelling machines—3628—E. T. Hughes.
Wool, &c., machinery for pressing—3555—W. Johnson.
Woollen yarns, &c., spinning—3632—J. S. Battye.
Worsted, &c., spinning—3568—H. Kershaw.

Patents Sealed.

1617. A. Brooman.
1904. G. Musgrove.
1911. W. R. Lake.
1915. W. Spence.
1919. O. Zabel.
1927. J. Macintosh.
1940. W. Madders.
1947. T. Gray.
1955. G. T. Smith and C. Challenger.
1961. W. Blackburn.
1962. E. T. Hughes.
1963. W. Bartram.
1965. R. H. Courtenay.
1971. D. Hebson.
1980. W. Coleman & S. Turton.
1986. A. Barclay.
1987. L. F. Banks.
1992. T. Jones.
1994. H. A. Bonneville.
1998. G. White.
2019. J. Clark and A. Ewing.
2038. W. Q. East.
2061. I. Williams and C. Wallendahl.
2063. W. Hutchinson.
2078. T. Kendrick.
2112. A. V. Newton.
2158. E. F. Jones.
2728. S. A. Varley.
2847. H. L. Bolger & J. Meekin.
2859. A. Bodart.
2893. T. Adams.
2896. C. E. Spooner.
2907. E. Tyer.
2930. J. Wallace.
2946. W. C. May.
2955. T. Greenwood & J. Keats.
3070. J. Buchanan.
3086. T. Deichmann.
3093. W. R. Lake.
3114. J. Wakefield.
3120. J. B. Elkington.
3133. M. Clemens.
3218. N. Shaw.

From Commissioners of Patents' Journal, December 28.

Patents on which the Stamp Duty of £50 has been paid.

3382. J. S. Benson and J. von der Poppenburg.
3434. W. Clark.
220. C. Wheatstone.
3417. W. Smith.
18. W. Chippindale.
237. P. Jack, jun., and A. Coulthurst.
3391. E. Allen.
3415. J. E. Brown.

Patents on which the Stamp Duty of £100 has been Paid.

3438. W. Henderson.
3442. R. Lakin and J. Wain.
3482. W. B. Adams.
3453. C. F. Varley.

Journal of the Society of Arts.

FRIDAY, JANUARY 7, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock :—

January 19.—"On the Coral and Pearl Fisheries.' By P. L. Simmonds, Esq., F.S.S.

January 26.—"On the Modes of Reading in Use by the Blind, and the Means for Arriving at Uniformity." By Thomas Armitage, Esq., M.D.

February 2.—"On Recent Improvements in Small Arms." By Capt. O'Hea.

INDIA COMMITTEE.

On Friday evening, January 21st, the discussion of Mr. Andrew Cassel's paper, "On a Gold Currency for India," will be resumed by Dr. Boycott, late of the Calcutta Mint.

THE LIBRARY.

At a meeting of the Library Committee, it was decided to provide for each member of the Society a transferable ticket of admission. This ticket will admit any friend to the use of the Society's Library and Reading-room. It is hoped that this arrangement may afford a convenient privilege to members, and extend the usefulness of the Society. The tickets are now in preparation, and will, at an early day, be sent round to the members.

DONATIONS TO THE LIBRARY.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors :—

The Parks, Open Spaces, and Thoroughfares of London, by Alexander Mackenzie; presented by the author.

Thirty-third Annual Report of the Art Union of London, 1869; presented by the Art Union.

Narrative of the Voyage of H.M. Floating Dock *Bermuda;* presented by John B. Day.

A Century of Birmingham Life, or a Chronicle of Local Events from 1741 to 1841, by John Alfred Langford; presented by the author.

Handy-book on the Registration of Shipping, by John W. Wood; presented by the author.

Geography, in its Relation to History, a lecture delivered at the Birkbeck Institution, by Professor W. Hughes; presented by the author.

MEMORIAL TABLETS.

Since the last announcement,* the following tablets have been fixed on houses formerly occupied by—

Benjamin Franklin, 7, Craven-street, Strand, W.C.
Sir Joshua Reynolds, 47, Leicester-square, W.C.

Leave has also been obtained to affix similar tablets to the former residences of Lord Nelson, John Flaxman, George Handel, John Dryden, Sir W. Blackstone, and Oliver Goldsmith.

* Vol. xvi., p. 584.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF INSTITUTIONS.

East Lancashire Union of Institutions.—The following is a summary of the work of this union for the year 1869, which now comprises twenty institutions and evening schools, containing in the aggregate about 3,000 scholars. The spring examination of evening schools was held on April 3rd, and was attended by 81 candidates (58 males and 23 females), of whom 47 males and 16 females were successful. The summer examination was held collectively, at Burnley, on Saturday, June 12th, and was attended by 158 candidates (150 males and 35 females), of whom 124 males and 35 females were successful. The total value of the book prizes awarded during the year is £41 9s. 0d. In the autumn of this year, Miss Burdett Coutts offered a special prize to that female candidate who had attended the classes of her institution most regularly for the twelve months ending June, 1869, and who had made most progress, from the examination of 1868 to that of 1869, in practical needlework, including cutting-out, and, in the written examination, in domestic economy and cooking. This prize, which consists of a workbox, Miss Coutts has awarded to a female student of Bacup Mechanics' Institution. The establishment of a systematic teaching of science by the organising masters of the union, in 1858, was the earliest well-arranged scheme for science instruction, on an adequate scale, to the industrial classes of Lancashire, and science teaching has steadily progressed in East Lancashire since that date. There are now 32 science classes connected with the work of this union, including a special class for certified schoolmasters, taught by the organising master, on Saturday mornings. Art classes are also held at four of the principal institutions. There are also in the district a number of other science classes which owe their origin indirectly to the East Lancashire Union.

CIRCULATION OF WORKS OF ART TO LOCAL INSTITUTIONS.

At the request of the Mayor of Manchester, Mr. Birley M.P., &c., Mr. Cole attended a meeting at Manchester, on 20th December, in the Mayor's Parlour, Town Hall, King-street, when he delivered an address on the "Educational Advantages of Circulating the Works of Art from South Kensington Museum." The Mayor of Manchester presided, and in introducing Mr. Cole to those present, he said that meeting had been held for the purpose of allowing Mr. Cole an opportunity of explaining the principle on which the art-treasures in

the South Kensington Museum were distributed to the public.

Mr. Cole said although Manchester had several times taken advantage of the government circulation of objects of art to local schools, museums, and other institutions, he had readily availed himself of an invitation which their member, Mr. Birley, had made to him, to come to Manchester to explain fully the principle on which this circulation took place. He was glad of an opportunity of coming to Manchester, because he felt that it enabled him to speak from an enlarged pulpit—one even more effective than the metropolis itself. He felt, moreover—he did not say it as a special compliment to Manchester—that the intelligence of this district was a little more concentrated than he could find in London, for London was so disjointed that nothing like cohesion existed at all, and heaven only knew if they would ever get it. In Manchester there was a strong local feeling, and there were a great number of towns in direct union; and therefore he thought he might appropriately come to Manchester, as a great populous centre, to explain the principles on which the national art-treasures were distributed. His own conviction for years had been that the present age, with all its vast civilisation, was in relation to the cultivation of the humanities of the people very much in arrear of what it was in the time of their forefathers, say three centuries ago. He was not going to say anything against the present times, as he appreciated a great number of their characteristics; but respecting the question of the cultivation of the instincts and the moral tendencies of the people, he felt we had not arrived at anything like a solution of the problem; and, as compared with the state of things 300 years ago, and before we had turned the Pope out of England, he thought we were very backward. He read in books that, three centuries ago, there was hardly a hamlet or parish—13,000 and more parishes existed then as now—in which they had not practically something like a picture gallery. The churches were the picture galleries; their walls were covered with pictures; and now-a-days they could not go into any old church and scrape off the white-wash without finding pictures, which had been intended for the instruction and elevation of the people. Besides these church picture galleries, art was carried into all kinds of implements. Some of those present had, no doubt, been at Kensington Museum when the "loan collection" existed, and had visited Paris in 1867, when a collection of works of art of past ages were brought together. The comparison of those objects and similar works of the present day was unfavourable to the latter. He boldly said that at the present time, in respect to certain kinds of art, especially in working in metals, the work done was nothing like the work which had been done three centuries ago. If they walked through the colleges of Cambridge and Oxford, where certain works in metal had been preserved, they would soon see the truth of his remark. We were babies in such art as compared with our forefathers. He might say that he believed we were not inferior to our ancestors in many things; but he thought it was something humiliating to see the wretched specimens of race cups which were produced at the present time. Not long ago a friend showed him a cup which he had had the misfortune to win, and he (Mr. Cole) would have thrown it into the gutter if it had been his, rather than live with it. It was a great, huge, monstrous, ill-chased thing, in which the artist had shown no more invention than to crib from Frith's "Derby Day," and plaster it all round the sides, adding three or four wretched little horses as a knob; the whole thing was really detestable. Again, let them consider the question of music. One and all of them thought it right to glorify God by singing hymns in church, but at the present time very little attention was given to the music, in fact, no public attention. We hardly paid any attention to the subject as compared with what it had received three centuries ago. If we looked to the time when Henry VIII. took possession of the monasteries, it would be found that, in every cathedral town in the country, a singing school was formed as part of the organisation of these towns. Stipends were laid out for this purpose, and music was held to be a national concern three centuries ago. He was quite certain it would be a profitable investment on the part of this country to cultivate music nationally. Men could not live by work alone; and so long as those who had the power did not put the right thing before the people, the people must remain in degradation. Could anything be more degrading to the age than the utter destruction of health and morals which the drunken habits of a large body of the people brought about? He felt quite certain that institutions which would cultivate the feelings of mankind, would have a great weight in reducing this calamity. It was no absurd proposition to say that the best mode of warring against these habits of drunkenness was by weaning people to other habits. In London, at this time, there were 150,000 paupers obliged to look to the poor rates for their subsistence, independently of what was done by private charity. If any one cause more than another contributed to the degradation of these 150,000 people, he believed it was drunkenness. He contended that one of the most practical measures which could be taken to stop drunkenness, was to give the people the proper means of enjoying themselves, and of being moral and righteous after their daily work was over. He knew nothing better than this matter of fine art for doing it. He was quite sure that if, in the evening, institutions were opened throughout the land the people would appreciate them and bless the promoters for their endeavours. He might point to South Kensington itself in proof of this. It had been opened for about ten years, and more than nine millions of people had gone there; out of that large number not a dozen persons had been turned out for drunkenness. He thought that was a most extraordinary fact. He maintained that it was an essential part of the education of the people of this country that in some way or other there should be provided the means for the universal cultivation of those things which would humanise the people after their toil was over. Museums and libraries were schools which adults would frequent, whilst they would hardly go to any others. He did not think that they need trouble themselves at present to discuss the question as to whether that ought to be done by local or State action, or by private benevolence, or what not. But he ventured to say that the thing ought to be done and must be done. He would like to say a few words to them as to how we stood in respect to art museums in eemparison with other countries—who, by the way, he might say, were very much inferior to ourselves in many other respects. Let them take France, and go by railway to Marseilles. They would see how the line was connected with numerous local museums of art. At Boulogne, a comparatively small fishing town, they had a fine museum, such as could not be found in any similar town in this country. It was in the main supported by the town, and partly contributed to by the State. Then Amiens, Beauvais, Dijon, Lyons, Avignon, Nismes, all had museums, and, in many instances, large collections of pictures. In Germany and Switzerland the same state of things prevailed. In England, the amount of drunkenness was tenfold, and even a hundredfold more than it was in France and other eountries. He attributed the temperate habits of foreigners greatly to their cultivation of the fine arts. His own belief was that every large centre, every place with ten thousand or more inhabitants, might, if so disposed, have its gallery of art and its museum. Manchester was pre-eminently able to have such institutions. If there was one place more than another which gratified itself by spending its superfluous capital in buying pictures, it was Manchester. The whole of the nobility and gentry of England did not buy half the number of pictures which the rich manufac-

turers of Manchester and the neighbourhood did. He felt quite certain that if a place was permanently kept open, where gentlemen who happened to go abroad could send their pictures to be taken care of, a large collection of works of art would be got together. Then there were men who, like Sir Joseph Whitworth and Mr. Sheepshanks, liked to do good during their own lifetime, and from whom contributions would no doubt be received. He could go into several houses in Manchester and do good service by taking away some of the possessions of the owner, the pictures being too numerous to be properly displayed. It is true they had one or two places in Manchester used occasionally for showing pictures, but no permanent gallery. Manchester, he fancied, was behind Liverpool. Sometimes they extemporised a gallery, as in the case of their member's (Mr. Birley's) factory, where they had got together a good collection of missionary art at the present time. One great use of museums was that they got a class of people to go to them, and who were thereby educated by what they saw, who otherwise would not be educated. He ventured to think the country at large did not make half the use of churches that they might. He dared say that their churches in Manchester were open every night and were crowded. He would like to tell them of a musical experiment he had tried in London, by which he had filled a church to overflowing. He had asked a clergyman for the use of his church for four evenings, and he had undertaken to fill it at every service. He had evening prayers, and he stipulated with the clergymen that the sermon should not be more than ten minutes in length. The people who assembled sang five hymns, and he had reverted to the patriarchal system of using the accompaniments of four silver trumpets and kettle-drums. He had an overflowing attendance at each service, and he assured those present that the solemn and grand effect of these trumpets, with 2,000 voices, was the finest music which he had ever heard in his life. He particularly recommended the use of trumpets, kettle-drums, and trombones, rather than the substitutes for those instruments on the organ. He felt certain that if he lived in Manchester he would have no difficulty in filling its churches with people from the public-houses. Assuming for an instant that Manchester was able to start a fine art institution, it was quite obvious that the collecting of ancient works of art must be slow and difficult. Ancient objects cannot be created like bread and butter. He was sure it would be their own fault if they did not make South Kensington Museum fill it for them. Owens College he hoped to see the central home for science and art in Manchester. The Natural History Museum and its branches would be at the new Owens College. Why not the half-starved School of Art there too? Why not a Museum of Fine Art? He hoped their enlightened corporation would make an annual grant of £5,000 for these objects. He should rejoice to see a system established by which a great storehouse should be established in the metropolis, or somewhere else, from which there should be a distribution of works of art to places throughout the whole country, as provision was made to receive them. Such a system would bring about frequent changes at the various museums, instead of stereotyping works on their walls. The South Kensington Museum sent art-collections as far as it could, and at the present time it had sent to Manchester—to the Missionary Exhibition—at the request of Mr. Birley, the Abyssinian trophies, which had cost the country eight or nine millions of money to obtain. If the government made a national collection of the superfluities which he knew to be in existence, there might be many separate collections of works of art for distribution in the provinces. He thought that the people of Manchester ought to hold their member (Mr. Birley) personally responsible, in some degree, if this suggestion was not carried out. When they established their free library in Manchester, he believed they had contemplated the formation of a fine art institution, such as the one he had referred to. So far as he knew, nothing had yet been carried out; but, having a free library and a rate in support of it, he thought that very little exertion would secure the gallery that was talked about years ago. If the present rate was not sufficient, it might, upon application being made to Parliament, be increased to 1½d. in the pound; and Manchester would thus set a brilliant example to the whole country. The plan of circulating works of art was originated, in 1853, in a great measure by the benevolence of the Queen and the Prince Consort. Her Majesty gave the South Kensington authorities power to go into Buckingham-palace and elsewhere, and select a collection for exhibition at Marlborough-house. Since then 138 local exhibitions in England had been aided by works of art from South Kensington, and although perhaps a million objects had been circulated in different parts of the country, not a single accident had occurred to them. He found that, setting aside the great exhibition at Manchester, the international exhibition at Dublin, and last year's exhibition at Leeds, upwards of three millions of persons had visited these exhibitions. The amount which had been raised by them was £75,000, and the surplus left (£20,000) had been devoted to various educational objects by the localities. They would, therefore, see that the system was sufficiently established to justify a very great extension of it. He believed that no government would object to any pressure for such educational purposes. His belief was that, whatever was to be done for education in this country, must depend greatly upon the expression of opinion through members of Parliament. Economy was very much needed in public administration, but expenditure on educational wants was productive, if wisely administered; and he thought the question of education for all, solved in a wise and liberal way, was the best means of promoting the welfare of the people, present and future.

THE NEW CAB LAW.

On the 1st of January, the Metropolitan Public Carriage Act of last session came into operation, with the order made by the Secretary of State as to licensing and general regulations. To be permitted to use a hackney-carriage or stage-carriage the proprietor must obtain an annual license (at a uniform rate of £2) from the Commissioner of Police, who is empowered to grant such license to any man above 21 years of age who has not been convicted of felony, the carriage having been first inspected and declared fit for public use by an inspector of public carriages. Drivers of hackney-carriages and the conductors of stage-carriages are to take out annual licenses in a similar manner, on a payment of 3s. for it before the 1st of February in any year, or 5s. if on and after that day. The Secretary of State has the power to revoke or suspend any driver's license, upon his conviction of the breach of any of the provisions of this act.

Each carriage is to have a metal plate affixed to it, bearing its number on being certified. The license can be suspended or revoked upon the breach of any regulations. There are ample precautions against possible evasion of liability, by provision against defacement of the distinguishing plates, and for notice of change of residence. The authorities are to be permitted at any time to inspect the premises where the horses and carriages are kept. The fares which each proprietor proposes to charge have to be indicated on the application for the license, but they may be altered on giving fourteen days' notice to the Commissioner of Police. So far, these provisions have an interest confined almost exclusively to proprietors and drivers of carriages.

The regulations in which the public feel an interest may be briefly stated. There is a provision against a larger number of persons being carried than that painted outside the carriage; and as every child is to be counted and charged for as a person, a lady and her two little

cherubs, or paterfamilias with his twin boys, will be deprived the enjoyment of a ride in a hansom licensed for two persons. The existing table of distances is to remain in force. Under the system of "free trade in cabs," which is professed to be established, the fares are of course the difficult question. It is provided that the proprietor shall affix to the top of the carriage, in a socket or by a hinge, a metal flag, on which shall be distinctly painted in black letters on a white ground, or white letters on a black ground, the fares licensed to be charged both for distance and time, the same as mentioned in the written application for a license. The licensed hackney carriage must not ply for hire except on an authorised public standing; and, while there, the flag must be raised on the hinge or fixed in the socket, so as to be plainly exhibited. On the carriage being hired the flag is to be lowered, and not again raised until again plying for hire on a public standing. No fare is to be recoverable in respect of any hiring, unless the carriage hired shall have been plying on an authorised public standing. When hired by distance, and required to stop, the driver can charge a fourth of the fare additional for every fifteen minutes' stopping; and a similar regulation applies to when the carriage is hired by the hour, according to the rate mentioned on the metal.

A shilling is to be the minimum fare, and luggage is to be chargeable at twopence per package when carried outside. The public have one security against being victimised by rapacious cabmen. The driver is to furnish a printed ticket to the hirer, specifying the fares as marked on the plate outside. This will give the latter the advantage of knowing, by the owner's name and number being printed on the tickets, to whom to refer for property accidentally left in a hired cab. It is the driver's duty to look after such property, and there are charges allowed for securing its safe custody and redelivery. Property left in carriages has to be deposited at a police-station, and if it is unclaimed within three months it is to be sold, and a reward of a shilling and upwards, proportionate to its value, is to be allowed to the finder. The penalty for the breach of any of these regulations is not to exceed 40s.

REPORT ON THE FRENCH POSTAL SERVICE.

The Post-office possesses the exclusive right of conveying letters, newspapers, printed sheets and periodical publications, packets and papers, weighing not more than one kilogramme.

The following items form exceptions to the rule:—Letters and parcels sent by servants or special messengers; account books, plans, and charts; papers relating to cases before the law courts; non-periodical publications, provided they contain no manuscript notes, and are not of the nature of circulars; journals, and other periodical papers relating exclusively to the arts, science, literature, or industry, when made up in parcels weighing more than one kilogramme, but not if the separate numbers or examples composing the parcel are addressed to various persons; and invoices or bills of lading accompanying goods, and notes carried by porters engaged in fetching or delivering goods, provided they are open to inspection.

In addition to letters, publications, and papers mentioned above, the post-office undertakes the following services:—

1. Transport of title deeds and papers of value of all kinds.
2. Transport of objects of value of small dimensions, under the designation of *valeurs cotées*.
3. Transport of books, engravings, lithographs, autographs, whether in sheets, or bound.
4. Transport of samples.
5. Transport of visiting cards.
6. Money orders, payable at all the post-offices in France and Algeria, and at any office in any given town; and also orders to the value of 200 francs (£8), between France, Italy, Switzerland, and Belgium. No arrangement, however, exists for the transmission of money between the post-offices of France and England.
7. The French post-offices also receive subscriptions for certain governmental publications, such as the *Bulletin des Lois*, the *Moniteur des Communes*, &c., and even for series, volumes, and parts of such publications.

It will not be out of place to mention here that the railway companies complain greatly of the immense quantity of printed matter and samples which they have to carry for the post-office, and argue that they are not really bound to carry anything but letters and dispatches. The post-office also, it is said, complains of the enormous increase in the quantity of matters which it has to carry, and proposes that some change be made with respect to newspapers, printed matter, and samples.

There are three distinct lists of charges for the conveyance of letters in France:—One for the general country service, a second for local districts or circumscriptions, and a third for the capital itself.

The following is the table of charges between any part of France, Corsica, and Algeria included:—

	Prepaid. fr. c.	Unpaid. fr. c.
Letters weighing 10 grammes or less	0 20	0 30
Above 10 and not over 20 grammes	0 40	0 60
" 20 " 100 "	0 80	1 20
" 100 " 200 "	1 60	2 40
" 200 " 300 "	2 40	3 60
" 300, for each 100 "	0 80	1 20

Charges for letters passing between any two places within the same local provincial district:—

	fr. c.	fr. c.
Letters weighing 10 grammes or less	0 10	0 15
Above 10 and not over 20 grammes	0 20	0 30
" 20 " 100 "	0 40	0 60
" 100 " 200 "	0 80	1 20
" 200 " 300 "	1 20	1 80
" 300, for each 100 "	0 40	0 60

Charges for letters between any two places situated within the fortifications or present limits of Paris:—

	c.	c.
Weighing not over 15 grammes	10	15
" " 30 "	20	25
" " 60 "	30	35
" " 90 "	40	45
" " 120 "	50	55
" over 120 per 30 grs. ..	10	10

The 15 grammes weight is generally considered as the practical equivalent of the English half-ounce; but, although the difference is small, it is in favour of the French rate, the English ounce avoirdupois being equal to 28·3495 grammes.

Taxes on registered letters, on which prepayment is compulsory:—

	All France, Corsica, and Algeria. fr. c.	Within the same postal district in the provinces. fr. c.
Not over 10 grammes	0 40	0 30
" 20 "	0 60	0 40
" 100 "	1 0	0 60
" 200 "	1 80	1 0
" 300 "	2 60	1 40
For each 100 grammes over	0 80	0 40

	Within the limits of Paris. fr. c.
Not over 15 grammes	0 30
" 30 "	0 40
" 60 "	0 50
" 90 "	0 60
" 120 "	0 70
For each 30 grammes over 120	0 10

In case of the loss of a registered letter, the post-office

pays the sender an indemnity of 50 francs. In addition to ordinary registered letters, there are two other classes of registered letters and packets. The first of these is that of letters containing bank-notes or other papers of value, the account of which is inscribed on the envelope; such letters are charged, in addition to the registered letter rates given above, ten centimes per 100 francs of declared value. The maximum value allowed to be declared within one cover is 2,000 francs (£80), and in case of loss the post-office reimburses the total amount.

In the case of all registered letters, the post-office insists on five seals being attached to the envelope or wrapper, and all the seals must be stamped with the same stamp, bearing one or more letters. In practice, the offices are so particular with respect to registered letters, that the clerks, on receiving them, lay a rule across each seal, to see whether the edges of the paper intersect the letters on the seals. When a letter is found in a letter-box having more than one seal upon its envelope, although not registered, it is presumed to contain something of value, and the person to whom it is addressed can only receive it at the office, where it must be opened in the presence of an employé, in order to prove that the regulations have not been infringed, by enclosing matters of value in an unregistered letter.

The last kind of registered objects to be mentioned is called *valeurs cotées*, that is to say, small objects of value, which are charged at the rate of 1 per cent. on the estimated value, which must not be less than 30 or more than 1,000 francs, with a 20 cent. stamp in addition. The boxes or cases in which these objects are enclosed are required to be solid, and not to exceed 10 centimetres (4 inches) long, 8 centimetres in width, and 5 centimetres in depth, and the objects themselves must not exceed 300 grammes in weight (10 oz.). The boxes containing these *valeurs* are taken to the post-offices open, the contents examined by the inspector on duty, who may, if he sees reason to do so, object to the estimate of their value; when that has been agreed upon, they are fastened with string or otherwise in his presence, and sealed, both by the sender and the office. In case of loss the post-office pays the estimated sum.

These *valeurs* are not distributed in rural districts, but the person to whom one is addressed may obtain it through the rural postmen, on filling up a form, otherwise he must go to the post-office of the district for it himself, on receiving notice of its arrival there.

The arrangements respecting printed matter and samples present considerable complication; they comprehend five classes, three of which are subdivided:—

Class 1.—Newspapers and other periodical publications dealing with politics or social economy, and being published at intervals not exceeding three months, not exceeding 40 grammes, 4 centimes, and so on, adding 1 centime for each 10 grammes to the maximum weight allowed, viz., 3,000 grammes (3 kilogrammes), 3 francs. If, however, the publications have to be delivered within the same department in which they are printed, or within any of the adjoining departments, then the postage is only one-half of the above rates. By special exception, however, journals published in the Departments of the Seine or the Seine-et-Oise do not enjoy this advantage in their own or the adjacent departments.

Class 2.—Journals, bulletins, memoirs, &c., relating to science, art, literature, agriculture, or industry, published periodically, and not less frequently than once in three months:—

Not exceeding 20 grammes	......	2 centimes.
„ 30 „	......	3 „
„ 40 „	......	4 „

and so on, as above (class 1), with the same maximum weight, and the same advantages as regards circulation in the same or adjoining departments.

Class 3.—Comprises circulars, and all kinds of printed matter not included in the two preceding classes, also bound books, engravings, and samples, either singly or in parcels, or with printed papers which refer to them. The postage is one centime per five grammes for each printed circular, &c., or for each sample or parcel of samples, up to 50 grammes; above that weight the charge is by weight, without reference to the number of circulars, &c., and the postage 10 centimes per 100 grammes, increasing afterwards at the rate of 1 centime per 10 grammes. The maximum weight allowed for samples is 300 grammes; and that for circulars, &c., 3 kilogrammes.

Class 4 (*Papiers de Commerce or d'Affaires*).—Includes law papers, insurance documents, manuscript music, and generally all kinds of manuscript which has not the character of actual and personal correspondence. Old letters, for instance, may be sent as *papiers d'affaires*. The postal rate is 50 centimes for 500 grammes (1 lb.) and under, and 1 centime afterwards for each additional 10 grammes; the same maximum as in previous classes, namely, 3 kilogrammes.*

Class 5.—This is a special class for notices of births, marriages, or deaths, prospectuses, circulars, &c., folded in the form of letters, or placed in envelopes, but not fastened; these are charged for singly. It also includes visiting cards, to which photographic portrait cards have recently been added, and two cards may be sent in the same envelope. The rate is 10 centimes per 10 grammes, up to 80 grammes.

In Paris, and in any case where cards are to be distributed within the arrondissement of the office at which they are posted, the charge is only 5 centimes.

The rates of the French post-office require stamps of very small value, namely, 1, 2, 4, 5 centimes, in addition to those used for letters, &c., which are of the value of 10, 20, 30, 40, and 80 centimes. A new stamp of the value of 5 francs is about to be issued.

Stamps are sold, not only at all the post-offices, but by every shopkeeper who has a letter box, by every tobacconist in the kingdom, and also by the postmen.

In the case of letters, those which are insufficiently stamped are charged as unpaid letters, less the value of the stamps used; but in the case of any of the five classes of printed or other matter, a fine equal to three times the amount of the insufficiency is added, and, if posted without any stamps, the packets are charged as letters. In case of the refusal of the person to whom the packet is addressed to pay the sum demanded, the post-office charges it to the sender. Samples of goods must have on the outside of the parcel a printed ticket bearing the trade mark, or name, &c., of the manufacturer or dealer who sends them.

The charge for post-office orders is one per cent. on the amount of the order, but when the sum is under 10fr., a tax of 20c. is imposed in addition. When the amount of the order exceeds 300 francs, the post-office does not undertake to pay it until eight days after issue, in order to give time for the paying office to give notice of the fact. An order payable in Paris is cashed, on presentation with the letter or envelope in which it arrived, at any of the branch or sub-branch offices.

There are seven deliveries of letters in Paris daily, with the exception of Sundays and *fête* days, when there are but five deliveries.

An extra charge for late letters was established a few years since in Paris, and seems to have met a public want; the extra charge is 20c. for the first quarter of an hour, 40c. for the second, and 60c. for the third, thus:—12 branch offices, where the boxes close at 5.45 p.m., receive letters till 6 o'clock with an extra stamp of 20c., and till 6.15 with a 40c. stamp; three chief branches, which have special boxes for late letters, receive them at the same rates, but a quarter of an hour later in each case; and at the General Post-office they are received

* Parcels of printed matter must not measure more than 45 cent. (18 in.) any way, and packets of samples, generally, not more than 25 cent. (10 in.) Articles composed entirely or partially of gold or silver cannot be sent as samples.

between 6.30 and 7 o'clock, with an extra stamp of the value of 60 centimes.

Very recently many changes have been made in the arrangements between France and other countries, and some incongruities have been got rid of, but many still exist. The following table will show the rates of letter-postage now in force between the chief countries in Europe. Between France and—

	Unit of weight. gr.	Paid. c.	Unpaid. fr. c.
Great Britain (¼ oz.)	7½	40	0 80
Austria	10	66	0 80
Bavaria	10	40	0 60
Belgium	10	30	0 50
Denmark	10	50	0 60
Prussia	10	50	0 60
Saxony (by Prussia)	10	50	0 60
Ditto (direct)	7½	50	0 60
Rhenish Prussia	10	40	0 50
Italy	10	40	0 60
Portugal	10	40	0 60
Holland	10	40	0 60
Russia (by Prussia)	10	80	1 10
Sweden	10	60	0 80
Norway	10	70	0 90
Switzerland	10	30	0 50
Luxembourg (lowest)	10	25	0 40
Greece	10	60	0 80
Spain	7½	40	0 60
Turkey (by French boats)	10	40	0 60
Baden	7½	30	0 40
Roman States	10	50	0 80

The charges for registered letters between France and Great Britain are 80c. per 7½ grammes; Prussia, Belgium, Italy, and Denmark, the ordinary postage with an additional tax of 50c., without regard to weight; Bavaria and Switzerland, the ordinary postage, with additional tax of 40c.; Luxembourg, the ordinary postage, with additional tax of 30c. In this ease, Great Britain stands at a great disadvantage, as will be seen by comparing the cost of a registered letter weighing 30 grammes (1 oz.), the lowest weight applicable to both, passing between France and Great Britain, with one passsing between France and Luxembourg:—

Great Britain, 4 rates at 80c. = 3f. 20c.
Luxembourg, 3 rates at 25c. + 30c. = 1f. 5c.

In the case of registered letters, containing matters of value declared, an arrangement exists between France, Baden, Bavaria, Prussia and the small German states, Luxembourg, and Switzerland, by which such letters containing bank notes or other paper of value, declared on the cover, and not exceeding £80 in one letter, are insured by payment of 20 or 30 centimes, according to country, per hundred francs of declared value, in addition to the usual charges on a registered letter, as given above. No such arrangement as this exists between the French and English post-offices.

Between France and the states before mentioned, and also Holland, an acknowledgment of receipt of either kind of registered letter may be obtained through the post-office, by the prepayment of 20c. additional.

The rates charged on journals, periodicals, and other printed matter passing between France and

Great Britain	8c. per	40	grammes.
Belgium	6c. ,,	40	,,
Italy	6c. ,,	40	,,
Luxembourg	5c. ,,	40	,,
Switzerland	5c. ,,	40	,,

Prussia and other countries the same as England. The postage of a newspaper sent from England to France is one penny, while that on a paper sent from Switzerland to France is only equal to one halfpenny.

France has conventions with most of the states for the transmission of samples, and also of business papers and other matters. The postal unit for samples is, in most cases, the same as that for printed publications, namely, 40 grammes, and that for *papiers d'affaires* 200 grammes. The arrangement with the British post-office, however, offers exceptions to both cases, as the following table, extracted from the tariff of foreign rates, will show:—

	Samples. c.	grs.	Papiers d'affaires. c.	grs.
Luxembourg / Switzerland	5 per	40	50 per	200
Italy	6 ,,	40	—	
Baden	10 ,,	40	50 ,,	200
Bavaria	10 ,,	40	50 ,,	200
Belgium	10 ,,	40	50 ,,	200
Denmark	10 ,,	40	(nil)	
Portugal	10 ,,	40	—	
Prussia	10 ,,	40	50 ,,	200
Greece	12 ,,	40	—	
Sweden	15 ,,	40	—	
Norway	18 ,,	40	—	
United States (by way of England)	20 ,,	40	—	

Between France and Great Britain there is one uniform rate for samples and papiers d'affaires, including photographs, legal, commercial, and other documents, printed proofs and manuscripts, not of the nature of letters, namely, 30c. per 120 grammes.

Arrangements exist between France and the following countries for the transmission of money through the post-offices: — Italy, Luxembourg, Switzerland, and Belgium. The charge is 20 centimes for every 10 francs or fraction of 10 francs. The amount of each order is limited to 200 francs.

No arrangement for the transmission of money by post-office orders exist between France and Great Britain.

The convenience of such an arrangement for international post-office orders is proved by the rapid increase in this branch of the French post-office business, which commenced in 1864, when the amount of the tax was 4,530 francs; in 1865 it had risen to 27,106 francs; in 1866 it reached 58,431 francs; and in 1867, 65,000 francs, so that the total of the sums which were transmitted during the last-named year amounted to 6,500,000 francs, or £260,000.

The growth of the international money order system is the more remarkable from the fact that the annual amount received for taxes on French money orders fell from 1,746,752 francs, in the year 1856, to 1,082,123 francs, in 1864, when the tax was reduced from 2 to 1 per cent., and that, in 1868, it had only risen again to 1,571,000 francs.

This may, however, be partially owing to the introduction of the system of registered letters containing values declared on the envelope, which was commenced in 1859. The number of these letters have risen steadily from 623,984, in 1860, to 1,781,000, in 1868, and the amount of value declared from 145,000,000 francs to 950,000,000 francs. The income of the French post-office from this source exceeded a million of francs (£40,000).

It may be remarked here that the foreign business of the French office seems to grow with greater rapidity than that within the limits of the empire. The following totals, like all the other figures in this report, are taken from the "Annuaire des Postes," published by order of the Director-General: — Income from postage on letters, in 1852, 40,633,199 francs; in 1867, 70,919,273 francs. Income from postage on journals, &c., in 1852, 2,845,911 francs; in 1867, 7,654,897 francs. Received from foreign offices, in 1852, 1,243,961; in 1867, 5,329,848 francs.

The following figures will furnish an idea of the growth of business in the French post-office: —Total number of letters in circulation in 1847, 126,480,000; in 1868, 349,335,000. During the same period the total number of letters sent to the dead letter office fell from

3,706,000 to 2,109,388, while the proportion of these which were ultimately sent to their destination rose from 7½ to 49½ per cent., showing a great improvement in the machinery of the office.

The number of registered letters rose from 176,000, in 1847, to 1,729,036, in 1860, and to 4,850,000, in 1868. The number of newspapers, &c., rose from 90,000,000, in 1847, to 330,500,000, in 1868. In Paris, the letters increased from 62,000,000 in 1860, to 87,000,000 in 1868. Lastly, the foreign business, separately, gives the following results:—

	1847.		1867.
Letters passing between France, her colonies, and foreign countries	8,000,000	..	31,000,000
Newspapers, and other printed matter	4,500,000	..	15,000,000
Letters passing through France in transit	1,750,000	..	9,500,000
Newspapers, &c., passing through France in transit	750,000	..	5,500,000
General total	15,000,000	..	61,000,000

The service of the French post-office is extremely well performed, although at times of pressure there is sometimes great delay in the delivery, on account of the want of more postmen; but the improvement that has taken place during the last few years is very remarkable.

As regards the arrangements between France and Great Britain, they certainly are not in accordance with the rapid growth of the commerce now carried on between the two countries. New conventions have been passed between France and several other states, reducing the rates of postage, while those on letters to and from Great Britain, as well as the unit of weight, remain what they were years ago, when the commercial relations of the two countries were infinitely less important. It is impossible that the postage between England and France should be allowed much longer to remain higher than that between France, Belgium, Bavaria, and Luxembourg; but there is a difficulty which has long stood in the way, and still opposes itself to all proposed changes between the two countries, namely the question of weight. England has her own single practical unit of half an ounce. France has never yet conceded to any foreign country a higher unit than 10 grammes or one-third of an ounce. This latter is sufficient to meet the wants of continental nations, who are accustomed to the use of lighter paper than we in England; but the annoyance and expense entailed upon those who reside in France, and have much English correspondence, is very great, on account of the number of letters heavily surcharged for over-weight, and it is not probable that the number would be much diminished if the unit were raised to 10 grammes. Moreover, this weight is unknown to the English post-office, while its initial weight of half an ounce (15 grs.) is that of the whole correspondence of Paris, one quarter of the total number of letters passing through the French post-office.

The Director-General of the post-office and the Director-General of the telegraphic service are now engaged in arranging a plan by which both offices may work together in the matter of money orders. The money being lodged at a post-office, the announcement will be sent by telegraph both to the post-office where it is to be paid, and to the person who is to receive it. Of course, the telegraphic dispatches have to be paid for according to the usual scale.

WHITWORTH SYSTEM OF GUNNERY.

It is well-known that the French have been trying the Whitworth guns, and have become convinced they have none so powerful. The Russians are investigating them, and the Turks are employing Messrs. Whitworth and Company to prepare tools for new artillery. It would be deplorable if, in case of war, the enemies of England used these guns, whilst the country which produced them had them not. To avert such a result, it is desirable to awaken a general public interest in the subject, and especially to invite the attention of real scientific authorities to the present state which the Whitworth system has reached.

At the last meeting of the British Association at Exeter, Sir Joseph Whitworth read the following paper "On the Penetration of Armour Plates with Long Shells of large capacity fired obliquely," which provoked a lively discussion, and deserves grave attention:—

At the meeting of the British Association, at Norwich, last year, I contributed a paper to this section on "The Proper Form of Projectiles for Penetrating through Water." This paper was illustrated by diagrams, showing the effect produced on an iron plate, immersed in a tank of water, by projectiles with flat, hemispherical, and pointed heads. Copies of those diagrams are now before you. In that paper I claimed for the flat-pointed form of projectile, made of any metal, three points of superiority over the ogival-pointed projectiles adopted in the service:—(1) Its power of penetrating armour plates, even when striking at extreme angles; (2) its large internal capacity for bursting charges when constructed as a shell; (3) its capability of passing undeflected through water, and of penetrating iron armour below the water-line. This latter feature was, I think, satisfactorily proved by the experiments described last year, and I desire to draw the attention of the section to the experiments I have made for illustrating the penetrative power of long projectiles with the flat front, fired at extreme angles against iron plates.

These experiments are illustrated by the projectiles actually fired, and the plates they penetrated, which are laid on the table, and also by the diagrams before you.

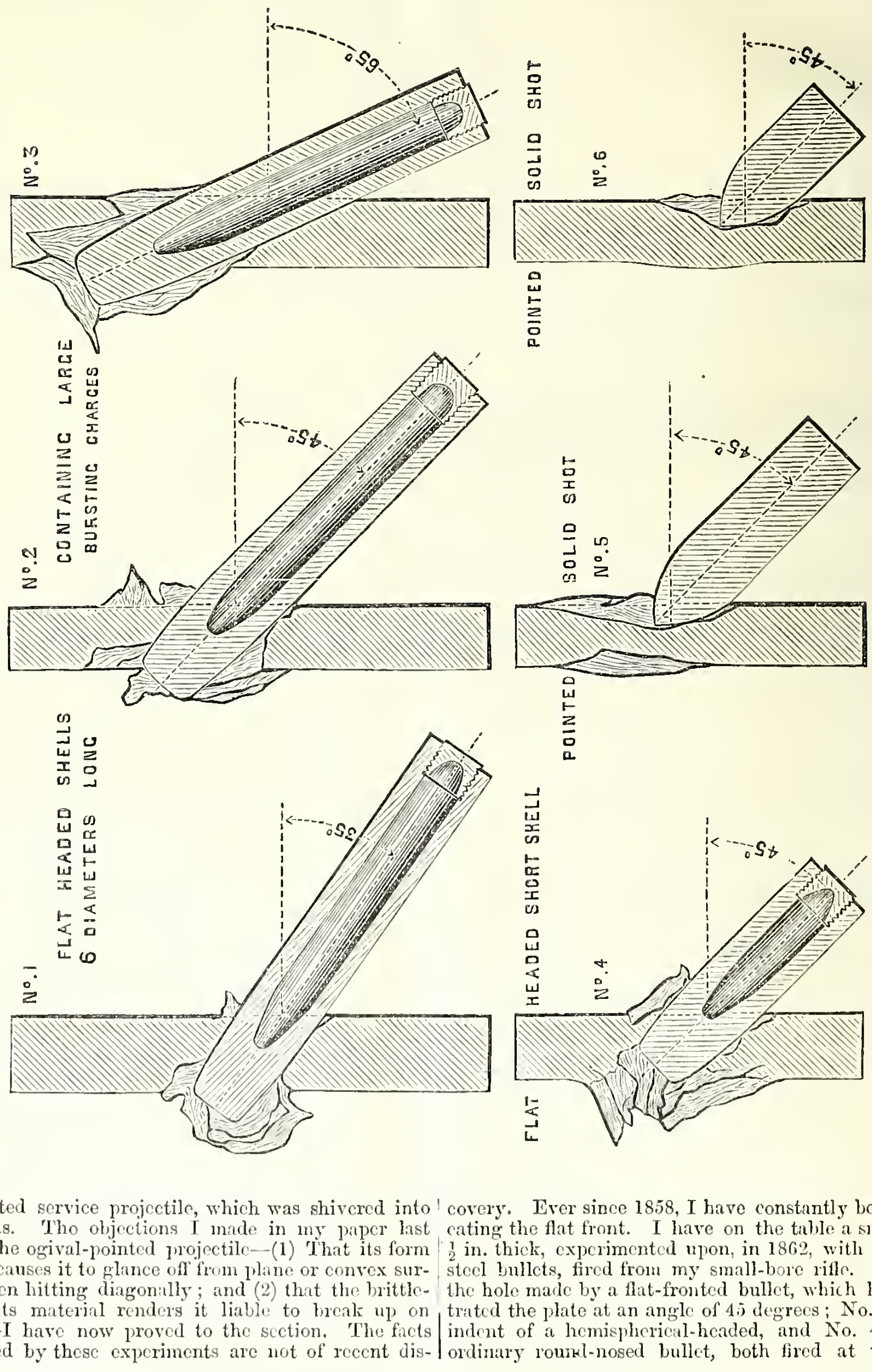
The gun from which the projectiles were fired is called a 3-pounder, though capable of firing much heavier projectiles. It weighs 315 lb., and the maximum diameter of its bore is 1·85 in. The charge of powder used, in all cases, was 10 oz., and the weight of the 6-diameter projectile is 6 lb.

No. 1 is a portion of a plate 2 in. thick, penetrated by the 6-diameter flat-fronted projectile No. 1, at an angle of 35 deg. No. 2 is a similar piece of plate, 1·7 in. thick, completely traversed at an angle of 45 deg. by the flat-fronted projectile No. 2, which buried itself to a depth of 30 in. in a backing of iron borings. No. 3 is a piece of plate 1·75 in. thick, penetrated at an angle of 65 deg. by the flat-pointed projectile No. 3. No. 4 is a plate 1·7 in. thick, nearly penetrated, at an angle of 45 deg., by the 3½-diameter flat-fronted projectile No. 4. No. 5 is a plate 1½ in. thick, against which the ogival-pointed projectile, No. 5, was fired at an angle of 45 deg.; the projectile failed to penetrate the plate, being deflected in consequence of the pointed form of the head. The distortion of its shape shows the force with which it struck the plate, and proves the good quality of the material which could resist such a test. No. 6 is a plate also 1½ in. thick, against which an ogival-pointed projectile, of the service proportions, viz., 2¼ diameters long, made of Pontypool white iron, has been fired; the projectile has scooped out a furrow 4 in. long and 7·10 in. deep; it broke up into fragments, of which forty-eight were recovered.

The plates Nos. 1 and 3 were purposely thicker than the projectiles could quite pass through, in order that the "work" of the projectiles might be as severe as possible. An examination of the projectiles themselves will show how well they have stood the severe strain to which they have been subjected. The data thus obtained fully establish, I think, the superiority I claimed for the flat-fronted projectiles made of my metal, and satisfactorily prove:—(1) That the flat-fronted form is capable of piercing armour-plates at extreme angles; (2) that the

quality of the material of the shells enables their length to be increased, without any risk of their breaking up on impact, and materially augments their bursting charge as shells; (3) that this increase in length, while adding to the efficiency of the projectile as a shell, in no way diminishes, but, on the contrary, proportionally improves, its penetrative power; (4) that the amount of rotation I have adopted in my system of rifling is sufficient to ensure the long projectiles striking "end on," and, consequently, to accumulate the whole effect of the mass on the reduced area of the flat front.

These experiments show, further, that the ogival-pointed projectile has but small power of penetration when striking at an angle, solely on account of the form of the head; a projectile of "Whitworth" metal, with the like ogival-pointed head as a service projectile, having resisted the shock of impact without breaking up, but being deflected in precisely the same manner as



the pointed service projectile, which was shivered into fragments. The objections I made in my paper last year to the ogival-pointed projectile—(1) That its form of head causes it to glance off from plane or convex surfaces when hitting diagonally; and (2) that the brittleness of its material renders it liable to break up on impact—I have now proved to the section. The facts illustrated by these experiments are not of recent discovery. Ever since 1858, I have constantly been advocating the flat front. I have on the table a small plate ½ in. thick, experimented upon, in 1862, with hardened steel bullets, fired from my small-bore rifle. No. 39 is the hole made by a flat-fronted bullet, which has penetrated the plate at an angle of 45 degrees; No. 40 is the indent of a hemispherical-headed, and No. 41 of an ordinary round-nosed bullet, both fired at the same

angle of 45 deg. These three rounds were fired in 1862.

Within the last few days, I have had an ogival-pointed shaped bullet fired at the same plate at the same angle, in order to confirm the effect with that produced on a larger scale on the plate No. 6. It is interesting to observe how closely the results obtained with the small calibre of my rifle agree with those of the 3-pounder gun which form the subject of this paper. Those experiments recorded in the paper were made with a gun of smaller calibre, from considerations of economy and convenienee; but I have always found that what I could do with the smaller calibres of my system, could be reproduced in the larger sizes; and, from my past experience, I feel warranted in asserting that the effect of penetration now exhibited could be repeated on a proportionate scale, with my 9 in. guns at Shoeburyness, or with the 11 in. guns my firm are now engaged in constructing.

A glance at the formidable nature of the projectiles thrown by these guns, and a consideration of the effects they may be expected to produce, will show the importance attaching to the question of penetration of plates by long projectiles. The 9 in. guns to which I have referred weigh fifteen tons each, and are capable of firing powder charges of 50 lb. A 9 in. armour shell, 5 diameters long, weighs 535 lb., and will contain a bursting charge of 25 lb.

I have no hesitation in saying that these projectiles would pierce the side of a ship, plated with heavy armour, at a distance of 2,000 yards, and at some depth below the water-line. The 11 in. guns will weigh twenty-seven tons, and will be capable of firing 90 lb. powder charges. The 11 in. shells. 5 diameters long, will weigh 965 lb., and will contain bursting charges of 45 lb., and would pierce the side of the ship *Hercules*, plated with 9 in. armour, at a distance of 2,000 yards.

Were it not that the increased destructiveness of war must tend to shorten its duration and diminish its frequency, thus saving human life, the invention of such projectiles could hardly be justified; but believing in the really pacific influences of the most powerful means of defence, I call these long projectiles the "anti-war" shell. The principle I have always insisted upon, and laid down for my own guidance in artillery experiments—when either a low trajectory or penetration is required—is, "that every gun should be in strength capable of withstanding the largest charge of powder that can be profitably consumed in its bore." I have drawn up the accompanying table of the sizes of the bores of my guns, with their proportionate powder charges, and the guns will all be fully equal to this duty, and I believe the greatest possible effect from the consumption of a given quantity of powder will be obtained. But the guns adopted in our naval service are not equal to such a test; nor, as I believe, are they so proportioned as to realise the best effect from the quantity of powder they consume.

Four guns of 12-inch bore have lately been put on board the *Monarch*. They weigh twenty-five tons each, and charges of 50 lbs. and 67 lbs. have been fired from them, with projectiles of 600 lbs. weight. I have no doubt that these guns have been made with all possible care, and are as strong as their material and construction admits; but if the weight of these guns were in proportion to the capacity of their bore, and if the material were the best that our metallurgical skill could supply for such a purpose, they ought to fire 117 lbs. of powder, and projectiles of 1,250 lbs. weight. They would then be efficient weapons; but at present they are more formidable in name than in reality.

We are often flattered by being told that we have the best guns in the world. That may or may not be the case. But I think that we should not rest contented while we are still so far from having attained as much as our present advancement in mechanical and metallurgical science has rendered possible for us.

Particulars of Ammunition for Whitworth Guns, from 5·5in. to 13in. bore.

Calibre of bore.	Powder charge.	Common shells, cast iron, 3.5 diameters long.		Armour shells, Whitworth metal, 5 diameters long.	
		Bursting charge.	Weight of shell.	Bursting charge.	Weight of shell.
in.	lbs.	lbs.	lbs.	lbs.	lbs.
5·5	11·0	4.0	70	6·0	120
7·0	23·0	8·5	150	12·0	255
8·0	34·0	13·0	220	18·0	375
9·0	50·0	18·0	320	25·0	535
10·0	70·0	24·0	440	35·0	740
11·0	90·0	32·0	580	45·0	965
12·0	117·0	40·0	750	58·0	1,250
13·0	150·0	51·0	960	75·0	1,615

Mr. Whitworth's patent cartridge increases the range from 15 to 20 per cent.

EDUCATIONAL NOTES.

The subscription list of the National Education League has received another addition of £1,000, by Mr. J. H. Nettlefold, of Birmingham. There are now seventeen subscribers of £1,000 each, and twelve of £500 each.

In reference to the vexed question of secular or unsectarian education, the differing views of two writers as to how far all religious teaching should or should not be entirely eliminated may be given. At a meeting held recently at Dundee, for the establishment of a branch of the Education League, a letter was read from the Rev. George Gilfillan, who, after expressing regret at his inability to attend the meeting, says:—"I cordially approve its object. I have long made up my mind on two points in reference to education. First, that it should be compulsory; and, secondly, that it should be, as far as possible, in schools, secular. Religion has seldom been taught there to any purpose. My own recollections of religious school training are those of dull drilled lessons, dog-eared Shorter Catechisms, dirty Testaments, and general disgust. I think that in all schools the Shorter Catechism (a very excellent work, but full of blunders) should now be omitted; that only well-selected passages from the Bible should be read, such as the narratives in both Testaments, the Psalms (with some omissions), the Proverbs, and portions of the Prophecies and Epistles; and that all the obscure parts of the blessed volume, all the chapters of proper names, all the controversial writings of Paul, and the entire books of Job and the Revelations, should be excluded—the two last for the simple reason that, since the greatest critics profess their ignorance of their meaning, it is not likely that children—no, nor their teachers either—can understand them. If I saw the general principles of Theism and of Christian morality well taught in schools, and in addition to this, the image of Christ as the Divine Teacher and Model Man projected with sufficient force upon young minds, I should be satisfied." On the other hand, Mr. G. J. Holyoake takes a very different view of the best mode of solving the religious difficulty. In writing to the *Daily News*, he objects to the interpretation of the word "unsectarian" as meaning a sort of neutral use of the Bible. He believes that this would greatly increase the difficulties of the question. He says:—"The one thing common to all sects of religionists is the mixing of doctrine with lessons of secular duty; and the only unsectarian quality of education is the separation of those things." He holds that "unsectarian education is a possibility in which two-

thirds of the people of Great Britain believe. In Ireland, it is an imperial necessity; in Scotland, it is an intellectual preference; and in England, the chief men of science, and the most self-reliant of Christian parties are in favour of it. Secular instruction itself is neither regarded as a novelty nor a sin. It is already recognised and exists in a degree in every religious school. All sectarian schools uniformly give both religious and secular instruction, but they give them both together, and this is the characteristic which marks sectarian education. Unsectarian schools, such as a national system of education must institute, are those in which the religious and secular instruction are given separately, and in which the attendance upon the secular instruction should be compulsory, and upon religious instruction permissive. But religious instruction, either before or after school hours, should be authorisable in every school by its local administrators, and of whatever kind they may sanction; and there should be no offensive meddling with, or paring down of creeds; no fettering the conscience of any pastor. There shall be only one condition, namely, that any parent who may object to the denominational procedure shall be at liberty, without hindrance, question, or disparagement, to withhold his child from attending."

At a recent meeting of the Social Science Association, a paper was read by Mr. Edwin Pears, LL.B., general secretary of the association, on "Grade Schools and Scholarships under the Endowed Schools Act." The argument of the paper was that the opportunities of intellectual distinction should be afforded to all classes of youth, no matter what might be their social position. He suggested that the lowest of the secondary education schools, called the third grade schools, for boys whose education was to terminate at fourteen, should receive from the primary schools free, or on payment of a small fee, all boys who could attain a certain educational standard, and that the scholarship of free instruction should be available for two years. The same principle should be adopted regarding the other schools.

At a meeting of the Town Council of Dunfermline, held on the 29th December, the following motion was adopted:—"The Magistrates and Council resolve to memorialise her Majesty's Government to introduce, in the ensuing session of Parliament, a Bill to regulate our national education in Scotland, unsectarian in principle, or undenominational in character, and compulsory in operation. That all the existing parochial schools, and other schools receiving government aid, should, as soon as possible, be converted into national schools; and that all government schools should be supported by grants from government and local rates. That a General Board of Education be formed for Scotland."

There was a meeting of head masters in the great school-room at Uppingham on Wednesday and Thursday, the 22nd and 23rd of December. The head masters of Lancing College, Liverpool College, Repton, Sherborne, Ironbridge, and other important schools were present. It was decided to hold a school conference every year at some school, and that each year a different place of meeting should be fixed, in order that all schools by degrees should have easy access to it. A strong opinion was expressed that communication between schools, seeing what was being done, and hearing the results of work, would bring out, day by day, unity of purpose, tend to obliterate difference of opinion on minor points, and ripen into a solid agreement on main school questions.

The Right Hon. Sir C. B. Adderley, M.P., said, at the distribution of the art prizes at Stoke, on Monday, 27th December:—Education, perhaps the greatest of all subjects that had occupied the attention of Parliament and the country of late years, clearly should not rest on any abstract principles of political economy. It was absolutely impossible that national education could rest on the bare principle of supply and demand, for this simple reason, namely, that—in this particular case—the demand was created by the supply. There was or could be, no demand on the part of an uneducated people for education. It was absolutely necessary, therefore, for the State, in the first instance, to give that artificial supply which would create the demand; and the demand, when once created, would rapidly reproduce itself. This being true of education generally, how much more true was it of education in the fine arts —education in the higher class of taste and perceptions of beauty. The advance of national education altered the demand for certain articles, for when the mind of the nation was cultured, and its perception of beauty was elevated, the mere supply of articles of utility ceased to be the ruling influence in the market, unless they were formed with that regard for beauty which the elevated tastes of the people required. It was all very well to say that a plate was a plate, so it was, and so long as the country only required to be supplied with a plate sufficiently hard baked to hold a slice of beef, and proof against fire and the carelessness of housemaids and waiters, it was sufficient. But the instant that the perception of beauty was awakened, and a higher taste was created among purchasers, the supply of such an article was not sufficient, and the mere ugly platemaker went to the wall. That had been the experience of late years in this country. He did not mean to say that utility and beauty were separate things; on the contrary, he maintained most emphatically that adapation and fitness were the very quintessence of beauty. But the perception and recognition of utility and beauty grew together as the product of advanced education, and manufacturers who failed to realise the fact that a better supply was, in consequence needed would find themselves unable to meet the country's demands.

THE NATIONAL EDUCATION LEAGUE AND UNION.

In a letter which appeared in the *Times*, on the 29th December, the Rev. James Ridgway, Principal of the Culham Training College, proposes that the Education League and the Education Union should endeavour to unite on a common platform. He points out that the two organisations are agreed upon the following points:—

1. The existence of a large number of children untouched by education, who swell the ranks of crime, vice, and misery.

2. The failure of all existing means to bring that class under instruction.

3. The necessity for some means of compulsion, direct or indirect.

The League, he says, would inaugurate a new system, of which the distinctive features are:—Free schools supported by local rates; compulsory attendance of all children under a certain age; and schools entirely unsectarian; while the Union would maintain, under certain restrictions, all existing denominational schools, would pay out of local rates the fees for pauper and vagrant children only, and would use indirect compulpulsion. He suggests to the contending parties to confer together, and each surrendering certain points of difference, to try to agree upon a measure that both would be prepared to support. A plan was submitted to Sir John Pakington's Select Committee, in 1866, by the Rev. H. W. Bellairs, her Majesty's senior Inspector, which he thinks might be taken as a basis.

Mr. Ridgway then points out how much time may be saved in teaching by superior school organisation, and on this point he refers to the "instructions to delegates," issued by the Council of the Society of Arts, and published as a supplement to the *Journal* of the 24th December:—"It has been satisfactorily proved," he says, "that by more efficient teaching, the ordinary hours of school work might be reduced from five to three hours daily, and, by larger schools and concentration of

teaching power, school life might be shortened from six to three years; thus, by the application of four trained teacher-power, *plus* 12 pupil teachers, the whole school period might be reduced to four years, during which 700 children might be taught, between the ages of seven and eleven, to write a clear hand, read intelligently, and to pass with credit the ordinary examinations in arithmetic, approved by the Privy Council, including proportion and decimal fractions. The annual cost would not exceed £1 per head, or a total of £4; whereas, at present, forty children under a master and mistress with a paid monitor will not reach the same standard in less than seven years, at an annual cost of £2 11s. 3d. per head, or a total expenditure of about £16 16s. per head." In conclusion, he says:—"It will be naturally asked how I propose to secure religious education. This must be dealt with by an organisation maintained by the several bodies respectively. For Church of England schools I would suggest that it be entirely under the management of the Diocesan Boards of Education. A head diocesan inspector should be appointed by the bishop, and singly (or with the aid of assistants in large dioceses) should inspect every school in the diocese, and examine in religious subjects only, reporting to the diocesan board, who might make grants on the results commensurate with those made by government for secular subjects."

Mr. Ridgway's proposals for a compromise, however, are by no means favourably received by Mr. J. Chamberlain, Chairman of the Executive Committee of the League, whose reply appeared in the same paper on the 1st January. He considers that the suggestion is based on an under-estimate of the importance of the principles at issue, and on an insufficient acquaintance with the constitution of the League. He repudiates the idea that "the executive of a great association, which has put forth a certain programme, and within two or three months secured for it the adhesion of 5,000 members, with subscriptions already exceeding £50,000, and which represents nearly 100 branches in different parliamentary boroughs, should entertain for a moment the idea of a compromise, whereby it would betray its trust, and destroy the organisation which it has created." . . . . "The differences between ourselves and the Union," says Mr. Chamberlain, "all arise from the fact that, although we agree as to the necessity of an extended education, they insist that its provision should be dependent on the continuance of the denominational system, while our action is independent of any such interest. We claim to represent the determination of the laity, and especially of the working class, to secure at least a good primary instruction for every child in the country." He believes that the Union scheme can never satisfy the great mass of the Dissenters, and he considers that the "Conscience Clause" has never met, and never can meet the religious difficulty. He goes on to say:—"Mr. Ridgway appears to imagine that our Bill violently extinguishes existing schools. It does nothing of the kind; it simply lets them alone. It is acknowledged that many children are totally uneducated and many others insufficiently so. Our scheme will secure the thorough instruction of the one and the other, but only the new schools provided for the latter will be necessarily free and unsectarian. Accordingly, the cost, in the first instance, will be the cost of the children at present uneducated. The denominationalists will be at perfect liberty to continue their present schools, and the expense will in no case be increased. It is calculated that if all the children in the country were educated in the schools proposed to be established by the League, the cost would be met by an average rate of 4d. in the pound, supplemented by contributions from the national exchequer of double this amount. The total would be under £6,000,000 sterling."

In conclusion, Mr. Chamberlain urges that compulsion is absolutely necessary, and that the education given must be free, because "it will be impossible to draw a line where payment should begin, and because it would be impolitic to degrade a whole generation of working men, by branding them as paupers wherever they are unable to meet the cost of school fees for their children. In our scheme all will contribute something in direct or indirect taxation, and all will be entitled to education as a right, and not as a charitable dole or a boon conferred by the Poor-law Guardians."

This correspondence does not appear to give much hope of the contending parties coming to anything like an agreement. The *Times*, however, in a leader on the prospects of the coming Parliamentary Session, deprecates any delay in bringing the question forward. It says:—"With respect to the measures which, if the Irish Land Bill leave time, must necessarily be presented to Parliament, the Education Bill holds the first place. There is, perhaps, some disposition to defer dealing with this great question, and that on the part of its most advanced partisans, who think the opinion of the country is ripening for a bold and comprehensive measure, but has not ripened yet. We think, on the contrary, that the facts are sufficiently before the country, that the subject has been fully discussed, and that it is time for action. There never does arrive a time in the history of any measure at which it may not be said that its further consideration would be beneficial; but we have to consider the present wants of the community, and if the opportunity presents itself for legislation, it ought not to be neglected in pursuit of some ideal perfection."

Mr. Ridgway, in a second letter to the *Times*, on the 3rd inst., discusses the subject of the production of qualified teachers, and considers the effect of the teaching to be followed in the normal colleges, as proposed by the League:—"'No creed, catechism, or tenets of any sect to be taught in such schools.' What would be the practical effect of such a constitution? If 'no creed or tenet of any sect is to be taught,' there can be not only no religious teaching, but no infidelity inculcated. Religion and antagonism to it must be alike ignored. So there can be no family worship of any kind, no appeal in matters of moral discipline to any religious feeling; for the various sects would not agree upon a common interpretation of the first four commandments, and I am not sure they would upon the remaining six. The head of such an institution could appeal to no higher motives than honour, expediency, worldly happiness."

GENERAL NOTES.

China.—A commercial treaty with China has lately been made by the Austrian government.

An Exhibition of Objects of Religious Art is to be held in Rome.

Cordova.—An international exhibition of art and industry is to be held in the city of Cordova, in the Argentine Republic, in October, 1870.

The Kildonan Gold Diggings.—The Duke of Sutherland has declined to grant new licences or to renew old ones.

Postage Stamps.—142,041,810 penny stamps were sold to the public in the United Kingdom in the year 1868-9.

Spurious Guanos.—The Royal Agricultural Society has been giving its attention to the increasing adulteration of manures and feeding cakes, and is conducting some analyses of samples sent them.

Wheat in California.—It is said more than 15,000 tons of wheat are awaiting shipment through a want of vessels. The farmers would be glad of an offer of a dollar and a-half per bushel.

Edible Seaweed.—The Chinese import large quantities of dry seaweed from Japan, which they use in place of salt, and also as a vegetable to thicken soups. It comes from the coasts of Jesso.

Gold.—The production of Victorian and New Zealand gold for the year may be estimated at £7,000,000 sterling. The gold-fields in the North Island of New Zealand are believed to be very rich.

Woollens.—The exports of woollens for the ten months ending 31st October, 1869, are given, on the authority of the Board of Trade, at 260,764,651 yards, against 231,425,771 yards, for the corresponding ten months of 1868.

Petroleum in India.—The Secretary of the Public Works Department has expressed his opinion that the supply which it is expected the salt range will yield will supersede both wood and coal as fuel for the railways of India.

Consumption of Cotton.— It is estimated that the consumption of cotton in England, during the next year, will be at the rate of 55,000 bales per week, which is about the maximum figure it has attained since the commencement of the American war.

A Ship Canal through the narrow neck of land separating Buzzard's Bay from Cape Cod Bay, in Massachusetts, is about to be commenced. The water-way is to be 300 feet wide, and twenty-four feet deep at low water. The canal will render unnecessary the long voyage around Nantucket and Cape Cod, and will enable vessels from Long Island Sound to proceed north without encountering the dangers of stormy seas and rock-bound coasts.

Reduction of Postage of Letters to the United States.—On the 1st of January, the combined rate of British and United States postage on letters posted in the United States, and whether conveyed by packet or by private ship, was reduced to threepence per half-ounce or fraction thereof, provided such postage be prepaid. Unpaid or insufficiently paid letters will be liable, on their delivery, to an additional charge of threepence each over and above the postage.

Canada and the United States.—A statement prepared in the United States shows their trade with Canada in their fiscal year ending June 30, 1869. The exports to the United States from the dominion of Canada were of the value of 30,352,010 dols.; and the domestic exports from the United States to Canada were of the value of 18,188,613 dols., to which may be added 2,858,782 dols., the value of foreign commodities re-exported (chiefly from warehouse) from the United States to Canada, their whole exports to Canada in the year being stated as 21,037,395 dols. The United States also imported in the year, from other British North American possessions on the Atlantic, to the value of 1,735,145 dols., and sent hither domestic exports of the value of 2,703,173 dols., and foreign re-exports 446,664 dols., making the value of the whole imports into the United States from the Atlantic portion of British North America 32,088,155 dols., and of the exports thither from the United States 24,187,232 dols. The exports from Canada to the United States are described as being conveyed to the value of 12,557,455 dols. in American vessels, and 17,795,555 dols. in foreign vessels. The largest items are animals, 3,470,973 dols.; barley, 4,624,007 dols; wheat and wheat flour, 2,119,390 dols.; fish (not of American fisheries), 1,003,904 dols.; provisions and tallow, 1,425,307 dols.; wood and manufactures thereof, 7,093,885 dols.; wool, 714,929 dols.; hides and skins, 411,248 dols.; furs, 111,967 dols. The exports from the United States to Canada in the year were conveyed to the value of 9,179,449 dols. in American vessels and vehicles, and 11,867,946 dols. in foreign vessels and vehicles. Among these exports are Indian corn and meal, 1,371,762 dols.; wheat and wheat flour, 7,314,001 dols.; cotton manufactures, 260,384 dols., tobacco, 740,291 dols.; gold coin, 609,339 dols.; pork, 807,729 dols.; machinery, 228,128 dols.; hardware, 203,747 dols.

Horse Flesh.—The Society for the Propagation of Horse Flesh as an Article of Food, has just published the following note:—"The consumption of this meat continues to increase throughout Europe. The quantity sold in Paris during the three months of September, October, and November, 1868, was 226,000 lbs., being the produce of 565 horses; in the same period of 1869, it had increased to 273,200 lbs., and 683 of those animals; or an augmentation of 47,200 lbs., and 118 horses. The development is as great in the provinces, and would be still more so but for the obstacles created in certain towns by the administration, to the detriment of the public health and the welfare of the needy classes, against the sale of this aliment."

Free Trade in France. — The leading free-traders of France have taken an important step in the formation of a Permanent League of Commercial Liberty, between the Parisian merchants and manufacturers, partisans, more or less, of free-trade and anti-protectionists, to combat systematically the active protectionists. "The numerous complaints to which the treaties of commerce at the present moment give rise," says a circular, "are the reasons for this measure, in favour of which several preliminary meetings have been held." These have resulted in a general meeting, at which the basis of a permanent association was proposed, a committee appointed, and a plan of proceeding discussed.

Wool.—The importation of colonial wool into London for the year ending December 31st, 1869, was as follows:—

	1869.	
New South Wales and Queensland	120,544	bales
Victoria	206,188	"
South Australia	66,097	"
Western Australia	4,861	"
Tasmania....................	17,362	"
New Zealand	85,329	"
Cape of Good Hope	134,163	"
Total	634,544	bales

From India, the importation was 57,524 bales, against 53,353 bales in 1868.

Oxygen Gas is now produced on a large scale commercially in Paris. Carts with metal reservoirs containing the compressed gas may be seen in the streets for the supply of consumers. The Gaieté Theatre is one of the largest consumers, the outside being illuminated every night by the oxy-hydrogen light, cylinders of magnesia or zirconia taking the place of those of lime, as ordinarily used for this purpose. The light is interspersed among the gas jets with good effect. In the interior, the scenes owe many of their beautiful effects to the use of this light. The oxy-hydrogen light is also used largely for the production of the illuminated advertisements now so common in the Boulevards and other places. These are produced by a magic lantern and screen on the second floors, and the parties undertaking the display of these advertisements are large consumers of the oxygen gas.

The Manufacture of Iron.—It is estimated that in England 500 blast furnaces are reducing, by their intense heat, nearly 12,000,000 tons of iron ore to 1,800,000 tons of metallic iron, which, at its place of production, has a value of about £11,000,000 sterling. Those blast furnaces consume more than 14,000,000 tons of coal; and, to convert the pig-iron obtained into bars, rails, &c., a like quantity of coal is required. In France the great iron industry is no less active. The works of Messrs. Schneider and Co., at Le Creusot, the largest in France, have fifty acres under cover. Here are fifteen blast furnaces, with twenty-seven steam-engines blowing air for them, and forging iron besides. At the mines and works over 3,500 men are employed. In Belgium, at the works of the Company Cockerill, near Liege, 7,400 workpeople are employed.

Waterproof Packing Paper, according to the *Stationer*, is thus made by some manufacturers :—"The paper must first be covered with a resinous liquid, then painted over with a solution of glue and soot, as, without this the paper will later show blotches. After this is dried, the actual waterproof coat is applied. This is prepared with $2\frac{1}{2}$ oz. of powdered shellac, dissolved in two pints of water, which is gradually brought to boil, and stirred until the substance is perfectly dissolved and softened, when gradually one-third of an ounce of powdered borax is added, until an intimate union of the substances takes place. The liquid is then left to cool, and, while still hot, any mineral colour may be added, such as lamp-black, yellow ochre, red ochre, iron blue, or burnt umber, whereupon it is left to get entirely cold. It is then ready for use. The operation can be so quickly performed with a brush that two women can prepare 3,000 feet in ten hours."

The Climate of Australia.—Attention has been drawn to the alterations which the climate of Australia is undergoing, in consequence of the systematic denudation of tree covering which the surface of the country is being subjected to. It is shown, for example, that in the case of the Ballarat district, the destruction of the timber has been accompanied by a corresponding diminution in the rainfall, and that, since 1863, there has been a more or less regular reduction from 37·27 inches in 1863 to 17·23 inches in 1868. During the past seven months of the present year, and including two of the ordinarily wettest, the rainfall has been only 11·20 inches. In connection with this subject, mention may be made of the fact that the government have appointed an inspector of State forests, whose duty it will be to prevent the waste of timber and the reckless destruction of live wood, and at the same time to establish nurseries of forest trees in various parts of the colony. The appointment has been conferred upon a gardener.

The Isthmus of Darien. — It is stated, by the *Philadelphia Public Ledger*, that no less than nineteen routes for a ship canal between the Atlantic and Pacific oceans have been surveyed. One is known as the Tehuantepec route; one as the Honduras route; five pursued the line of the San Juan River to Lake Nicaragua, and thence took different routes to the Pacific; three followed the same river to Lake Managua, and there diverged; four were across the Isthmus of Panama; and five received the designation of the Darien Isthmus routes. Of the Darien routes, three follow the river Atrato southward from the Gulf of Darien, seeking a sufficient depression in the Cordilleras, between the valley of that stream and the Pacific. The other two cross the isthmus from the eastern extremity of the San Miguel Gulf. Some of these routes have been condemned as impracticable, on account of their cost and length, and it is asserted that it is almost impossible to discover any new line, although the Atrato river, when more closely surveyed, may afford greater facilities for the construction of the canal.

Ether.—The President of the College of Physicians has forwarded to the *Practitioner* the result of an experiment tried by Sir Frederick Pollock, who, some years ago, suffered from the undefinable nervous *malaise* incident to old age, and which sometimes makes itself known in painful spasms, more or less connected with the digestive system. It was necessary to find some drug that would be at once stimulant and narcotic in its effect, such as tobacco or opium. These drugs failed to produce the desired effect. He therefore tried ether—the best rectified ether—which he inhaled from an ordinary bottle, applied to one nostril; it should be stated that the safety of the experiment to some extend depends on the inhalation of the spirit through only one nostril. A few whiffs taken in this way removed spasm and pain, and induced a general tranquillity of the nervous system. The quantity of ether used is variable; sometimes it amounts to several ounces a-day. It is supposed that but very small quantities of ether can enter the system in such inhalations as we have described, since not only does much escape at once into the air, but also of that which is actually inhaled a large proportion is again exhaled. Never, in any case, is so much of the vapour absorbed as to disturb consciousness or to cloud the intellect. Nor is sleep in any way at all compelled, although, by the removal of nervous irritability, it is favoured.

The Salmon Experiments in Tasmania.—The success of the salmon experiment in Tasmania, according to the *Melbourne Argus*, has at last been placed beyond all doubt. Two men fishing in the Derwent in Beauty Bay, with a seine, captured a salmon 10 in. long and 5 in girth, and a second 9 in. long. The fish are the natural production of the Derwent, *i. e.*, they are the offspring of salmon which had been hatched from the original ova, and consequently may be looked upon as the second generation. The incident naturally created a good deal of excitement in Hobart Town, where for some days nothing else was talked about, and much gratification is felt here at the successful introduction of this fish into one, at least, of the Australian colonies. A meeting of the Victorian Acclimatisation Society has been held, at which it was unanimously decided that a letter should be addressed by the president to Sir Robert Officer and the other salmon commissioners, congratulating them upon the success which has attended the efforts to acclimatise this king of fish; and it was suggested by the president that some live salmon in a gravid state should be obtained and brought over to Victoria as soon as practicable, for the purpose of stocking some of our rivers. It is proposed in Hobart Town to send one of the captured salmon smolts to London, to be submitted for verification to Mr. Buckland and other authorities.

Eggs.—England is said to receive annually from Ireland one hundred and fifty millions of eggs, and from France over one hundred and thirty millions. The great object is to get fresh ones, and many modes are resorted to to ascertain this important point. Some dealers place them in water, when, if fresh, they will lie on their sides; if bad, they stand on one end. In many countries the eggs of lizards are eaten. In the West Indies the eggs of the guana are thought a delicacy, and in the Antilles the eggs of tho alligator, which are said to taste very much like hens' eggs, which they also resemble in shape. Turtles' eggs are held in great esteem wherever they are found, as well by Europeans as others; they have a very soft shell, and are about the size of a pigeon's egg. The mother turtles lay thrice a-year, at intervals of two or three weeks, depositing in one night as many as a hundred at a laying. An experienced eye and hand are required to detect the eggs, as they are always ingeniously covered up with sand; but when they are hunted very few escape. The Orinoco Indians obtain from these eggs a kind of clear, sweet oil, which they use instead of butter. In the month of February, when the high waters of the Orinoco have receded, millions of turtles come on shore to deposit their eggs. The certainty and abundance of the harvest is such that it is estimated by the acre. The yearly gathering about the mouth of the river alone is about five thousand jars of oil, and it takes five thousand eggs to make a jar.

The Frescoes of Giotto.—The frescoes of Giotto, in the church of the Arena at Padua, are monuments of great value to Italian art. By a recent decree of the Minister of Justice, they have become the property of the city. Acting on the proposition of the Commission for the Preservation of Monuments, the Municipal Council decided to restore those frescoes which stand above the entrance door, and which represent "Death," "Judgment," "Hell," and "Heaven," as the cracking away of the plaster has increased considerably latterly. To carry out this difficult restoration, Professor Guglielmo

Botti was sent for from Pisa, who is well known from his restoration of the frescoes of Benezzo Gozzoli, in the Pisa cemetery. The Marquis Pietro Selvatico, a competent judge in these matters, and a well-known writer on art, writes as follows in the *Giornale di Padora* of the manner in which Professor Botti has performed his works, that "Botti came to Padua without loss of time, and set to work with a fearlessness which was evidently due to confidence in his own skill. With a quickness truly marvellous, he put together the cracked and broken plaster, and, by means of a cement, fastened it to canvas stretched on a frame, without losing a single morsel. The most difficult operation being accomplished, which any slight involuntary movement might have spoilt, he removed the plaster, which had been previously wetted, to put on in its place a coating of very strong cement, and on this he reapplied the plaster, carrying the fresco with such precision as not to cause the least displacement, so that all the pieces were joined together in the same position as they were originally, and so firmly as to exclude every possible danger of scaling off or falling to pieces.

Lancashire Manufactures.—The "Annual Cotton Circular" says:—"We regret to say that the year just closed has been one of the worst, if not the very worst, for the manufacturing industry of Lancashire that has yet been experienced. During much of the time spinning and weaving has not been practicable, except at a ruinous loss, and large portions of the machinery have been compelled to stand idle, causing wide-spread pauperism and distress among the working population. The towns of Preston and Blackburn have suffered especially from this calamitous state of trade, and at certain periods of the year as much as half the machinery in these towns was unemployed. Very many failures occurred, particularly among the smaller manufacturers, and the gloom that prevailed in Manchester was at times really distressing to witness. In the spring months, and again in September and October, this depression was most marked, and the feeling often found expression that the cotton trade of Lancashire was fairly destroyed, and would never be prosperous again. Mill property was in many cases sold at a ruinous sacrifice, often realising not more than one-fourth the cost of construction, and it was well understood that many insolvent concerns were only saved from the hammer because the creditors knew that a forced sale of machinery would only yield the price of old iron. Indeed, several old mills have been broken up and the machinery disposed of as old iron, and in this way the consuming capacity of Lancashire has been materially reduced, to the ultimate advantage of the trade. We are happy to report, however, that a much more cheerful tone has sprung up in Manchester in the last month or two; a more healthy and general demand for its productions has been experienced than has been known since the beginning of 1868. Many mills have been set to work that had been standing idle for years, and the margin between the price of cotton and that of yarn and cloth has become larger than has been known for a long time past. It is generally admitted that the production is now being turned off at a small profit, and this is matter for sincere congratulation. We are in good hopes, for reasons which we shall afterwards state, that this improvement will not be ephemeral, but will continue during most of the coming year."

The Vaudenvinne Steam Excavator.—It is stated that a new machine, actuated by steam-power, and promising to be of great utility in the construction of canals, reservoirs, and other earthwork, has been invented by a Belgian engineer, Mr. F. J. Vaudenvinne, of Brussels, and is being introduced into this country by Mr. Charles F. T. Young, C.E., of Duke-street, Adelphi. It is capable, also, of being applied to the reclaiming and breaking up of waste and uncultivated lands, and will stir up the soil to a depth of eight feet by a width ten feet and a half, at the rate of two feet a-head per minute. When employed for excavating purposes, it will dig and load into waggons over 2,600 cubic yards per day of ten hours, at a cost for the machine and men working it, including all expenses, of £3 per day, and in that time will perform the labour of 300 men. A small-sized machine has been built in England, which will be at work in London in a few days, for the inspection of engineers and scientific men interested in the subject. The employment of this machine will enable many improvements and works to be undertaken and carried out, which at present it will not pay to execute by hand labour only, and it would seem that there are few places in which its use will not be found of great advantage.

CORRESPONDENCE.

GOLD CURRENCY FOR INDIA.

Sir,—Be good enough to note in your *Journal* for this week, that there is an error accidently uncorrected in your report of my sketch of a plan for an international Indian gold currency. For $2\frac{1}{2}$ rupees of gold coinage being made equal to 5 francs of gold coinage, read 2 rupees. (*Vide* Art. 1, p. 105 of *Journal*). The correction is important, although it follows from the context that 2 rupees of gold are suggested as the equivalent of 5 francs, or 1 dollar, or 4 shillings worth of international gold coinage.—I am, &c., Fredk. Hendriks.

29th Dec., 1869.

TECHNICAL EDUCATION IN MANCHESTER.

Sir,—I regretted very much my inability to attend the Conference in Manchester, and the more so, as I should have liked to urge, as a part of any scheme of technical education, in an industrial and commercial city like Manchester, the development of such practical instruction in the languages of the commercial world as would be calculated to promote and increase the trade of Manchester. If Manchester is to compete with French, German, Swiss, and Belgian goods in foreign markets, it must be not only by improved scientific instruction, but by enabling its commercial agents to communicate with the natives of various countries, to understand their wants, and to carry on the contest with our rivals. Our deficiency in this respect, and the qualification of the Germans, deprive us of many a customer.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W., Dec. 31, 1869.

MEETINGS FOR THE ENSUING WEEK.

Mon......Institute of Surveyors, 8. Mr. Edward Smyth, "On the Enfranchisement of Copyholds."
R. Geographical, $8\frac{1}{2}$. 1. Lord Houghton, "Visit of the Society's Envoy to the Opening of the Suez Canal." 2. Letter of Mr. G. W. Hayward to the President, on Central Asia and the Pamir Steppe.
Medical, 8.
Social Science Assoc., 8. Adjourned discussion on Mr. E. W. Hollond's paper, "On the Employment of Paupers."
Tues ...East Indian Assoc., 3. Dr. A. Graham, "On the Industrial Settlement of Europeans in the Hilly Climates of India."
R. Medical and Chirurgical, $8\frac{1}{2}$.
Civil Engineers, 8. The President's Inaugural Address.
Photographic, 8.
Ethnological, 8.
Wed ...Geological, 8. 1. Mr. T. G. B. Lloyd, "On the Superficial Deposits of Portions of the Avon and Severn Valleys and adjoining Districts." 2. Mr. R. Etheridge, "On the Geological Position and Geographical Distribution of the Reptilian or Dolomitic Conglomerate of the Bristol Area."
Graphic, 8.
Microscopical, 8.
Archæological Assoc., 8.
Thur ...Royal, $8\frac{1}{2}$.
Antiquaries, $8\frac{1}{2}$.
Zoological, $8\frac{1}{2}$.
Royal Society Club, 6.
Mathematical, 8.
Fri ......Astronomical, 8.
Quekett Club, 8.

Journal of the Society of Arts.

FRIDAY, JANUARY 14, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

January 19.—"On the Coral, Pearl, and Amber Fisheries." By P. L. Simmonds, Esq., F.R.C.S., F.S.S., &c. Edwin Lankester, Esq., M.D., F.R.S., will preside.

January 26.—"On the Modes of Reading in Use by the Blind, and the Means for Arriving at Uniformity." By Thomas Armitage, Esq., M.D.

February 2.—"On Recent Improvements in Small Arms." By Capt. O'Hea.

INDIA COMMITTEE.

On Friday evening, January 21st, the discussion of Mr. Andrew Cassel's paper, "On a Gold Currency for India," will be resumed by Dr. Boycott, late of the Calcutta Mint.

EDUCATIONAL CONFERENCE.

The Council propose to hold an Educational Conference in the early part of February. The particulars will appear in a subsequent *Journal.*

IMPROVED CABS AND CAB INDICATORS.

In response to the offer of prizes offered for improved cabs and cab indicators, there have been sent in for competition eight communications with respect to cabs, accompanied with four drawings, and fifteen communications with respect to the indicators, including eight models and four drawings.

DONATIONS TO THE LIBRARY.

The following works have been presented to the Library, and the thanks of the Council have been communicated to the donors:—

A Catalogue of the Library of the Corporation of London; presented by the Corporation.

Thoughts on Speculative Cosmology, and Principles of Art, by W. G. Herdman; presented by the author.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

FOOD COMMITTEE.

With reference to the samples of preserved meats from Australia (boiled beef and boiled mutton in tins), forwarded by the Colonial Office for the consideration of the Food Committee (see correspondence in *Journal,* p. 2, vol. xviii.), the following correspondence has taken place:—

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-street, Adelphi, London, W.C.,
23rd December, 1869.

Sir,—In reference to your letter of the 1st November, enclosing copies of despatches from Victoria, relating to the samples of meat preserved in the colony, which accompanied your letter, and also in reference to your letter of the 14th instant, I am directed to send you the report of the Food Committee of this Society thereon.

The Committee, after careful examination of the samples, report as follows:—

1. The meat is thoroughly sound.
2. The fat is not excessive.
3. The gelatine is slightly defective, as compared with some other samples which the Committee have formerly had from Australia.
4. The texture of the meat is good.
5. The flavour and nutritive qualities appear to equal those of other specimens from Australia which have come before the Committee; but they are not equal to those of the sample from Her Majesty's victualling-yard at Deptford, of meat preserved in that establishment by the process now in use there. The Committee are unable, in their present state of information, to say with confidence whether this difference may be due to the nature and condition of the meat itself, previous to its preservation, to the climate in which it is preserved, or to the mode of preserving it.

The Committee are of opinion, and they venture respectfully to suggest, that it would be of advantage if specimens of the meat preserved in the Deptford victualling-yard were sent to Australia, for the inspection of the meat-preserving companies in that colony, together with full details of the process of preservation adopted in the above establishment.

I am, Sir, your obedient servant,
P. Le Neve Foster,
Secretary.

To Sir Francis Sandford, &c., &c.

Downing-street, 11th January, 1870.

Sir,—I have laid before Earl Granville your letter of the 24th ultimo, and I am desired by his lordship to express his thanks to the Food Committee of the Society of Arts, for the report they have been good enough to furnish on the samples of preserved meat from Victoria, which were submitted to them.

I am, Sir, your obedient servant,
F. R. Sandford.

P. Le Neve Foster, Esq.

CANTOR LECTURES.

ON THE SPECTROSCOPE AND ITS APPLICATIONS.*

By J. Norman Lockyer, Esq., F.R.S.

Lecture I.—Delivered Monday, December 6th, 1869.

I am sure I need hardly remind a large number of my audience that these powerful instruments of research with which you see me surrounded, very much as an eclipsed sun is surrounded by the corona, are a product, not of the last 100 years only, but even of the last decade.

* The right of reproducing these lectures is, by an arrangement with the Society of Arts, reserved by the author.

Ten years ago, a lecture on the spectroscope would, I may almost say, have been an impossibility. The instrument, as we now know it, was only then in its infancy. And yet, so far as one can see now—it is always very easy to prophecy after the event—there seems very little reason why lectures on the spectroscope should not have been given nearly two centuries ago, for, within six years, two centuries have elapsed since the immortal Newton made his classical researches on the action of a prism. You may, perhaps, be inclined to ask, how it could take 200 years for a knowledge of the prism, and a knowledge of the wonders that can be worked by it, to become part and parcel of our common stock of information? If you ask me to explain this, I tell you candidly that I cannot, but there is this grain of comfort connected with it which none of us should forget—we may almost say for certain that Newton and his successors would have brought a great deal more out of the prism than they did, if they had given a little more attention to it—had tortured it as they did other things; and I dare say that those who will follow us will point to us and say the same; they possibly will say that in the 19th century men of science, in working and experimenting, saw a great many things, and chronicled them, but did not care to go any further with them. This is very true, and the result is that work is not done which might be done if we were more receptive and original in our methods of investigation, that is to say, if we trusted nature more and ourselves less.

Now let me, at the outset, be perfectly frank with you. When I was requested to give these lectures, I was told to be as elementary in my treatment of the subject as possible. My sailing orders are perfectly clear, and I hope those who have already passed through the elementary stage will bear with me.

I propose that this first lecture should in the main consist of an account of the prism and the principles of the spectroscope, and then of a description of some of the spectroscopes which you see on this table. I hope afterwards to go somewhat in detail into the applications of the spectroscope, not only with regard to terrestrial matters, but also with regard to those problems which we may possibly consider much grander ones, which deal with those celestial bodies which are sufficiently our neighbours to send us light.

Obviously, the first question we have to answer is this, What is a spectroscope? This I answer by saying that a spectroscope is a combination of prisms. The next question, then, that arises, is, What is a prism? Here is one, and I think I need not spend much time in describing it to you. It is, as you see, a piece of glass—though it need not necessarily be so—bounded by five surfaces, two of which, as you see, are parallel to each other—though they are not necessarily so—and three of which, bounded by parallel edges, cut each other at different angles. The importance of these different angles you will see bye-and-bye. The discoveries of Newton, to which I have already alluded, were connected with prisms, that is to say, with the representatives of this piece of glass which I hold in my hand, and they were based on well-known properties of light. I have there an electric lamp, which enables me to throw a very brilliant beam of light wherever I want it to go. If I leave that beam of light alone, it will simply travel in a straight line from its source, and to get it out of that straight line I have to do one of two things; I must either reflect it or refract it. The reflection and refraction of light depend upon perfectly well-regulated laws, which it is hardly necessary that I should explain to you at length. I wish to show you, however, at the very first blush of the inquiry, what refraction means, and how it differs from reflection. Mr. Pedler will now be good enough to place a reflector in the path of the beam, and what will happen will be this—the beam, instead of going straight across the room, will be bent out of its course.

I have also arranged a vessel of water, and I will now cause the reflected beam to strike upon the surface of the water. You will see that the beam is also driven out of its path when it impinges on the surface of the water, in the same way as when it impinged on the surface of the reflector, but not to so great an extent. You see we have got rid of our straight beam of light across the room. That the angle of reflection is equal to the angle of incidence, is all I need trouble you with on the subject of reflection. But I want you to observe that when the reflected beam strikes the surface of the water, it no longer travels in the same straight line as it did before it reached the water. It forms a sort of angle or elbow. You see, therefore, in one experiment, although a very elementary one, the effect both of reflection and refraction. If I had time to vary the angle at which the light strikes the water, I could show you that the angles formed there are bound together by a regular law, as is the case with reflection; and if, instead of water, I had taken other transparent media, I could have shown you that the amount of elbow would vary with the medium I employed.

Now it is clear that, in refraction, we are dealing with light going from a rarer into a denser, or from a denser into a rarer medium, and it is extremely important that this should not be lost sight of, because in the experiments I shall have to place before you, we shall have to deal with these two things. First, the light has to go from the air into the glass, and then, having travelled through the glass, it has to come out again into the air, so that we shall really have a double effect produced by this refraction under certain conditions. Perhaps you will ask me what are those conditions? I hope to be able to show you by a simple experiment. We have here a piece of glass, bounded by parallel surfaces, and inclined to the beam. You see when the beam passes through that the effect is imperceptible. The reason of this is, that when we get the light falling on the glass from the air, then travelling through the glass, and coming into the air again, under exactly the same conditions, what is done at the first surface is exactly undone at the second, so that we get pretty much the same effect as at first. But, now, if instead of having the glass bounded by parallel surfaces, we turn one of the parts of which it is composed, so that the sides are no longer parallel; you will see that there is a distinct alteration in the effect produced; the beam is directed to another portion of the wall altogether. This premised, we come to Newton's first proposition, which is this (I do not suppose that the order of propositions in Newton's optics represents the order in which he discovered the different phenomena — in fact, we have evidence that it does not):—"Lights which differ in colour differ in refrangibility." I think that requires no explanation. You will be able to translate it for yourselves thus. Lights which differ in colour are differently acted upon by a prism, which, as you have seen, gives us a considerable result of the action of refraction. I have there an arrangement by which, instead of getting one beam of white light, we get two of differently coloured lights, red and blue. Let us pass these two beams of different colour through the same prism, and if what Newton says, that lights which differ in colour differ also in refrangibility be true, you will see that the action of the prism on these two differently-coloured beams will be unequal. In other words, you will get the red beam deflected to a certain distance from a straight line, and the blue deflected to a certain other distance. You see by this experiment that there is a distinct difference in the amount of refrangibility—that the red light is not diverted so far out of its original direction by the prism as the blue.

We now approach Newton's great discovery, which is this:—"The light of the sun consists of rays of different refrangibility;" that is to say, if we get a beam of sunlight, and torture it by means of a prism, we shall get colours of different refrangibility. I hope you will look

upon that electric lamp, which has been called a domestic sun, as not a bad substitute for sunlight; and now, instead of two coloured beams, I will pass one of perfectly white light through the prism. You see we have one single beam of white light passing through the prism, and the action of that prism is at once to turn that beam into a beautifully coloured band, which will remind you of a rainbow. It was this which Newton did in a dark room, which led him to his important discovery, and to another proposition which I now mention. White light is compounded, or may be compounded, of light of different degrees of refrangibility. Please to consider the image on that screen as an indication of the different refrangibility which the beam of white light undergoes after it has passed through the prism. You see red at one end, where the action of the prism is feeblest, and again you see the coloured band passing through orange, yellow, green, blue, until you get to the violet. But how is it possible to show the truth of Newton's assertion that white light is compounded of these different colours? We can do so by simply placing in the path of this coloured beam, which you see passing through the room, another prism placed in a contrary direction; you see in a moment that we have got back white light.

Possibly you may ask how it is that white light is built up of all colours? That question I can answer to a certain extent by an experiment of a different order. Here is a disc painted of different colours. If it be true that the idea of white light is simply an idea built up by the eye, because we have all these multitudes of light waves perpetually pouring into it with a velocity that is very much greater than anything which can be translated into words, surely we should get something like this effect also if we were able, by rapidly rotating this screen, to obtain a more or less perfect substitute for white light. The screen being made to rotate rapidly, you see we have something like an approximation to white light, though not so clear as it might be. I am very anxious that you should see that this is really an effect due to the flowing in of light from different parts of that wheel into the eye, and so forming this compound impression, which is conveyed to the brain, and so, instead of illuminating the disc continuously by the electric lamp, I will do so intermittently, by an electric spark. You see now that, although the disc is rotating rapidly all the time, each separate colour is now discernable, and the disc appears to stand still. The reason of this difference is, that in one case the rotation of the wheel builds up a compound image in the eye, and in the other case it cannot do so, because the flash of the light is much more rapid and instantaneous than the rotation of the wheel.

There is one more experiment I am anxious to make, to show that all the beautiful colour which we get in nature is really reflected after all, and that if our sunlight, instead of being polychromatic, that is to say, compounded of all these beautiful colours, were monochromatic, or of one colour only, the whole expanse of creation would put on a very different appearance from what it does. Instead of illuminating this room, as it now is, by this white light of the electric lamp, I will illuminate it by a light that only contains one colour—by the yellow light of sodium. If you now look at this diagram, you will see that some of the letters upon it are almost invisible, some are very visible, the yellow light only allows a difference to be seen of more or less depth of shade—there is no difference in colour. But when we allow the polychromatic light from the lamp, as we get it from the sun, to shine upon the diagram, you at once see that all these letters are of different colours, and burnt out, as it were, into beauty. This experiment feebly indicates the advantage we possess of living in a universe lit by white or polychromatic light, instead of light which is merely blue, or yellow, or any other colour.

Hitherto we have spoken only of refraction. I now introduce the word "dispersion," which represents simply a measure of different refractions, or the difference between the bending of the red and the violet rays of light. In an ordinary spectrum, such as you see there, the difference between the red and the violet is the difference of the refraction of those two colours by the prism, and the angle which the red, or yellow, or other colour, forms with the original path of the compound-beam is called the "angle of deviation."

There is one other consideration which we owe to Newton. In his very first experiments, that great philosopher discovered that the quality of the spectrum depended very much on the following consideration:—If I wish to get the best possible effect out of that prism, and the purest possible spectrum, I have so to arrange it that the particular ray which I wish to observe, whether the yellow, the blue, the green, or any other, leaves that prism at exactly the same angle as the incident compound ray falls on it. This angle is termed the "angle of minimum deviation."

The two things, therefore, of great importance which we owe to Newton, are, first, the dispersion of the prism; and, next, the pointing out the extreme importance of arranging the prism, so that, if you want to observe a particular ray, it should leave the prism at the same angle as the white light falls on it.

It is very curious, however, that Newton, although he made many experiments on prisms, really omitted one of the most important points, which you will see carefully arranged for in every one of the spectroscopes before you. And here again you see the importance of patience in these matters, for we had to wait a century and a quarter before the next essential point was hit upon in the construction of a spectroscope. Newton made a round hole in a shutter for his experiments, but we now know he ought not to have done that; he ought to have made a slit. But this did not come out until 1812, when Dr. Wollaston, by merely using a slit instead of a round hole, made a tremendous step in advance. You will see the importance of this in a moment. We have now a round beam travelling through the room. We will now put the prism in the path of that beam, and you see at once that the spectrum is not a pure one. Bear that spectrum in your mind a moment, while Mr. Macleod changes that round aperture for a slit. You now see a spectrum purer than we have seen before; the red, blue, green, and violet, instead of over-lapping and destroying the beauty of the spectrum, show distinctly as simple colours, each one speaking for itself on the screen. By using this narrow slit instead of the round hole which Newton made in the shutter, we got the first idea of the tremendous importance of spectrum analysis, for, no sooner had Dr. Wollaston examined the sun-light, as Newton had done a century and a quarter before, than he found out that it was not at all as Newton had represented it. Newton told us in fact that the sunlight was continuous, that is to say, that the spectrum was such a one as you have seen on the screen to-night, that there was no break in the light which flowed out to every part of the spectrum, from the extreme red to the violet. When Dr. Wollaston tried the slit, he found, however, that the spectrum, instead of being that rainbow band of light which you have seen, was really broken by a succession of fine—beautifully fine—black lines.

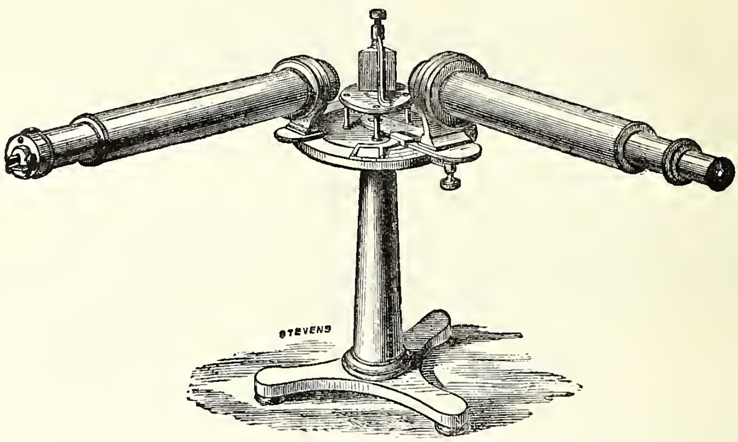
I must again apologise for the absence of the sun, but I will make up for the defect, as far as possible, by showing you some slides representing different parts of the solar spectrum. There is, first, a portion of the red end of the solar spectrum, not continuous, like the red end of the spectrum which you saw just now, but intersected by numerous black lines. There, again, is a portion of the yellow part—still the lines are there whatever part of the solar spectrum we examine; and these slides are carefully photographed from the most elaborate maps that have been produced—those of Kirchhoff and Bünsen. These lines were observed by Dr. Wollaston,

but it was not until 1814 that we find them mapped out with the greatest care, to the number of 576, by a German optician, named Fraunhofer; hence they are termed "Fraunhofer lines," the principal ones being lettered A B C, &c.

If we say, then, that spectroscopic inquiry dawned with Newton, certainly the sun began to rise with Fraunhofer, for he, no longer content with getting a sunbeam through this slit, and finding out and measuring with most admirable accuracy these 576 lines in that band of colour, turned his telescope to the moon and the planets, and the different stars; and he discovered that, in the case of the stars, the positions of the lines varied considerably from those they occupied in the spectrum of the sun; and this is one of the most important discoveries which have been made during the present century in these matters. Indeed, it is the foundation of very much of the later more detailed work.

We have now to pass on from 1812 to the year 1830, when Mr. Simms, an optician of world-wide reputation, made another very important improvement in the spectroscope. Instead of merely using a prism and observing the slit with the naked eye, he placed a lens in front of the prism so arranged that the slit was in the focus of the lens, as you see in this instrument. The light which is allowed to pass through the slit, is turned into a parallel band and allowed to travel through the prism; then, instead of having merely the eye to observe the spectrum, there is another lens which throws an image of the slit, which may be magnified at pleasure (Fig. 1). The

Fig. 1.

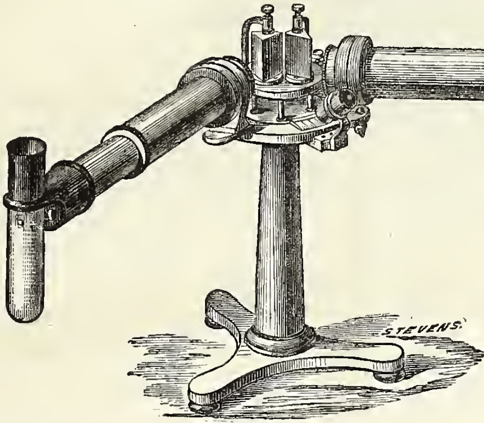


very great importance of this construction is at once obvious, if you think for one moment of the photographs I have shown you on the screen. We now know, and it is not too early to place this before you, that these black lines indicate regions in the spectrum where there is no light. If the light is perfectly continuous, so that every ray of light is enabled to register itself at this end of the telescope, by painting an image of the slit, you will get a continuous spectrum; but supposing for instance, that the whole of the yellow light were absent, it is clear that the spectroscope, if it does its duty well, will give you blackness where the yellow light is absent. We do not find that the whole of any particular colour is absent, but here and there, scattered over all the colours, there are these places where the rays of light do not come to tell their story. This is the explanation of the Fraunhofer lines in the solar spectrum. In the light which we get from the sun, certain of the rays which we may suppose ought to come to us, do not come, and we get no news from them. We do get news of some of the other rays, which show us the various shades of blue, of green, and so on, but here and there a ray, which possibly might come if it were not better employed, does not come, and therefore the image of the slit cannot be painted. I am glad to say that we know a little more about them than we did a year ago. You may imagine the enormous mystery—the wonderful reverence almost—with which this question of the Fraunhofer lines was approached, until they were thoroughly understood; and recollect that we owe the discovery of them—by which we are enabled now to determine the pressures acting in the atmospheres of the most distant stars—simply to the fact that Dr. Wollaston, instead of drilling a round hole, used a slit, and to the other additional fact, that Mr. Simms, instead of using that slit with a mere prism, used a lens, and made the beam parallel, and then viewed that parallel beam, after it had passed through the prism, through another telescope. You see how closely connected are the grandest discoveries with the skill and suggestiveness of those who supply different instruments for our use.

Now, I must ask you to come back again to the prism. I have already told you that dispersion is the measure of the difference of the refrangibilities. I have there a prism which appears like any ordinary prism as it stands there, but it really is composed of several layers of different kinds of glass, and I want to show you, by its means, how very different is the degree of dispersion which we can get from different materials. Pass an ordinary beam of light through that prism, and it will be seized hold of, and we shall get different spectra. We have three distinct spectra, showing that there is something in the different layers of which this prism is composed which turns the light out of its path, and which disperses it, more in some cases than it does in others. This something is the density of the glass composing each layer; and we are not limited to glass (for if we were we should not be able to go so far in these inquiries as we do). I have here two pieces of glass, which I will hand to the chairman, in order that he may perceive, by the difference in their weight, the great difference in their densities. It is a very natural conclusion that the heavier and denser glass should have a stronger action on the light than the lighter glass has. So that, in these inquiries, if we want to get great dispersion, not only must we use heavy glass, but we leave glass behind altogether, as amongst the liquids we find some which give even a greater dispersion than the densest glass. You shall now see a beam passed through a prism made of bisulphide of carbon; you see at once that the spectrum is much longer than that produced by the densest flint glass we can get. But there is another consideration to be borne in mind. The dispersive power and refractive

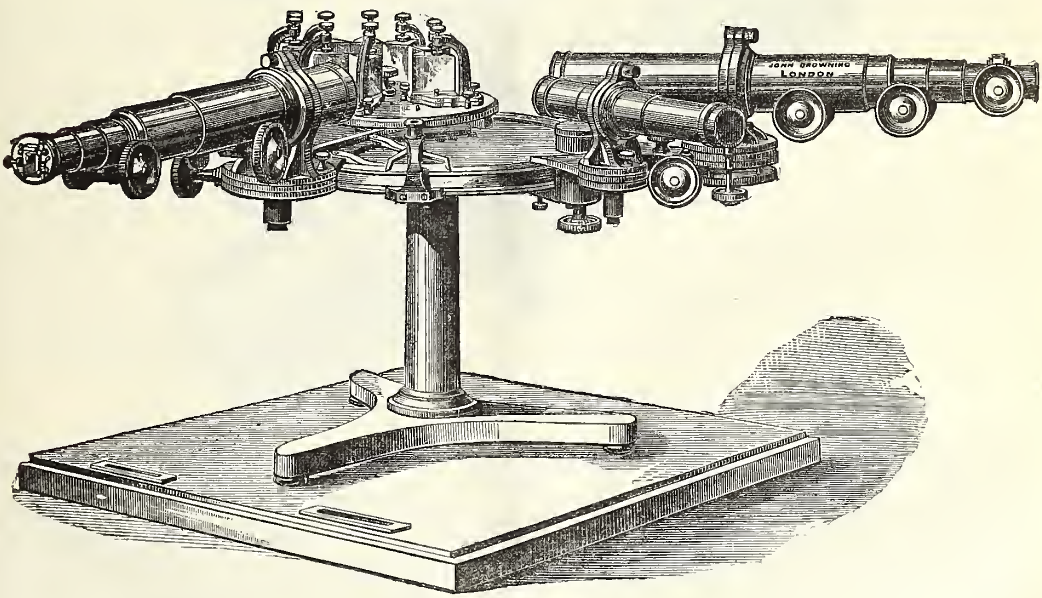
power not only depend on the density of the glass, but on the angles of the prism. I will now send a beam of light through two prisms of unequal angles; the effect is extremely distinct. One prism has an angle of 20°, and the other of 60°, and the larger angle gives us a much greater deviation and dispersion; therefore, we not only have density to help us, but we have also the angle of the prism. And now let us go on to a third important point in the matter. We are not limited to one prism at all if we wish to get a great amount of dispersion (Fig. 2); if you will think the matter over, you will see that there is no good reason

Fig. 2.



why we should not employ two, and then you will find that the dispersion will be considerable. It is almost impossible to employ three in an experiment of this kind, because the light would be refracted so enormously that the lantern would be in its way. So you see, first, we have a single prism of a dense substance; by increasing the angle we get increased dispersion, and then we get it still further increased by adding another prism, and so we might go on, adding prism after prism, until we get to any number of prisms arranged in the best possible manner for the light to be successively dispersed by each of them (Fig. 3). First of all, you have the dispersive power

Fig. 3.



of glass, then you have the angle of the prism, and then you have a number of prisms, all of them capable of being so arranged that we can make them all useful in these inquiries, until at last we get a dispersion of such an enormous amount, that the spectrum of the sun, as mapped by Kirchhoff and Bunsen, is several yards in length, although it is nothing but a succession of images of one of the finest slits which our best opticians are able to make.

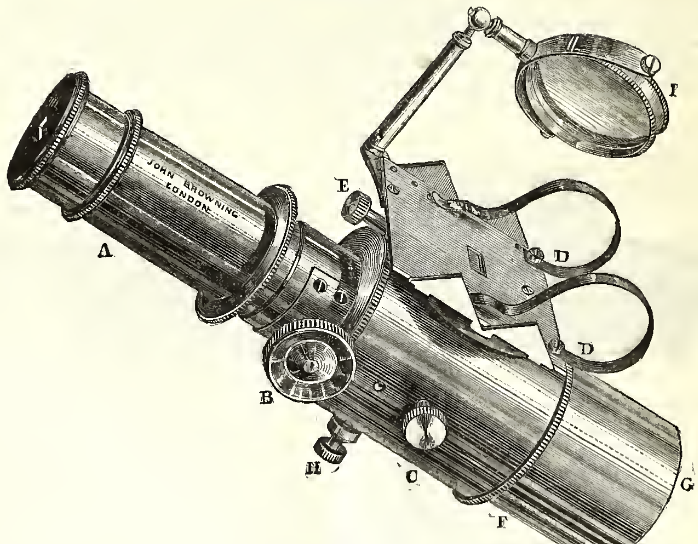
You see, therefore, that our spectroscope depends, first of all, on Newton's discovery of the prism in 1675, and on the fact which Newton found out incidentally, that it is

important that the prism should be used at the angle of minimum deviation. We then get the slit added by Wollaston in 1812; then the collimating lens added by Simms, in 1830. In this way we have arrived at the spectroscope improved and modified as an instrument, until at last we get spectroscopes so arranged that the glass is of the finest possible material, the angle being the largest possible, the glass the densest possible, and the number of prisms as great as possible.

There are some other considerations connected with the manufacture of spectroscopes which it is hardly necessary I should bring before you, as they are rather more in the nature of detail than of general principles; but I must point out that where liquids are employed, it is absolutely essential that the temperature should be as equable as we can get it. A current of warm air in a room is quite sufficient to render any spectrum obtained by these liquid prisms perfectly useless; hence, although their great dispersive power is of great value in some cases, where we want dispersion more than anything else, still, as a rule, we are limited for nearly all our researches to these dense glass prisms of great angle, to which I have already alluded. But there is another consideration of great importance which comes in here. If the angle of a prism be large, a ray of light travelling from one prism to another enters the second at an extremely small angle, under which circumstances a large amount of light is reflected, and thus lost, so that it is a question, which I am not quite sure is yet solved, whether, in spectroscopes of this construction, it is not better to use a greater number of prisms of a smaller angle than a smaller number of a large one. It is perfectly true that in all cases the reflection at the first surface of a prism is something considerable, and therefore the fewer surfaces, and therefore prisms, you have to deal with the better; but there is also another question, whether the loss of light in falling on a prism at a large angle, as you see here, is not really greater than the loss of light which would be occasioned from its having to pass through an extra prism on its path? Another important consideration, besides the purity of the material, is the perfect figure of the slit. You might imagine that the slit of a spectroscope was perfectly easy to make; but, judging by the results of the manufacture, it is extremely difficult, for a perfect slit is still very rare. Mr. Browning (to whom science is so much indebted for his careful manufacture of spectroscopes), however, has told me that he has quite lately arrived at a very important improvement: by making the slit of a compound of gold, it is perfectly easy to get one which, first of all, will not rust, which will not be acted upon much by temperature, and one also which will take a good figure without any very great difficulty.

So far, I have spoken of spectroscopes as spectroscopes —as one of the instruments the improvement of which should be cared for by every member of this Society. Their applications will come after. Here, thanks to Mr. Browning, are representatives of all now constructed, with two, three, or four prisms (Fig. 4). Here is a

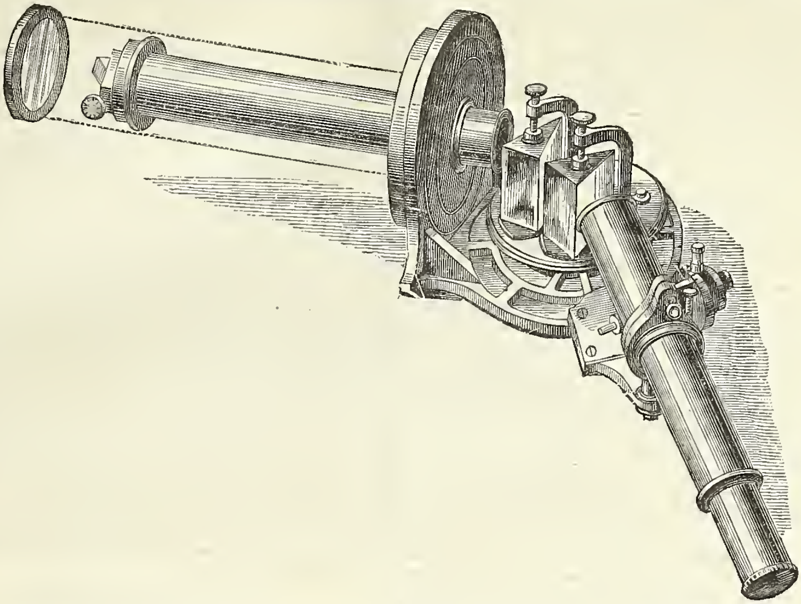
Fig. 4.



chemical spectroscope, for this instrument is now almost as important and essential in a chemical laboratory as a balance. Here is another, applied to a microscope; there, again, it is applied to a telescope. As it is essential not only to determine the spectral lines of the substances in our laboratories, but the different positions of the dark lines and bright lines in the various orders of celestial objects, such as comets, nebulæ, and so on, we must for this purpose have something attached to the telescope, as it is essential for the miscropist to have something attached to the microscope. Here is a star spectroscope, which apparently differs in no way from the other spectroscopes (Fig. 5).

But there is one very important consideration which I have to draw attention to with regard to this spectroscope. I have insisted on the importance of the slit; but you will see in a moment that the image of a star, if it is a good image, will be a mere point in the telescope, and, therefore, while a slit is not absolutely necessary, it is essential to have some arrangement by which that point of light, the spectrum of which would be merely a line, and, therefore, not broad enough to enable us to see what the lines are which we may expect in the spectrum of a star, if it is anything like the spectrum of the sun, shall be turned into a band; that has been accomplished by means of a cylindrical lens, its function being to leave the light alone in one direction, but to turn it into a band in another direction, so that when the light of the star gets through such a lens, it is no longer a line but a band, and this is then grasped by the object

FIG. 5.



glass, sent through the prisms, and received by the observing telescope, so that when you get the image of it in the observing telescope, instead of having a line of light so fine that we can see no lines in it, it is a distinctly broad band in which the lines can be observed. As this lens is simply a contrivance for enabling the eye to see about where there is a line, I submit now, as I submitted some years ago, that the proper place for it is close to the eye, between the eye and the image. I suggested this to Mr. Browning some time ago, and since then I have been gratified to find that, in many of the spectroscopes used on the Continent, this arrangement is adopted.

Of the special application of the spectroscope to the microscope I need say but little now; but here is a diagram which shows some of the first arrangements. The light which illuminated the object in the microscope was first of all passed through a prism; but in later arrangements it passes through the prism in its passage from the object. This is obviously a much better plan, because, in the first instance, you could only deal with transparent objects; but here, as you deal in any case with the light that comes from the object itself, it is quite immaterial whether the object be opaque or transparent.

It will be my duty, in the following lectures, to deal with the applications of spectroscopes in all their forms.

EDUCATIONAL NOTES.

On New Year's-day a meeting of delegates from the various industries represented by the Leeds Trade Council was held in the Mechanics' Institute of that place. Considerable difference of opinion appeared to exist among the speakers. Mr. Hurin, an engineer, advocated a secular and compulsory system; while Mr. Miller, a cloth dresser, thought that Englishmen would not endure compulsion, and advocated the Bible as the only sure standard for education. Another speaker, a cabinet maker, denounced the clergy and ministers of religion very strongly, and said the only objection he had to the League was that they had taken ministers of religion into their ranks. Mr. Pickles, engineer, said he represented a number of men who were opposed to the League because it would introduce police supervision, and that would be no better than a spy system. He had come to the conclusion that the scheme of the Union was the best. For his own part, he thought they were overrating the education question, because it was well known that the most scholastic and enlightened nations had been the most sunk in profligacy. The meeting was then addressed by another cloth-dresser, a miner, a mason, and other representative working men, and, after some hours' discussion, a resolution was passed in favour of a free, unsectarian, and compulsory system.

At a meeting of Wesleyan Methodists, on the 4th of January, at Bilston, the Rev. H. W. Holland advocated the entire abandonment of the denominational system, and the formation of a national system, which should incorporate within itself the denominational schools. He had no sympathy with the Manchester Union. If he were driven to decide between the Union and the League, he should not hesitate for a single moment to join the latter. The Manchester Union told them what the denominational system had done; but it did not tell them what it left undone. It might be replied that the denominational system did not profess to educate the whole nation. Then, if it did not, it was high time that it stood out of the way, and allowed the nation to educate itself.

On Wednesday evening, the 5th January, a meeting of working men, convened by the officers of the Education League, was held at Birmingham, when Mr. Dixon, M.P. presided. In giving an account of the progress of the League, he stated that they had not only got some fifty members of Parliament, 500 ministers of religion, and 8,000 or 9,000 members, but they had got a subscription-list amounting to about £50,000. He thought there were now practically only two parties in the country on the education question—the Birmingham League and the Manchester Union—and the people would have to accept and give their support to either one or the other. He then briefly stated the points of difference between the two bodies, and advocated the claims of the League to the support of the working men, expressing a hope that at least 20,000 of them in Birmingham would join it, so that, when their measure was introduced into Parliament, they might be able to say it had the support

of the working class, that class whom it was specially intended to benefit. A long debate followed, in which numerous working men took part. Mr. David L. Marks, a member of the Provincial Typographical Society, proposed as an amendment, "That the interests of education would be best served by a deputation meeting of the League and Union, with a view to amalgamation," but this was not seconded, and was received with the remark, "They would mix as well as oil and water." Great unanimity prevailed in favour of purely secular schools, and a resolution was unanimously passed, pledging the meeting to support the League.

Sir Charles Dilke, M.P., in a recent address to his constituents at Chelsea, expressed his regret that, in the draught Bill prepared by the executive council of the League, there was something suggested in regard to the reading of the Bible in the schools, which the opposite party would seize hold of and use as a compromise with their views. But he hoped that a meeting of the London branch of the League would be called, at which some change in that respect might possibly be effected, because there was no chance of a complete Bill on that question being carried at once. There was, indeed, a possibility of the government Bill being carried at once, but it was not likely to be a complete measure; and there was no likelihood of the League's Bill being immediately passed. He therefore thought it would be wrong for the League to begin the campaign with a compromise. Sir Charles combated the argument that the plan of the Education League would greatly increase local taxation. The rates, he believed, would be ultimately decreased, by the diminution of pauperism and crime consequent on the spread of education.

The following resolution was moved in the Manchester City Council on Wednesday, the 5th January, by Mr. Alderman Rumney, and unanimously adopted:—"That it is desirable that a system of national education should be established, which shall provide elementary instruction for every child in the country. That the attendance of children at school shall, in the absence of home instruction, be rendered obligatory. That schools supported by public rates or national taxation should be under local control, and the instruction therein given should be common to all, and be such as would not interfere with the religious convictions of any sect or party."

At a meeting of the Christian Young Men's Association, at Cambridge, held on Wednesday, the 5th inst., Professor Fawcett, M.P., delivered an address on education, in which, referring to the question of compulsion, he says:—"Government interference can only be tolerated if that which it seeks to do cannot be done without it, and facts prove beyond dispute that if we go on in the future as we have in the past, the education of the nation will never be secured. The principle must be broadly and distinctly laid down, that education shall be guaranteed to every boy and girl. Everything should be done not to interfere more than is necessary between the parent and the child; but we ought for ever to banish the idea that liberty is in the slightest degree infringed if a parent is prevented from inflicting upon his child the irreparable injury which ignorance entails. If a child is thus wronged the State becomes his natural protector, for he has no power to protect himself. This indicates the essential difference between government interference on behalf of grown-up people and on behalf of helpless and dependent children. The former is, if you like, antagonistic to individual liberty, but the latter kind of interference on behalf of children is consonant with the principles, not only of justice, but of freedom."

The *Pall Mall Gazette*, in a recent leader, advocates a similar view. It says:—"We hear a great deal about the rights of parents, the rights of conscience, and the wickedness of State interference. Yet those who use this language most eagerly, and repeat the commonplaces connected with it most loudly, never have a word to say about the rights of children. They think it a very hard thing that the parent should not have a right to do as he pleases about educating his child; but it never appears to occur to them that the child has a considerable stake in the matter as well, and that it is a monstrous hardship on any human being that those who have brought it into the world should not supply it with the training necessary to play its part there. In the present state of society some degree of education is just as necessary to a person as food and clothing; and the right of a parent to neglect to educate his child—a right which, under the present law, he undoubtedly possesses in England—appears to us as absurd and pernicious as the right to neglect to feed and clothe him." At the same time, it sees great practical difficulties in carrying out these principles. It regards these as "so great, that the fullest admission of the principle that education ought to be compulsory is quite consistent with a recognition of the prudence of abstaining, in the present state of affairs, from any but very cautious measures in that direction."

The *Times*, however, is not yet prepared to advocate a compulsory system. Commenting upon Professor Fawcett's address it says:—"Is compulsion likely to be the most effectual means for creating an enthusiam for learning among those to whom it would be applied? If English parents look with disfavour on too much book learning already, are they likely to view it more favourably when it comes to them under the authority of justices of the peace, and is associated with fines and imprisonments?"

SCIENCE SCHOOLS.

THE TECHNICAL SCHOOLS, ARTHUR-STREET, CHELSEA.

By George C. T. Bartley.

The science schools and classes, which now exist in more than 500 places in the United Kingdom, have been brought into existence chiefly by the agency of the Science and Art Department, a branch of the Education Department of the Committee of Council, under the direction of the Lord President of the Council, assisted by the Vice-President of the Committee of Council on Education.

The origin of the science division of this department may be said to date from the year 1852, when the subject of giving encouragement to the advancement of practical science was mentioned in the following words, by her Majesty, in her speech from the throne, on the 10th November, 1852, in opening the session of Parliament:—"The advancement of the fine arts and of practical science will be readily recognised by you as worthy of the attention of a great and enlightened nation. I have directed that a comprehensive scheme shall be laid before you, having in view the promotion of these objects, towards which I invite your aid and co-operation."

In order to carry out this proposal, the Board of Trade, in a letter addressed to the Treasury, and signed by Mr. Cardwell, on the 16th March, 1853, suggested the formation of a Department of Science, similar to the one already existing under that Board for the encouragement of practical art.

These two branches were to be formed into one, the motive power to be local and voluntary, and mainly self-supporting. This letter further advised the formation of a metropolitan establishment for the collection of illustrations, models, &c., of both science and art, and of a science school of a very high class, where pupils should complete their training, and from which information might be circulated to the provincial schools. The Government School of Mines and of Science applied to the Arts was to discharge the functions of this Metropolitan School of Science, and accordingly, with several other institutions, namely, the Museum of Practical Geology, the Geological Survey, the Museum of Irish Industry, the Royal Dublin Society, and, later, the

Science and Art Museum, Edinburgh, was proposed to be placed under this new department.

Her Majesty's Treasury approved of this proposal, laying particular stress on the idea that the best method of encouraging local institutions would be attained by the creation of a metropolitan school for science; and, accordingly, the Board of Trade Department of Science and Art, as it was to be called, came into existence.

During the first six years, that is, from 1853 to 1859, very little was done for the promotion of science, the title of Science and Art Department being almost a misnomer. A few experiments were tried, and offers held out to localities to take up the subject of science instruction, but only eleven places in the United Kingdom responded. These were, Aberdeen, Birmingham, Leeds, Newcastle, Poplar (Green's Sailors' Home), Stoke, St. Thomas' Charterhouse, Truro, Wigan, and Wandsworth. The attempts at Leeds, Newcastle, Stoke, Truro, and Wandsworth were, however, soon given up, and the want of success of the plans pursued may be judged of from the fact that the aid from the Department to all the science classes, for the six years, amounted to but £898, the great difficulty in all cases being to obtain any fair amount of local interest and pecuniary support, without which, at that time, it was not considered desirable to grant State aid.

In the year 1857, a Treasury Commission, composed of Lord Granville, Sir S. Northcote, and Sir C. Trevelyan, recommended that the Department of Science and Art should be transferred from the Board of Trade, and placed under the Lord President of the Council, assisted by a vice-president of the Committee of Council on Education, as a branch, though distinct from the Department for Primary Education.

It may, therefore, be said that, up to the year 1859, there existed no general system of aid to science instruction which might be taken advantage of by any locality for its artisan population. In that year the minute of the 2nd June was passed by Lord Salisbury and Mr. C. B. Adderley, to give aid in obtaining instruction in the following subjects, viz.:—

1. Practical and descriptive geometry, with mechanical and machine drawing, and building construction.
2. Physics.
3. Chemistry.
4. Geology, mineralogy (applied to mining).
5. Natural history.

By this minute, payments were to be made to teachers on certificate allowance, and also on results, but in all cases the local managers were to guarantee for the support of the school, from fees or local funds, a sum at least equal to the government grants.

This last condition would have rendered the spread of science schools very slow, if not altogether impossible, but it was never imposed. It was argued, and no doubt with great truth, that, when persons desire a thing, they are willing to pay for it, and the amount of their liberality will be in proportion to the desire they have for attaining the object; thus, if a locality could not meet the State half-way in the cost of a science school, no doubt the demand for the school and the desire to create it were not very great. It is, however, clear that the more the school is really required the greater is the apathy frequently displayed concerning it, and that consequently this is a reason, not for withdrawing, but for increasing the State aid. It is to be hoped that a time will shortly come when the appreciation amongst all classes of the practical advantages of a scientific knowledge will be so great as to render a system of large payments or bribes on the part of the State unnecessary; but until such a change has taken place, it is useless to suppose that localities will sacrifice time and money for an object the use of which they do not understand, and concerning the benefit of which they are often quite incredulous.

In March, 1860, the first Science Directory, containing all the regulations on which aid to science instruction was to be granted, was issued, and the condition concerning local subscriptions was withdrawn, though the importance of all students paying fees, and as large fees as can be possibly obtained, has since been strongly urged. The real cause of the great success of the present plan, which, with various modifications in detail, has been in operation since 1860, is that, without irksome conditions, offers have been held out to enterprising teachers to form classes. The plans, from 1853 to 1860, all seemed intended, as it were, to awaken the locality to a sense of its duties and responsibilities to perform the task of educating its artisan classes, not only without profit to itself, but at a sacrifice of both time and money. The new plan held out offers to teachers. It said, "If you will qualify yourselves to teach, passing such and such an examination, the State will remunerate you for every artisan you can manage to get hold of, and induce to be taught; the amount of the remuneration to be in proportion to the amount of instruction imparted; or, if the teaching is deficient, and brings forth no fruit at the annual examination, no payment is to be made." No arrangement could be more satisfactory from a taxpayer's point of view. The country desired science instruction to its artisans, and it obtained it at a first cost, without any costly machinery or establishment. All the risk of success, the chief work of organising the schools and getting the pupils together, fell mainly upon the teachers, whose pecuniary interest it was to make them answer. Consequently the scheme became a sound commercial undertaking, in which the community, under every condition, was a gainer, and could not be a loser.

It must be considered also that this system provided a means of educating teachers, somewhat slow at first, though probably as fast as was then required, and that, too, at no cost to the State, such as an outlay on science-training colleges would have involved. Pupils of superior ability prosecuted their studies for several years in a science class, and in numerous cases have become most successful teachers.

The details of the existing plan it is not necessary to enter into. Suffice it to say that a liberal payment is made to the teacher, varying with the grade of success, on every pupil of the artisan or industrial class who comes up and passes at the annual Science Examinations in May.

These examinations are held wherever local committees are formed to conduct them, and prizes and medals are awarded as a further stimulus to pupils.

As might be supposed, in the early years, this system grew but slowly, owing to the apathy of districts and the scarcity of teachers. A uniform and steady increase, however, was manifested from the first, and of late the development of the scheme has been most rapid. This may be judged of from the following table, prepared from the annual reports of the Science and Art Department:—

Year.	No. of persons under instruction.	Number of individuals examined.	No. of teachers paid.	Amount paid to teachers.
1861	1,330	650	26	£1,298
1862	2,543	1,239	51	2,666
1863	3,111	1,581	52	3,240
1864	4,666	2,070	70	3,076
1865	5,479	2,383	92	3,500
1866	6,835	2,980	123	5,002
1867	10,230	4,520	194	7,976
1868	15,010	7,161	285	12,725
1869	25,680	12,915	460	17,000*

In the year 1862, eight (afterwards increased to nine) exhibitions to the Royal School of Mines were established; and, in 1865, ten (afterwards reduced to nine) more to the newly-created Royal College of Science in Dublin.

* Approximate.

Six of these are awarded each year to those who do well in the May examinations, and they have been the means of completing the training of several successful teachers, amongst whom is Mr. A. W. Bickerton, the master of the school about to be briefly considered.

(*To be continued.*)

EFFECT OF EDUCATION IN THE SCILLY ISLANDS.

The facts contained in the following narrative by Edward C. Tufnell, Esq., given in his report "On the Employment of Children, Young Persons, and Women in Agriculture," are given as having an important bearing on the subject of education, and on the increase of pauperism:—

"Forty years ago the islands of Scilly were in a state of the severest misery and destitution, and were the continual objects of charitable appeals for relief, which in one instance produced the large sum of £20,000. The following is an extract from a report of a committee appointed to inquire into their condition:—'Nothing can exceed the wretchedness and misery to which the unhappy islanders of Scilly have been subjected within the last two years. By far the greater proportion of extreme suffering has fallen on the females of those islands amongst the poorest classes. Doomed by a mysterious Providence to privations the most extraordinary, and incapable of obtaining that kind of employment most suited to their sex, they have dragged on a life of sorrow and anguish the most poignant and the most alarming. Widows have sighed in vain for relief; orphans have bewailed their lot in gloomy solitude; aged and decrepit women have beheld with horror the approach of increasing infirmity, without the commonest necessaries of life to sustain their declining years. And mothers have travailed again with sorrow and agony over their wretched offspring; while children have pined away in artless woe and unavailing complaints, stricken with death for want of bread.'

"The numerous committees that were successively formed to alleviate the distress, adopted the usual schemes for finding work for the inhabitants. The women were to be taught to spin and knit, to plait straw, and make line twine. The raw material was purchased for these manufactures, and 'measures adopted to find a market in all directions for the goods manufactured; and suitable rewards were to be distributed annually to the most industrious, cleanly, and frugal person.' All the apparatus necessary for fishing mackarel and pilchards, which abounded in the surrounding seas, were procured at an expense of £8,000. In a word, all the ordinary popular devices for raising a starving population were set on foot, and ended in failure. The large subscription of £20,000 seems indeed to have produced absolute injury. It attracted back to the islands many Scillonians who were in employment elsewhere with the hope of sharing in this large sum, which was finally all spent without leaving a trace behind.

"In the year 1834 the islands were leased to the present lessee, Mr. Augustus Smith, who appears to have discovered at once the real cause of the misery of the inhabitants, and to have applied the appropriate remedy.

"One of the chief evils was the cottier system, under which each family was settled on a small portion of land, that was often scattered in minute fragments over the islands, and on the death of the father each little farm was re-divided equally among his children. This system had introduced a pauperised population, which was continually increasing from this subdivision of land, and mainly dependant for subsistence on the produce of these minute farms. These small holdings were consolidated, one of each family alone was permitted to take the farm, and the younger children were told that they must make their way in the world, either by going to sea, entering service, or learning some trade. But that they might be well qualified for their future callings, Mr. Smith's next care was to provide a thorough useful course of education. Schools had previously existed in the islands, and considerable sums been expended in their support, but, owing to the inefficiency of the teachers, the want of all necessary appliances, and the absence of all regular inspection, these establishments were wholly inoperative as to producing any real benefits. The proprietor founded good schools in each island, appointed efficient teachers, stimulated their efforts by continual inspection, and obliged the inhabitants to send their children to them, by making them pay school fees for each child of an age to go to school, whether they sent their children or not.

"In these schools, besides the elementary subjects of education, history, geography, and the rudiments of navigation were taught, with a view of preparing the youthful population for what seemed their most fitting career—a sea-faring life. This last improvement—the good schools—was the real lever which succeeded in raising the population out of their low condition.

"Ten years after the introduction of these improvements I visited the islands, and so can speak from personal examination of the result. The success was nothing short of marvellous. The chronic misery which used to cause yearly applications for public subscriptions had absolutely ceased. I never met with a better dressed population, nor one showing in their cottages and deportment clearer signs of comfort and refinement. I inspected all the schools, and found the children well instructed. I was particularly struck with a discovery I made on the island in which the proprietor resided, that one in five of the population was at school. This considerably exceeds the Prussian proportion of one in 6·21. An observation of the chief clergyman was still more striking, as he stated to me that he had a difficulty in finding persons willing to receive the sacrament money. Contrast this with the report above quoted, 'that nothing could exceed the wretchedness and misery of the islanders.' Drunkenness had been the characteristic of the population, yet now it was almost unknown, and the inhabitants of one island had forsworn spirituous liquors altogether.

"The potato famine tried the islanders rather severely, as one of their most profitable occupations was growing potatoes for the supply of shipping. The London market, though tried, failed altogether; and it was not till some years after the famine that the islanders, who planted earlier and earlier every year, as more likely to secure a good crop for their own supply, at last discovered that they could compete with Penzance in the London market. The neighbouring county of Cornwall suffered greatly from this cause. Yet, so far from Scilly sending forth the old cry for assistance, subscriptions were sent to relieve the suffering Cornishmen.

"The proprietor allowed one son in each farm to succeed his father on death. But the people soon found out that small farming was a very unprofitable work, and so the children voluntarily took to ploughing the sea instead of the land; while the excellent training the boys received in the schools caused them to be in demand by the Liverpool and London ship-owners.

"The conduct of these youths was so good, and their intelligence, owing to their superior education, so marked, that even before their time of apprenticeship was expired they were frequently promoted to be mates and stewards; and on a late visit to the islands, I ascertained the remarkable fact, that of all the boys who had gone to sea, not one, when grown up, had remained before the mast, but had all become masters or captains of vessels; and at this moment, many boys whom I had examined in the schools are captains of large ships, sailing from Liverpool and London.

"Now I wish to make a special remark on the methods

adopted to bring about this great change. The proprietor did not, as before, resort to the plan of setting the women to spin and knit, and promise to buy all they produced. He did not supply the men with nets, and tell them to go and catch the fish that abounded around them. He even adopted some plans that, on first sight, might have appeared harsh. The inhabitants had been in the habit of cutting turf for fuel, and this he positively prohibited, as destructive to the surface, but took care at the same time that coals should be imported, and on sale at a cheap rate in the chief town. He was bound by his lease to make some improvements in the chief harbour, and the employment thus created assisted the proprietor in meeting the first difficulty, but no employment was given simply for the sake of employment. No over-paid work was offered; no doles of relief were given; no subscriptions solicited; no one was forced or bribed to emigrate; in a word, every measure adopted tended to dispauperise and induce self-reliance, and was a complete reversal of the patronising, petting system previously tried. The real lever was found by raising the intelligence of the population, pointing out the way to self-support, and then leaving them to shift for themselves.

"The result was perfect success. Of course in ten years the old pauper spirit could not be completely eradicated, but the pauperism was then smaller than I believe any place in England. It amounted in money to 8d. per head on the population, while in Kent and Sussex 15s. per head was a common sum. I found, for instance, that on one island, containing a population of 214, the sole pauper was an old woman, who was paid 9d. weekly.

"The increase that followed in the shipping interest of the islands was remarkable.

"In 1830 the port of Scilly had above 50 tons, 5 vessels, giving 406 tonnage; in 1842, 37 vessels, giving 3,715 tonnage; in 1844, 38 vessels, giving 4,120; in 1869, 28 vessels, giving 6,177 tonnage.

"It has often been observed that the effect of good schooling on a low-waged population is to diminish their numbers, and this result took place here. The increased intelligence of the population enabled them to look farther afield for employment, and resort to more profitable occupations than were open to them within the confined area of Scilly. Thus it has been found necessary to import labourers to do the agricultural work of the islands."

PRESERVATION OF MEAT.

The following is the process for the preservation of meat that has been patented by Professor Gamgee. The animals are in the first place killed by being made to inhale carbonic oxide, and the carcases, when set, are suspended in an air-tight chamber, which is first filled with an atmosphere of carbonic oxide and nitrogen, and to this is afterwards added some sulphurous acid. In tropical or hot climates it is necessary to cool the meat artificially; but in England this is not required. The time of suspension in the chamber varies with the effect that is to be produced, and might be so prolonged as to render the meat at once imperishable and uneatable. But it is said by the inventor that perfect security against change for three or four months may be obtained without any loss of flavour or apparent freshness; and some carcases of sheep are about to be shipped to Australia as specimens. Other carcases, prepared in like manner, have for some little time been sold to butchers, whose customers, it is supposed, do not discover anything unusual in the joints supplied to them. It may be hoped that Mr. Gamgee's process will not only serve to bring foreign meat in any quantity to our shores, but that it will also prove a great saving to butchers and families by rendering ordinary English meat no longer a perishable article.

CORRESPONDENCE.

PAUPER CHILDREN.

SIR,—Your *Journal* for December 3rd, 1869, contains an article headed "Pauper Children," by Mr. G. C. T. Bartley, in which a very unfavourable view is taken of the system of boarding-out orphan and deserted pauper children, and as reference is made in it to "the report of a committee of the Bath Board of Guardians, of which Col. C. W. Grant, R.E., is chairman," I respectfully trust that you will do me, and the cause I advocate, the justice to insert the following reply to some of the remarks in Mr. Bartley's article, the fear of intruding too much upon your space preventing my noticing all his objections.

In the article in question, a comparison is drawn between "cottage farming" and industrial school training, in which the former is treated as identical with the system of "boarding-out the orphan and deserted children now in our workhouses."

All opponents to our system call it "farming out," because it is an opprobrious term, and because it recalls painful and disagreeable recollections and associations, and because they hope, by so doing, to convey a bad first impression, and thus prejudge the case; but what possible similitude can there be between farming children out by hundreds, in such an establishment as that of Drouett's, at Tooting, where they were practically left without any supervision, and boarding them out one, two, or at most three in a cottage home, subject to constant control and inspection of the most efficient kind? But, even if any doubts remain on the point, I would beg to refer to a small pamphlet by Miss F. Hill, lately published by Macmillan and Co., entitled, "The Boarding-out System distinguished from Baby-farming and Parish Apprenticeship," in which the subject will be found fully and conclusively treated. The Poor-law Board itself heads a printed form, lately issued to its inspectors, "Boarding-out of Pauper Children," so it is to be hoped that our detractors will now cease to soil their hands with the stale scare-crow of "child farming;" moreover, it is a pity that Mr. Bartley does not quote correctly, for Mr. M. D. Hill, Q.C., has never advocated the farming system, but quite the reverse, nor are the remarks about "village gossips" his.

Mr. Bartley, in his first objection, endeavours to show, on the strength of information derived from isolated instances, that the cottages of our agricultural poor are utterly unfit for the reception of workhouse children, and "that the better class of persons would not receive such unpromising companions for their children," and then asks might not the proverb, "Physician, heal thyself," be said to far the greater number of cottagers in the country? I would beg to refer him to another passage in the same book, "First cast out the beam out of thine own eye, and then shalt thou see clearly to cast out the mote out of thy brother's eye." It is not necessary that every cottage in a parish should be good, or even that the greater number should be. Mr. Archer has estimated that in Wiltshire there are about 100 cottages to every one orphan or deserted workhouse child, and if this is about the average in country districts, are we to suppose that out of these 100 cottages not one could be found fit for the reception of one orphan child, or whose occupant would refuse to receive one? When it is remembered that there are upwards of 650 unions in England and Wales, each comprising from 10 to 25 parishes, and that there may be about 20,000 or 25,000 children at most to be boarded out, it will be seen how very small a proportion of good cottages are required to receive them, and how possible it will be to select only the good, and refuse the bad. London I admit to be exceptional, but when the law preventing children being relieved out of the limits of the union is repealed or modified, it does not seem impossible that the orphans in the metropolitan work-

houses might be boarded out in the districts round London, the network of railways admitting of easy and frequent supervision by a superior and well paid inspector, specially appointed for the purpose, as in Scotland; for instead of the "tens of thousands" of such children in London and the other large towns Mr. Bartley speaks of, there were in the metropolitan workhouses and district schools on the 1st January, 1869, precisely 5,562 orphans and deserted children. If all these could not be so dealt with, and only those really orphans were selected, this number would be reduced within feasible limits, for it must be remembered that this number is the aggregate result of many years, many of these orphans having been a great number of years in the workhouses, so that, when these are worked out, the average yearly supply of fresh orphans will be comparatively very small—a fact easily ascertained, and which would show what number it would be necessary to provide for in future years.

At Manchester, in the Chorlton Union, homes have been found in the town, among the *élite* of the working classes, for these children. In the suburbs and country round Bath the same; as also in the other unions in England where the system has been tried. As to the fear of "these dangerous children polluting the homes of the poor," the remark might apply to casual children, but not to the orphans, for even were one of this latter class to turn out unequivocally bad, it would soon be known to the foster-parent, or by some of the various means of supervision, before the family could become polluted, and the child, if necessary, removed.

Mr. Bartley, after declaring that the homes of the agricultural poor are utterly unfit for the reception of children, and then that "it is not in the agricultural districts that the system is so much required," admits that "in Eton, Swindon, and other places," and "in small country places where local interest" prevails, it can be well looked after; that no one "will deny but that the farming (boarding-out) system is better than leaving the children in the unions, or even in most of the union schools," so that the question is disposed of thus far; and in his concluding paragraph he says that "the farming (boarding-out) system would, no doubt, answer extremely well, and far better than the industrial (*i.e.*, district or separate) school plan, if the cottages of the poor were what they should be, if a universal system of education pervaded the land, and if the cottagers could be depended on to do their duty." I reply to the first of these "ifs," that the very small per-centage of good cottages required, with the fact that good homes have been found in those places where the system has as yet been tried, justify the belief that there are a sufficient number of "cottages as they should be" to be found. To the second "if," I say that one of the conditions required in boarding-out a child, is that there is a parish or national school within reasonable distance of the home, at which compulsory attendance twice a day is required up to 13 years of age; that the parishes in which, or contiguous to which there is no school are comparatively few; moreover, that the regular attendance of the foster-child would help much to secure by degrees the more regular attendance of other children in the family; and that, if the education thus provided is good enough for the labouring man's child, it ought to be so also for the pauper orphan, and if it is not, it is the fault of the State, and must be remedied. To the third "if," I submit that the supervision provided by the boarding-out system, as now being adopted in England, is of such a nature, official and voluntary, and the returns obliged to be made at not less than quarterly intervals to the Poor-law Board so stringent and exhaustive, as utterly to prevent the children being neglected or ill-used in any way; that the mere fact of the children being obliged to attend school twice a-day, thus being brought constantly under the eyes of the schoolmasters and mistresses, who have to report on their appearance, whether clean, tidy, well-clothed, apparently well-fed, and cared for; also being seen by the clergy and others in their frequent visits to the schools, as well as by the villagers in their progress to and from school; in fact, the very openness to detection of any ill-usage, which all the aboves implies, prevents the possibility of any continued ill-treatment or neglect, whilst their being under the care of the medical officer of the union answers the objection as to the want of medical aid. I maintain, therefore, that these three "ifs" may be taken as complied with, and that the conclusions based on this being done have been obtained.

As to the spread of disease in over-crowded homes, in the first place, we do not place children in over-crowded homes; secondly, they are not allowed to leave the workhouse without a certificate from the medical officer of the union that they are not suffering from any disease, or in want of medical aid; and, thirdly, the change from the atmosphere of the workhouse to the fresh country air has wonderful effect in restoring a child's health, as we have many instances to show; and, even as at Manchester, where the children are removed from a well-situated workhouse into the town, their health has rapidly improved with cottage homes and cottage life. What is now found to be true in this respect in large public hospitals and infirmaries, is equally true with workhouse and district schools; and it has been stated, on the best medical authority, that even with less food, and apparently less comforts, children will thrive better in cottage homes than when congregated together in large masses.

The statistics regarding Scotland merely show that, since 1851, there has been the smallest possible increase in the number of paupers, about $1\frac{1}{4}$ per cent. only in proportion to population, but that this small increase, as compared with pauperism in England and Wales for the same time, may in a measure be due to the system of boarding-out the pauper children. The increase in the cost of relieving the poor has arisen from many other causes besides the dearness of bread, and has been equally the case in England. No possible proof of the failure of this system in Scotland can be drawn from these statistics. Mr. Bartley says, in his concluding paragraph, "that of the children in the established schools, 90 per cent are absolutely depauperised," taken probably from the Rev. S. V. Edwards's letter to Mr. Tufnell, "that not 10 per cent. of our children (*i. e.*, from the Hanwell School) have fallen into open sin, and have joined the criminal ranks;" but this record only relates to two years after the children have left the school; and Mr. Edwards states, "that 1,500 children have gone out of the school to gain by honest labour and industry an independent livelihood." But as the school at Hanwell was established in 1855, when the children from the Norwood School were removed into it, and has averaged from 1,000 to 1,200 in number, and as Mr. Tufnell, in his evidence before a select committee of the House of Commons, stated that, for a school of 600 children, 1,200 pass through every year, and it was also stated that in the Stepney School 75 per cent. come and go, or only 25 per cent. remain any length of time, at this rate it may be asked, How many thousand children must have passed through Hanwell in these fourteen years, as compared with the 1,500 who have been sent out to service? So that the 90 per cent. absolutely depauperised must mean of those placed out, and not of all the children in the schools; and Mr. Edwards's remark that "not 10 per cent. of our children have fallen into open sin, or joined the criminal ranks," is a very different thing from being "absolutely depauperised." And at what cost has this been achieved? At Hanwell, the present cost is 8s. 9d. per week for each child. There are 80 paid officials, including two resident surgeons and 12 paid nurses; and at Stepney, for 230 children there are 34 paid officials, warm baths, and every kind of comfort. But the result in district schools in general is very different. In a return of the Poor-law Board, quoted by the *Times*, April 2nd, 1862 (see Miss F. Hill's "Children of the State," p. 69), it appears that of

boys educated in district schools, 11·6 per cent. returned to the workhouse, and 27·3 per cent. of the girls. What per-centage, in addition, "fell into open sin or joined the criminal ranks," is not stated, but how widely does this official return differ from isolated unauthenticated results. By the return now quoted, more girls educated in district schools return to the workhouse than girls brought up in workhouse schools at one-half the expense. Then, as to the health of these schools being raised above the average, it has been shown that, taking the ages between 5 and 15, the usual ages of children in district schools, the mortality at Hanwell, for an average of 11 years, was 16·5 per 1,000, as compared with 6·5, the average mortality of children of these years in England and Wales, or 2½ times greater, so that their health was so much below instead of above the average, and instead of the spread of disease being reduced almost to a minimum, it is so increased that, whereas 22 per cent. of the children had ophthalmia on entering the school, the numbers in the school suffering under that complaint was 70 per cent., so much had it spread instead of being reduced; and the same thing must occur with cutaneous and other infectious diseases, when 1,200 or 1,500 children occupy the same building, in spite of everything being done that medical care and treatment can devise, to prevent their extension. But, besides all this, district schools have the inherent defect that they cannot impart to the orphans of the labouring class that domestic education, that knowledge of the ways of the world, of its trials, temptations, its dangers, that it is so absolutely necessary should be acquired before a youth or maiden is fit to enter upon his or her own responsibilities, whilst the training in these schools must be entirely devoid of those home influences, of that mutual interchange of affections, in fact, of that love which is as necessary for the proper development of the pauper child as for the children of any other grade. God is love, and to bring up children without love is almost to bring them up without God, and it is to supply this necessary item in a child's training, which no money can buy, that the boarding-out system proposes to accomplish, by appealing to the better side of human nature—by appealing to those who have children of their own, to do to these helpless little ones as they would wish their own children, if similarly placed, to be done by; and those who know personally and practically the kindness of the poor to each other, in cases of illness, suffering, or distress, and (whatever their detractors may say to the contrary) their natural kind-heartedness and parental love, will believe with me that this appeal will not be, as indeed it has not been, made in vain.

The Poor-law Board are now taking every means to ascertain the results of the working of this system in Scotland, and in the few unions by which it has been adopted in England, so that its merits or demerits will shortly be ascertained, so far as it has as yet been tried; but it cannot be expected that the scheme, especially as carried out in England, can be perfect at once, or that some failure should not occur, especially in what may be considered by official inspectors as the requisite accommodation to be insisted upon. This is a difficult point; as whilst, on the one hand, we require it to be such as is necessary for health, decency, and morality; on the other hand by insisting an official quota of cubic feet of space, or on more than good cottage accommodation, we should lay the system open to the charge even now made against us, of placing these orphans in a better condition than children of the labouring classes generally, or of the poor ratepayers, and I trust that this point will be duly considered, should any report of overcrowding in the homes now provided for the children boarded out, be made in the returns lately ordered by the Poor-law Board.

I am, &c.,

C. W. Grant, R.E.

December 27th, 1869.

CLIMATE IN AUSTRALIA.

Sir,—Alterations of climate in Australia are imputed to "a systematic denudation of tree covering which the surface of the country is being subjected to."* At Ballarat it is said that the annual fall of rain has been reduced from 37·27 inches, in 1863, to 17·23 inches, in 1868, and that the local government has, in consequence, appointed an inspector of nurseries of forest trees for the colony, to, I assume, bring the old volume of rain back again. Waste of any sort is to be deprecated, and a wise provision for the future is most laudable, but when such things are to be repudiated or to be encouraged under scientific and official sanction, we should be certain that the reasons given and inferences drawn are sound. Clearing forests and cultivating the surface of the ground does modify the ordinary local climate in ordinary times, such as by removing swamp and subsoil water, which prevent evaporation and fog. Trees, during growth, are water evaporators to the extent of one thousand pounds weight of water evaporated for each pound weight of woody fibre given. How trees cause rain to fall has not been clearly explained, the operation can only be by their acting like the flanks of mountains against which vapours are drifted, and where condensation takes place. Do trees, which during growth are ever evaporating water, also at the same time condense it from the atmosphere? They must do so if they are rain-makers.

Climate, in its widest sense, cannot, however, be affected by man, as it is dependent upon the heat of the sun, the area of the ocean, and the atmosphere. Condensation, forming dew, rain, hail, or snow, as connected with climate, is equally beyond human control. How then can felling a few square miles of forests or planting forests, in any appreciable degree alter climate? The heat transmitted by the sun, the area of the ocean, or the volume and motion of the atmosphere, will not be affected excepting in the milder portions of the year, over the very small area man has operated upon; but this will not alter the climate of a country or reduce its fall of rain.—I am, &c.,

Robert Rawlinson, C.B.

P.S.—If the appointment of a gardener to look after forest-planting is made dependent upon his work, or the result of his work bring back rain, one may assume that if he brings deluges he will be discharged. But the climate of Ballarat district will be found to go on much as usual, if records can be referred to for the last fifty years. There will, in the future, be periods of extreme drought and periods of extreme wet, and all works in the colony which may be affected injuriously either way must not look to their newly-appointed rain-maker to shorten such periods of drought or to diminish floods. South Africans employ rain-makers; Australians, it appears, are commencing to do so too.

SILK SUPPLY.

Sir,—With reference to the recent paper of Mr. Dickins, the treatise of M. Cesar Moreau, folio, A.D. 1826, may be referred to with advantage. In 1554, a sumptuary law was passed in England, prohibiting the wearing of silk upon the hat, bonnet, girdle, scabbard, hose, shoes, or spur leather, under penalty of £10 and three months' imprisonment, except all magistrates of corporations and persons of higher rank. It was repealed in the 1st year of King James I., who, as well as his queen, supported English silk culture. This king licensed M. Vetron, from Picardy, and Mr. Matthew Stellenge, to plant mulberry trees in England. The first tree was planted in Charlton-park, in Kent. The queen wore a silken court dress made by herself. Evelyn mentions a mulberry grove on the site of Buckingham Palace. In 1821, those trees remaining at Charlton were described in

* Present vol., page 149.

particulars of sale. The first and last public silk works commenced and ended there. Subsequently, the London merchants caused the Court to discontinue the silk cultivation, but it revived in 1685, when the French refugees settled in England and Ireland.

In 1804, M. Giboin published his discovery for mulberry leaves, by drying the autumnal foliage and immersing it in hot water. In 1826, Dr. Sterler, botanist to the French Academy of Sciences, discovered food for silkworms, in lieu of any mulberry leaves. Miss H. Rhodes previously communicated to the Society of Arts that one line of the silkworm measured 404 yards, weighing 3 grains when dry. One pound avoirdupois of spun thread might be extended into a line 585 miles long, and a thread round the earth would weigh 47 pounds. The largest mulberry trees I have seen in England stood some years since at Harrow, in the gardens of the head-master and the late Mrs. Leath, one in each.—I am, &c.,

Chr. Cooke.

Swallcliffe, Oxon, December 24th, 1869.

MEETINGS.

Endowed Schools.—On Thursday, a public meeting, convened by the Scholastic Registration Association, was held in the rooms of the Society; Sir John Pakington, Bart., M.P., in the chair. In the course of his opening address, he said it was most extraordinary that in the year 1870, in civilised, prosperous, enlightened England, we should find the whole country at this moment agitated by disputes between two rival associations in regard to the best mode of educating the people. These two associations seemed so likely to quarrel on a subject which more than any other required Christian charity and forbearance, in order to accomplish a great object in the best and most practical manner, that there seemed little chance of a satisfactory solution being arrived at unless the government were to step in between them. They were assembled that night to consider the best mode of raising the status and the social position of the English schoolmaster, and of affording the middle and upper classes of England a guarantee that the men who undertook the education of their children should possess those qualifications without which it was impossible that they could be fit for their duties. Resolutions in favour of the classification of teachers and the recognition of practical experience in teaching were adopted, as were also the following:—"That this meeting regards the proposal to place 'registered' schools on an equality with endowed schools, and to entitle them to compete for exhibitions on certain conditions, as sound in principle, and as designed to effect much good by upholding and advancing existing institutions." "That this meeting rejoices to find in the Bill a considerable, if not a full, recognition of the claims of girls' schools to an equality of position with boys' schools."

Workmen's International Exhibition, 1870.—A conference of delegates, to consider and decide upon the details of the forthcoming Workmen's International Exhibition, was held on Monday last, at the rooms of the Society. Mr. Samuel Morley presided. The plan of the arrangements of the Agricultural Hall, which were after the model of the Paris Exhibition, 1867, was shown; and a discussion took place on the opening of workshops in the exhibition, and the diffusion of technical education, in favour of both of which strong opinions were expressed. Papers written by artisans in their own department were to be encouraged, read, and discussed.

OBITUARY.

John Tidd Pratt.—On Sunday night, Mr. John Tidd Pratt, for many years registrar of friendly societies, died at 29, Abingdon-street, S.W., in his 72nd year. The deceased gentleman was called to the bar, at the Inner Temple, in 1824, and, in addition to his office as registrar of friendly societies, held a post in the National Debt Office, and was the barrister appointed to certify the rules of savings banks. He was the author of "Laws Relating to Friendly Societies," "A Collection of the Public General Statutes," "The History of Savings Banks," "The Laws of Highways," "An Analysis of the Property-tax Act," "Suggestions for the Establishment of Friendly Societies," and other works of a similar character. In the latter years of his life he rendered efficient service to the public in disclosing, so far as official restraint would permit him, the unsound condition and business of some of the benefit, friendly, and similar societies. He also gave great assistance to the legislature in its efforts to bring about a sounder state of things amongst such associations. He was always ready to supply anxious private inquirers with any information they desired, as to the position and stability of societies in which they were interested. He was a member of the Society of Arts.

Alfred Davis, who died on Thursday, the 6th inst., was elected a member of the Society of Arts in 1855. In early life his mother was left a widow, with a large family, and in very humble circumstances; she was, however, assisted by friends, and commenced a small business in Houndsditch, where, by the industry and courtesy of herself and children, they soon became the large wholesale suppliers of hardware to travelling hawkers; and when steel pens were first introduced, they soon did an enormous ready-money trade in that article alone. Upon the death of his mother, Mr. Alfred Davis and his brother greatly extended their field of operations, and became wholesale dealers in every description of hardware goods, upon a large scale. Mr. Alfred Davis, however, took especial interest, during the time he was in business, in the collection of corals from every part of the world, and of every variety of form and character; and upon retiring from business some few years since, he lent his collection for a time for exhibition at the Crystal Palace. Mr. Davis was a member of the Jewish community, and, as such, took an especial interest in the Jews' Free School, of which he was treasurer, and to the funds of which institution he was a donor of vast sums, last year having given £6,000 to free the school from debt. For some years past, he took a lively interest in the work of the Society of Arts, and gave annually a donation to its funds; and on the occasion of a recent visit to the City of London Middle-class Schools, Mr. Davis, to show the interest he took in the cause of education generally, gave a donation of £500 to the school funds.

GENERAL NOTES.

Postage to India.—Much dissatisfaction is caused in India by the heavy fines, in addition to heavy postage, exacted by the English Post-office on many Indian letters.

Prizes have been offered by the Governor-General in Council for the best essays, by officers and non-commissioned officers, on the dress of the British and native soldiers of India. The prizes are to be awarded at the approaching Industrial Exhibition at Mean Meer.

Indian Cotton.—Mr. Watts, secretary of the Manchester Cotton Supply Association, is now on a visit to the cotton districts of Western India. His aim is to encourage measures for increasing the yield of cotton per acre.

A Public Library for Islington.—A meeting was held on Wednesday evening, in the Parochial School-room, Liverpool-road, to consider the propriety of applying the provisions of the Public Libraries Act of 1865 to the Islington district. After discussion, the motion was carried by show of hands.

Cinchona.—The culture of the cinchona, or Peruvian bark, in St. Helena, is progressing satisfactorily. The plants are all in excellent health, and have a fine green, vigorous appearance. There are now about 4,000 planted out, and it is thought a sufficient number can be obtained from them to stock the whole colony.

Free Library at Doncaster.—A new free library for Doncaster has been opened with considerable ceremony, in the building which was formerly the grammar school of the town. The library has been formed by the gift of the books of the Subscription and Mechanics' libraries, and volumes have also been presented by gentlemen resident in the district.

Tenant-right.—The claim for the extension of tenant-right to England, which has been agitated in some of the chambers of agriculture, has (says the *Law Times*) already sensibly affected the land market, disinclining prudent persons to invest in property so threatened. It is also alarming mortgagees not a little, as well it may, for any considerable decline in the value of land would seriously shake their securities.

Vesuvine.—Under this name, M. Knosp has brought into commerce a dye material belonging to the class of aniline dyes, which is reported to be sold in the state of paste and powder. This dye yields shades of bright, as well as deep orange, and bright brown, and is suitable for dyeing silk, wool, and cotton; but this latter fabric has to undergo a series of mordanting processes before it is in proper state to receive the dye.

The Irish Exhibition Palace was put up to public auction on the 31st ult., but, no adequate offer being made, the property was withdrawn. It cost £100,000, and the highest bid made was £25,000. The late government offered £47,000 for it, in order to found an Irish Institute of Arts and Manufactures, after the model of South Kensington Museum, but the shareholders thought it an illiberal offer.—*The Architect.*

Depth of the Atlantic Ocean.—In laying the cable between Ireland and Newfoundland, important facts were discovered in reference to the ocean bottom. The mean depth of the Atlantic was ascertained to be 12,000 feet, or over two miles and a quarter, a plateau at that depth extending from the banks of Newfoundland to within 150 miles of the Irish coast. The locality where the Atlantic reaches its greatest depression is believed to be a wide chasm, ranging 1,000 miles east and west, and having a depth equal to the height of the Himalaya mountains.

Light Gold Coin.—A currency question has arisen of a very serious nature, with regard to the lightness of the old Spanish onzas and other gold pieces, the result of use and friction, and the inferiority of the gold as well as the lightness of the new coins that have been struck. Spanish coins are examined with much circumspection, if not suspicion, abroad, not only for the above reasons, but from the fact that false coining is carried on very extensively in Spain, more so, perhaps, than in any other country. A large amount of capital must be invested in this illicit trade, as the quantity of gold used in the fabrication of the pieces renders detection very difficult.

Ship Ventilators.—A plan has been published, with illustrative diagrams. It is called a self-acting ventilator, and is said to be applicable in every case where a current of air exists, or can be created, and the same effect is produced whether the air blows at the rate of twenty miles an hour into the ventilator when it is standing still, or whether the ventilator passes, as the ship moves, through the still air, at twenty miles an hour. The air enters the large mouth of a pipe, and can only escape through the small end with great force into a larger pipe; there it drives out the foul air escaping from the chamber, to be constantly filled from below, at a rate proportionate to the quantity of air received into the mouth.

Prizes for Designs.—The proprietors of the *Ironmonger* propose to offer prizes for designs of articles of common use which are sold by ironmongers. The relative merits of the designs sent in will be determined by competent judges, whose decision will be followed in awarding the prizes. The best designs will be brought before the subscribers to the *Ironmonger* in a series of carefully-executed plates. The designs will remain the property of the draughtsmen. It is hoped that this scheme for encouraging designers will bring out latent talent. Ironmongers' assistants who have a natural taste for drawing will be able to turn it to good account, in producing improved patterns for the articles which they are continually handling.

The Physiology of Crime.—A paper, by Mr. J. B. Thomson, on the question of the inherited tendency to crime, appears in the current number of the *Journal of Mental Science*. The author arrives at these conclusions:—1. That crime being hereditary in the criminal class, measures are called for to break up the caste and community of the class. 2. That transportation and long sentences of habitual criminals are called for, in order to lessen the criminal offenders. 3. That old offenders can scarcely be reclaimed, and that juveniles brought under very early training are the most hopeful, but even these are apt to lapse into their hereditary tendency. 4. That crime is so nearly allied to insanity as to be chiefly a psychological study.

Window Gardening.—A correspondent writes:—"More than twenty years ago, whilst visiting a sick woman in Bristol, I was struck with the peculiarly strong and healthy appearance of some geraniums in her window, and upon asking her how she treated them, was told that she merely threw her spent tea leaves upon the mould, and now and then a little soap suds. I was struck by the reply, and on afterwards meeting with healthy, well-grown plants in small rooms, was led to ascertain how far they had been nursed in the same way. I found that in several instances tea leaves were the manure employed, and have little doubt that if the successful competitors at any window-garden show were questioned, it would be found that many of them had adopted a similar course of treatment."—*Chamber of Agriculture Journal.*

Flax in New Zealand.—The preparation of flax as an article of commerce is making steady and perceptible progress in the country districts of this colony. Begun at a time when distress was rife, as a means of affording a bare subsistence to numerous families, it has grown into a profitable pursuit, taken up by settlers as affording employment to all members of the family, and proving most remunerative when carefully carried out. They are also embarking largely in the cultivation of the plant, so that the supply may not be lacking at any future date. Formerly in the way of the pastoral farmer, from its luxuriant growth, it now has given an extra value to land by suddenly springing into a staple product. After many years of patient trial, suitable machinery has been constructed to prepare it for the European market, where it is passing into consumption as a substitute for Manilla hemp, or mixed with it in ropemaking.

Permeability of Caoutchouc Tubes.—In *Cosmos*, December 25, M. Jouant states that, from a series of experiments he has made, the following conclusions may be drawn:—A vulcanised caoutchouc tube of 1·2 m.m. thickness, and having a surface of 33·60 sq. m.m., loses, in three days, by diffusion, 21·3 per cent. of hydrogen, while 11·2 per cent. of air has at the same time entered. That the non-vulcanised caoutchouc tubing is by far less permeable for gases is proved by the following facts:—A tube of the last-named substance, having 50·00 sq. m.m. surface, has been submitted to the same experiment during twenty-eight days, and lost during that time, by diffusion, 22·6 per cent. of hydrogen, while only 5·6 per cent. of atmospheric air entered the apparatus, which

was arranged precisely alike for both experiments, and so constructed as to indicate any change of pressure going on internally, by means of manometer tubes. The permeability of caoutchouc for gases is a well-established fact, and a consequence of its peculiar structure.

The New Coal Discoveries in India.—The question as to the precise character of the mineral discovered in the Kistnah district is at present attracting considerable attention, and we have received from Colonel F. Applegath, of Vizanagram (who, it will be remembered, found and burnt coal at Jaggiapetta some years ago), a small specimen of the fuel, which may be examined at our office by those interested. The specimen forwarded is too small to permit of a decided opinion being formed respecting it, but Dr. Benjamin H. Paul, F.C.S., to whom we have submitted it, and who has long devoted special attention to the examination of fuels, states that it appears to possess all the characteristics of a lignite or brown coal. From the fact mentioned, that the sample is taken from near the outcrop, he considers it would not be possible to judge with certainty of the quality of the mineral as fuel, though it is probable it would prove very valuable in this respect, especially in India.—*Mining Journal.*

New Carriage-Break.—A carriage-break has been invented and patented by Messrs. Parry and McHardy, to which the horse or horses unconsciously supply the power when backing. The attachment is made at the end of the pole, a chain, passing through a small wheel in the end of it being fixed to the collar. Thence an iron rod is continued under the pole to a screw connection, by which the pole is detached, and the break regulated. A series of levers are then arranged, by which the pressure of the horses when backing is applied to the skids which bite the circumference of the wheels, with great power. A spring releases the break when the pressure ceases, and a stud, pressed by the foot of the driver, takes off the break when it is desirable to back the carriage. A laden carriage may be taken down hill as gently as possible, and all strain is taken off the horses. The break is very highly recommended by those who have seen and applied it. Mr. Ayshford, of the Britannia Works, Walham-green, is the agent.

American International Exhibition.—The Bill to encourage and promote the International Industrial Exhibition to be held in Washington City, in 1871, creates a body corporate, under the name of the International Industrial Exhibition Company, that shall have perpetual succession, and shall be able to sue and be sued in all courts within the United States; and the sole purpose of the said corporation is declared to be the holding, in the City of Washington, during the year 1871, of an exhibition of the works of industry and art of all nations. It also enacts that the corporation shall have power to borrow money; to issue bonds, not exceeding in amount two-thirds of the capital stock of the company; to award prizes; and, at the close of the exhibition, to sell or otherwise dispose of the property of the company. Also that the capital stock of the company shall consist of 300,000 shares, at 10 dollars each, which shall be subscribed for. And the corporate authorities of the cities of Washington and Georgetown, and the county of Washington, are authorised to contribute to the said International Industrial Exhibition Company, amounts respectively equal to three-fifths of one per cent. of the assessed value of all taxable property within their respective jurisdictions. The exhibition building, when completed and prepared for the reception of goods, is to be a bonded warehouse, in which goods may be received, unpacked, exhibited, repacked, and re-exported without the payment of duties to the United States. That packages directed to the Industrial Exhibition, received at any port of entry of the United States, shall be forwarded, unopened, under the seal of the custom-house of the said port, to the exhibition building at Washington, there to be opened under the inspection of revenue officers appointed for that purpose; and that, at the close of the exhibition, the goods shall be re-packed, sealed, and returned to the port of entry at which they were originally received, for re-exportation. But if any such goods shall be sold during the exhibition, or at its close, for delivery in the United States, they shall be subject to the same duties as if imported in the ordinary manner, such duties to be collected in such mode as the Secretary of the Treasury shall prescribe. The Secretary of State is directed to notify, as soon as possible, all foreign governments of the intended exhibition, and to invite them to take such measures as they may deem advisable to secure a proper representaion of their respective art and industrial works at the said exhibition.

Coal and Iron in the United States.—The quantity of iron made with bituminous coal in Pennsylvania, in 1868, was 194,000 tons (in round numbers), as compared with 191,072 tons in 1867. The production of iron made with anthracite coal in Pennsylvania, last year, amounted to 671,955 tons, as compared with 594,270 tons in 1867. The production of anthracite iron effected last year in Pennsylvania involved a consumption of 1,512,000 tons of coal. The production of rolled iron in Pennsylvania last year is computed to have been 520,000 tons, as compared with 490,081 tons in 1867. Railway iron figured in the total for 1868 to the extent of 276,500 tons, against 245,081 tons of the previous year. In 1868, the rolling mills of Pennsylvania consumed 1,210,000 tons of coal, of which 380,000 were anthracite, and the remainder bituminous. It is curious to observe that, notwithstanding the great increase in the demand for railway iron in the United States since the close of the war, the native productions do not appear to have been very materially extended.

MEETINGS FOR THE ENSUING WEEK.

Mon......Victoria Inst., 8. Rev. C. A. Row, "On the Testimony of Philosophy to Christianity as a Moral and Spiritual Revelation."
British Architects, 8.
Medical, 8.
Asiatic, 3.
Social Science Assoc., 8. Dr. Stallard, "On the Construction of Barracks, in reference to the Physical and Moral Improvement of the Soldier."

Tues ...Civil Engineers, 8. Renewed discussion upon Mr. Grantham's paper, "On Ocean Steam Navigation."
Statistical, 8. Prof. Levi, "On the Statistics of Joint-Stock Companies from 1814 to the Present Time, and of Companies, with limited and unlimited liability, formed since the year 1856."
Pathological, 8.
Anthropological, 4. Annual Meeting.
Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."

Wed ...Society of Arts, 8. Mr. P. L. Simmonds, "On the Coral, Pearl, and Amber Fisheries."
Meteorological, 7.
R. Society of Literature, 8½.

Thur ...Royal Inst., 3. Prof. Odling, "Chemistry of Vegetable Products."
Royal, 8½.
Antiquaries, 8½.
Zoological, 4.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Linnæan, 8. 1. Prof. Babington, "On the Flora of Iceland." 2. Rev. O. P. Cambridge, "On New British Spiders."
Social Science Assoc., 8, at the Society of Arts. Mr. J. Jones, "On the Best Means of attaining Concerted Action between the Representatives of the Poor Law and of Private Charity respectively, with special reference to the Poor Law Minute of the 20th November, 1869."

Fri ......Philological, 8½.
Royal Inst., 8. Prof. Tyndall, "Haze and Dust."

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Mr. Scott, "Meteorology."

Journal of the Society of Arts.

FRIDAY, JANUARY 21, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock —

January 26.—"On the modes of Reading in use by the Blind, and the means for arriving at uniformity." By Thomas Armitage, Esq., M.D.

February 2.—"On Recent Improvements in Small Arms." By Capt. O'Hea.

INDIA COMMITTEE.

This evening, January 21st, the discussion of Mr. Andrew Cassel's paper, "On a Gold Currency for India," will be resumed by Dr. Boycott, late of the Calcutta Mint.

EDUCATIONAL CONFERENCE.

The Council propose to hold an Educational Conference in the early part of February. The particulars will appear in a subsequent *Journal.*

ART-WORKMANSHIP COMPETITION.

In response to the offer of prizes issued by the Council in 1869, one hundred and forty-three specimens have been received for competition in the various subjects for which the prizes have been offered. These articles will shortly be arranged for exhibition in the Society's Great Room.

DONATIONS TO THE LIBRARY.

The following work has been presented to the Library, and the thanks of the Council have been communicated to the donor:—

The Body and its Health, by E. D. Mapother, M.D.; presented by the author.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

FOOD COMMITTEE

The Committee met on Wednesday, the 19th instant. Present:—Benjamin Shaw, Esq., in the chair; the Rev. J. E. Hale, and Mr. Phillips Beavan.

The Committee had before them specimens of meat and other articles of food preserved in Canada, and sent to the Society by Messrs. Collett and Co., of Gloucester.

The specimens were labelled as follows:—

1. One leg of mutton, killed in Toronto, Ontario, June 12th, 1867. Bailey's bisulphite of lime was injected (of full strength) into the veins. Before the skin or entrails were removed, signs of decomposition were visible on the third day; it was then immersed in the bisulphite of lime, and remained in it for a month; then, to give it a better flavour, and to remove the sulphate of lime on the meat, it was put into a sweet pickle, but it could not be used, and it has been hanging ever since.

2. One quarter and part of one of mutton, with two pieces of beef, and a part loin of veal; bought in Toronto market (dead). It was killed 6th April, 1869, immersed in bisulphite of soda for 12 hours, then dressed with a coat of pimento, hung up for a short time to dry, packed in clean straw to prevent the joints touching each other, shipped to England in May, and opened in July, and has been hanging exposed until this time. We roasted a piece from the centre of the beef, leaving the ends as sent, and we cooked a part of one quarter of mutton.

3. One leg of mutton, taken from a sheep killed in Toronto late in April, 1869. Bisulphite of soda was injected into the carcase, and it was then packed and sent to England with the pelt on. It was skinned in July, and has been hanging exposed since then. The flesh, both fat and lean, was quite a dull red colour, and in nowise in so good condition as the mutton and beef, and tasted of the skin.

4. A half of a small cheese, made from milk when the cattle were feeding on hay and turnips. The milk was standing in a kitchen where there was a fire; the temperature ranged about 70° for eight days previous to making into cheese. Twenty-four pounds of milk was used, a wine-glassful of the bisulphate of soda was put into a carboy, and the milk put to it warm; curd heated to 90 degrees.

5. A half of small cheese. Milk set at 10 days old, treated as No. 4, and the curd heated previous to pressing to 120 degrees. The cheeses being packed when quite soft, and remaining packed close for some time, became quite mouldy. All of them were made in March and April, 1869.

6. A half of small cheese from milk (44 lbs.), and 16 days old. Treated as the others. Heat of curd 98°. Soft when packed, and got pressed out of shape. They have all been exposed to the fly during the time they have been in England, and were made at my own house by myself and father. Neither the milk nor cheese have been out of my charge.

7. A small sample of Canadian malt. In the manufacture of it a small portion of bisulphite of soda was used, to prevent souring of the grain and mustiness in the flour.

8. A small sample of Canadian ale, brewed September, 1868, at Mr. Severn's brewery, Yorksville. No ferment has ever been put to it. A little bisulphate of soda was used in the manufacture, to show its keeping quality. It has been in the sitting-room since that time, except on the passage.

9. Some small experimental cheeses, made from pints and quarts of milk taken up daily of the milk-seller, on his morning calls. Made July, 1868, in Toronto. Milk kept from four to eight days before using.

10. A sample of rennets, or, as called here, vells—cured in the season of 1867. They were blown, and then dipped in bisulphite of soda—not turned, but a little salt put to each end.

A piece of the beef, a portion selected as the best specimen sent, was roasted for the Committee. The meat, however, in the opinion of the Committee was not successfully preserved, and was quite uneatable. It is but right to state that the meat, and other specimens, had evidently been kept for a much longer period than was fair to test the value of the preservative process.

Mr. Sloggett brought before the Committee a specimen of meat preserved by a process which he will be prepared to explain at a future meeting of the Committee. In the meantime, the meat remains in the possession of the Society, for the purpose of testing its keeping qualities.

CANTOR LECTURES.

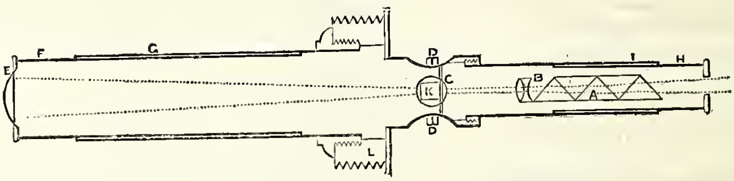
ON THE SPECTROSCOPE AND ITS APPLICATIONS.*

By J. Norman Lockyer, Esq., F.R.S.

Lecture II.—Delivered Monday, December 13, 1869.

In my last lecture, I endeavoured to give you an idea of the action of the simple prism. I will now bring to your notice another kind of prism, which differs from the simple one very much as the achromatic telescope differs from the non-achromatic one, which was the first attempt made at an instrument for astronomical observations. Many of you know that the object-glass of a telescope, as now constructed, consists of two lenses made of different kinds of glass. Of course, we have dispersion and deviation at work in both these kinds of glass, but the lenses are so arranged, and their curves are so chosen that, as a total result, the deviation is kept while the dispersion is eliminated, so that, in the telescope, we have a nearly white image of anything which gives us ordinary light, although, as you know, it is by the deviation alone that we are enabled to get the magnified image of that object. So also in the spectroscope we have an opportunity of varying the deviation and the dispersion. By a converse arrangement we can keep the dispersion while we lose the deviation; in other words, we have what is called a direct vision spectroscope (Fig. 6). Here is one composed,

Fig. 6.



Direct Vision Spectroscope applied to a Star Spectroscope.

as you see, of two prisms of one kind of glass, and three prisms of another kind, arranged with their bases the opposite way, and the final result is such that when we want to examine the spectrum of an object we no longer have to look at it at an angle. No doubt you recollect the angle which was made by the light the moment it left the prism, but we have an opportunity, by this arrangement, of seeing the spectrum of an object by looking straight at the light-giving object, and in the application of spectrum analysis, especially to the microscope and telescope, this recent modification—which, I am informed by Mr. Browning, was first proposed in this country, although M. Janssen, a name you well know, was the first to bring it to general notice—is one of great practical importance, so that in any research which does not require excessive dispersion, this direct vision arrangement is getting into common use. I have here another direct-vision arrangement which is well worthy of being brought to your notice. It does not depend at all upon the principles I have just been trying to explain to you. It is called the Herschel-Browning direct-vision spectroscope, in which the ray is refracted and reflected internally, as shown in the Figs. 7, 8, and 9. We have, therefore, in addition to

Fig. 7.

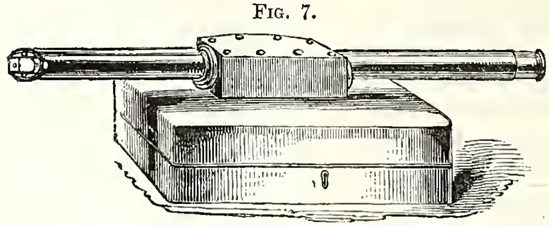


Fig. 8.

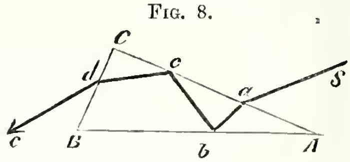
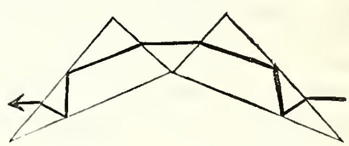


Fig. 9.



the simple prism which I brought to your attention more particularly in our last lecture, two other aids to research of extreme value in certain classes of observations.

It is not necessary that I should recapitulate what I said on the last occasion, but, with your permission, I should like to keep two or three lines of communication with the rear well open. We first saw Newton founding spectral analysis, by using a hole in a shutter and a prism; then we discussed Wollaston's substitution of the slit;

* The right of reproducing these lectures is, by an arrangement with the Society of Arts, reserved by the author.

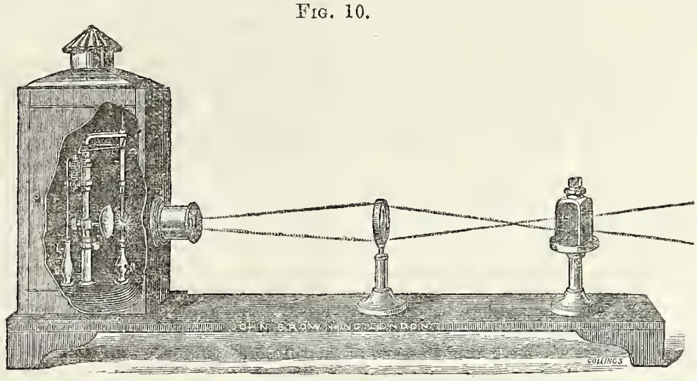
after that we discussed Mr. Simms' introduction of the collimating lens; and then the modern spectroscope, such as you now see before you.

It is time, now, that we came to the applications of the instrument. And in dealing with these applications I shall divide my subject at two perfectly distinct portions. I shall first deal with those applications which depend upon the different modes in which light is given out or radiated by various bodies under different physical conditions, with, in fact, the *radiation* of light. And, in the second place, I shall deal with the spectroscope's story of the way in which the light of a continuous spectrum is stopped or absorbed by different transparent bodies—with the *absorption* of light.

I.—RADIATION.

In this part of my subject I shall again have to make use of the electric lamp. And I want you to understand that that electric lamp arrangement is just as much a spectroscope as anything on the table before you (Fig. 10).

FIG. 10.



You have first the slit, then the collimating lens, after which the prisms follow, exactly in the same way as you have them in the ordinary instrument. The only difference is that, as we have full power to vary the position of the collimating lens, we can do away with the second lens, and the image on the screen; instead of having those two lenses, we really only require one. It must here be remarked that, in many kinds of spectroscope made now by Mr. Browning, we really have nothing more nor less than the construction which you see in that lamp. Here, for instance, is a little spectroscope of wonderful cheapness and power, by which you can see hundreds of lines in the spectrum of the sun, and which you can carry in your waistcoat pocket; in this only one lens is used. Of course it is much better (other things being equal) to use one lens than two, so that you see the tendency of the present time is to greater simplicity in the construction of all these instruments.

The first application is one of the most general importance. It enables us to differentiate between solid, liquid, and gaseous substances, and between gaseous or vapourous substances in different stages of pressure. If I were to burn a piece of paper, or a match, you all know we should get a white light, but you may possibly not all know that if we raise any solid or any liquid to a state of incandescence or glowing heat, we should get exactly that same sort of light. I have something in that lamp which will show you exactly what I mean. I will throw over the screen an image of what are called the carbon points; you will thus be able to see some part of the anatomy of the electric lamp. We have here our magnified image. These carbon points, as I think is pretty obvious to you, are heated to incandescence by the passage of the current. Now, carbon is a solid, and therefore if we take carbon as an example of a solid or liquid substance in a state of vivid incandescence, if we get from these carbon points a continuous spectrum, you must accept that as an indication of the truth of what I say, for I have not time to experiment on every solid and every liquid substance. Here on the screen is the spectrum, and you see it is continuous, that is to say, there are no breaks, as you see in these two diagrams of the solar spectrum, where the black lines represent the breaks in the solar spectrum which are called the Fraünhofer lines.

Let us then consider this fact established, namely, that solid or liquid bodies, when heated to a vivid incandescence, give a continuous spectrum without bright lines. Under these circumstances the light to the eye, without the spectroscope, will be white, like that of a white-hot poker; but if the degree of incandescence is not so high, the light may only be red, like that of a red-hot poker. But so far as the spectrum goes—and it will expand towards the violet as the incandescence increases—it will be continuous.

Now, suppose, instead of giving you the spectrum of those solid white-light-giving carbon points, I show you the spectrum of something the vapour of which is coloured, I think you will be prepared to understand that there may be some difference in the spectrum of that vapour or flame; and this is an extremely important point. Mr. Ladd is now burning what you will at once recognise as the red fire of our pyrotechnic displays. You must not consider that this is sensational, for Sir John Herschel, very many years ago, was on the eve of discovering the great points of spectrum analysis which I have to bring before you, by merely examining these coloured fires. Here is a vapour of a different colour. The light of these substances comes from the vapour; and you will see that the electric arc which passes between the points, the images of which I throw on the screen, is differently coloured, according to the substance which we burn in the points. Now, these differences in colour are accompanied by differences in the spectra. You now see the colour and light produced by burning chloride of strontium, and, at the same time, you see the spectrum of the vapour of that substance. We have something very different from the continuous spectrum we had before, and, this is, in fact, one of the first practical outcomes of spectrum analysis. It enables you in a moment to determine the difference between a solid or liquid body, which gives you a continuous spectrum, and a vapour or gas, which gives you a spectrum containing bright lines. The reason that different vapours and gases are of different colours is now clear; if we examine the light by means of a spectroscope, we find that the light rays which they emit are located in different parts of the spectrum. Instead of strontium, the spectrum of barium is now visible on the screen, and it is quite different from the other.

In these spectra, as you have seen, the spectrum

consists of lines which are located in different parts of the spectrum. If we burn some sodium in air, and then examine the spectrum of its vapour, we shall have further evidence of the connection between the colour of the light which we get from a vapour and the spectrum of that vapour. Mr. Macleod will heat some metallic sodium, and you will see a strong yellow light due to its vapour. At the same time, Mr. Ladd is preparing to show us the spectrum of the same vapour on the screen. You will imagine, *à priori*, from what I have already said, that as the colour of the light is orange, the line of the vapour will appear in the yellow or orange part of the spectrum, and I do not think you will be mistaken. You see, now, that from the sodium vapour itself we have a distinct yellow light, and in the spectrum on the screen we have a brilliant yellow line. With regard to solid and vapourous bodies, therefore—I need hardly refer to liquids—the electric lamp affords us a very handy method, when properly employed, of examining their spectra.

But there are a great many gases which the spectroscopist also has to study, and to study with the greatest care; and here, I am sorry to say, the electric lamp utterly fails us. The light which we get from a gas is so feeble that it is quite impossible to throw its spectrum on the screen, if we render it incandescent in the way in which we render incandescent sodium, barium, and the other substances I have brought before you. But we have other means of examining the spectra. I have here some tubes containing hydrogen and other gases at different pressures, and when we wish to study the spectrum of a gas, we do it in this way:—We enclose it in a tube, and send a current through it by means of an induction-coil. There you see a spark passing through a tube containing hydrogen at the pressure of one atmosphere. I am anxious to show you, not only the colour of the light, but also the arrangement by which we observe it, because it is one in daily use in all our laboratories; and I am glad to have the opportunity of showing you the *modus operandi* by which a great deal of the work has been done to which I shall have to allude in the course of the lecture. You see, as we cannot use the electric lamp, we have to place one of these tubes in front of the slit of an ordinary spectroscope. Here is another tube in which the red light of the hydrogen is seen very distinctly. You see there is a great difference in the colour of the gases in these two tubes, and this difference is due to the different pressures.

Spectrum analysis, then, teaches us this great fact, that solids and liquids give out continuous spectra, and that vapours and gases give out discontinuous spectra; that is to say, that we get lines in different parts of the spectrum instead of having an equal light all over the spectrum. I might vary this statement, by stating broadly that the radiation or giving out of light by solids and liquids is a general one, and that the radiation or giving out of light by gases and vapours, instead of being general, is in the main a selective one.

These tubes put us in possession of another important point, which has already been arrived at by two different lines of investigation. Only within the last year or two, Dr. Frankland, in investigating the spectrum of hydrogen, which, as you know, according to the statement I have just made, ought to give a discontinuous spectrum, was astonished to find that, by observing the spectrum under very great pressure, he got a white light, and therefore a continuous spectrum. At the same time, Dr. Andrews, another Fellow of the Royal Society, who was working at the theory of vapours and the theory of liquids from a perfectly different standpoint, and who never thought of using a spectroscope at all, arrived at the conclusion that it was quite possible that vapours might be so condensed in almost every case, that by crushing them together, so to speak, you might really arrive at a liquid form of the vapour which you might choose to investigate. I hope you will not think that these high physical investigations are not practical enough. Let me remind you that we do not know what they may lead to.

Not only did Dr. Frankland determine that very dense gases and very dense vapours gave continuous spectra, but in another research, in which I have had the honour of being associated with him, we have shown that the spectrum of a vapour or of a gas does very much more than tell us merely what the gas or vapour experimented upon is, it in fact tells us something of the physical condition of that gas or vapour, that is to say, whether it is very rare, or whether it is very closely packed together—whether it exists under a low or a high pressure. Very fortunately for us, this is an investigation which has not only an immense application in every chemical experiment with which the spectroscope has to do, but it has its story to tell and its aid to give concerning every star that shines in the heavens.

Spectrum analysis, then, if it merely differentiated between gases, vapours, solids, and liquids, and between gases and vapours in different states of pressure, would really be a new chemistry altogether, and I have no doubt that the time is not very far distant when, not only in the chemists' laboratory, but in a great many applications of the physical sciences, the spectroscope will be considered as necessary and will be almost as much used as a chemical balance, and the sooner that time comes the better.

But not only are we able to differentiate between different bodies, but the most minute quantities of substances can be determined by this method of research. The thing seems so impossible, that you may, some of you, feel inclined to doubt my assertion when I tell you, for instance, that Kirchhoff and Bunsen have calculated that the 18-millionth part of a grain can be determined by the spectroscope in the case of sodium; that is to say, if in anything which I choose to examine by means of my spectroscope the quantity of sodium present amounts only to the 18-millionth of a grain, the spectroscope is perfectly competent to take up that minute quantity, and bring it out into daylight. You all know how important chemical analysis is in thousands of things connected with the arts, manufactures, and commerce, in detecting adulteration for instance, and in these matters the spectroscope gives our chemists a power which was undreamt of a few years ago. Take another instance. Lithium is a substance the knowledge of which as a common element we owe to the spectroscope; the 6-millionth part of a grain of this can be detected. If we examine anything for lithium, and do not get the characteristic line, we know that not even the 6-millionth of a grain is present. Strontium, again, can be discovered if only a millionth part of a grain is present. So much for the great power of spectrum analysis in its physical applications, and its dealing with minute quantities of the elements which we know already, and this of itself would be of enormous importance.

But the spectroscope does not stop here; it discovers the known elements under conditions where detection seemed almost impossible, and in which the old chemistry was powerless to help us. Let us take, for instance, lithium. Lithium was only known formerly to exist in four minerals; it is now known, thanks to the spectroscope, to exist almost everywhere. If Mr. Ladd were to put a cigar between the poles of the electric lamp, we should get a spectrum of lithium, and if we analysed in the same way the ash of milk, or the ash of blood, we should also find it. Dr. Miller has recently shown that, in the Wheal Clifford mine, 800 lb. of this salt are given every 24 hours, though before the advent of spectrum analysis no lithium was known to exist there. Surely this is an application of very great importance.

But, further, spectrum analysis is not satisfied with showing us sources of known elements; it discovers new elements altogether. In 1860, Bunsen happened to be examining the result of one of his analyses of the waters

of a spring near Dürkheim, and he saw some lines which he had never seen before, although he had very carefully mapped the spectra of the known elements. Bunsen, as you know, is a very resolute chemist, and what he did was this. Having faith in his instrument, he evaporated no less than forty-four tons of the water of this spring, and out of these forty-four tons he got about two hundred grains of what turned out to be a new metal. Rubidium was the next metal which was discovered in this way. Take another instance, the discovery of thallium by Mr. Crookes. Mr. Crookes was working with a seleniferous deposit from the Hartz mountains, when, by the aid of the spectroscope, he discovered this metal, which I am informed, is now extensively used in the manufacture of fireworks. You now see on the screen the spectra of this metal, and you will understand why it has been named thallium, from the Greek word for a twig, on account of the beautiful green colour of the single line ordinarily visible.

There is another very beautiful application of the spectroscope, which perhaps many of you will say is of more practical importance than those I have already brought to your notice. You know that, in the Bessemer process, five tons of cast iron are turned into cast steel in twenty minutes. Now, steel is only cast iron minus some carbon. It is clear, therefore, that the process depends upon getting rid of the carbon. How then can the spectroscope aid us in determining the time at which the carbon is got rid of? Nothing is more easy. The heat from the incandescent iron is so intense that the vapour of the different substances mixed with it are visible above the retort in which the metal is placed, and we get, so to speak, an atmosphere of incandescent vapour surrounding the cast-iron. When we examine these incandescent vapours by means of a spectroscope, it is found that the spectrum changes very considerably at different times during the combustion of this cast-iron. Now, it so happens, that the process of conversion is such a delicate one that a mistake of ten seconds either way spoils the whole five tons which are being operated upon. You will see in a moment, therefore, that this is a case in which any rule-of-thumb or very rough method might now and then lead to a mistake; but when the spectrum of these incandescent vapours thrown out by the cast-iron is examined very carefully by means of a spectroscope, it is found that at the first the spectrum of carbon is quite visible, but at the right moment, which has been found by practice, that spectrum disappears, the combustion having been sufficient. All we have to do now, to ensure the charge being properly turned out, is, therefore, by means of the spectroscope, simply to watch the carbon lines in the spectrum, and when they are about to disappear, say, "Now," and the thing is done without any possibility of error. This is an instance of the practical application of the spectroscope in one direction; now let me give you one in another.

When Dr. Bence Jones wished to determine some questions connected with chemical circulation, he employed the spectroscope with great success. Many of you, at the first blush, would be inclined to say it was not very likely that the spectroscope would help us here. If it were a question, for instance, of our own chemical circulation, we would not relish the idea of being converted into an incandescent vapour for the pleasure of testing a theory. But, fortunately, there are such things as guinea-pigs, and Dr. Bence Jones, by studying the vapours of the ashes of these animals, has arrived at some results of extreme importance. His *modus operandi* was as follows:—He gave the guinea-pigs chloride of lithium, and then the question was to find, by burning the ashes of the different parts of the guinea-pigs, variously removed from the fountain of circulation and from the ordinary ducts of the body, to ascertain how long it took lithium to get absorbed into every part of the body. The most distant part, as far as circulation goes, is the lens of the eye. If, then, we give a guinea-pig chloride of lithium, then kill the guinea-pig, and examine the ash of the eye lens, say three hours after the lithium has been taken into the system, and if we find the lithium line in the spectrum of the ash vapour where no lithium was before, that is to say, if by means of the spectroscope we see that line which I have shown you on the screen, we know that the chemical circulation of the body is such as to take lithium through the body to that particular point of the circulation in that time. In the human subject Dr. Bence Jones has hit upon a very practical method of arriving at something like the same conclusion, by examining the spectra of the ashes of cataracts.

So far as I have dealt with the spectroscope, up to the present time, I have dealt in the main with the application of the prism to chemistry and to physics, but I must now, with your permission, take you to the skies, reminding you that to-night I am merely dealing with the giving out of light. In my next I shall have to deal with the stopping or absorption of light, by vapours and other transparent media when the light passes through them.

I said one word about the special fittings that were necessary for the application of the spectroscope to the telescope on a former occasion, and I will now show you photographs of Mr. Huggins' observatory and my own, in which you will see exactly how the spectroscope is applied to a telescope. By this means you will obtain a good idea of the method of research employed, in the same way as I hope I gave you an idea of the method of research in the case of hydrogen tubes. Broadly speaking, one of these spectroscopes is arranged for showing the spectra of the stars, nebulæ, &c., and the other for observing the spectrum of the sun.

In the former, the number of prisms, and the consequent deviation and dispersion, is small; in the latter these are large, the deviation amounting to 300°: the light from stars, &c., is dim, and many prisms cannot be employed to widen out the spectrum, but, in the case of the sun, there is light sufficient to give us a bright spectrum after it has been enormously dispersed.

In both spectroscopes the arrangements employed are similar, and resemble those of the instruments on the table. A finder on the side of the large telescope enables the image of the star to be brought on the slit, while, in the case of the sun, its image is received on the slit screen, and any part of the image may be brought on the slit by mere inspection.

In the first place, then, what does the spectroscope tell us with regard to the radiation from the sun and the stars? And here I ask you to neglect and banish from your mind for a time any idea of those dark lines in the solar spectrum that I drew your attention to on a former occasion. I hope I shall be able to explain them satisfactorily to you afterwards, but for the present I wish you merely to take the fact that our sun, but for the dark lines, would give us a continuous spectrum. The spectrum of the stars is very much like the spectrum of the sun. There, on the wall, is a diagram of the spectrum of the sun, and here is a representation of the spectrum of the star α Orionis In both cases we should obviously have a continuous spectrum but for the presence of the dark lines. I think you will see in a moment what I am driving at. Suppose the sun or stars composed of only sodium vapour, for instance, it is clear that their light analysed by the prism would give us no indication of a continuous spectrum at all, but, in the sun and star beams, we should merely get one bright line in the orange. But neglect the dark lines for a moment, and dealing merely with the continuous spectrum of sun and star, it shows that we have a something, whether it be solid or liquid, or whether it be a dense gas or vapour, competent to give us a continuous spectrum. So we are justified in assuming that sunlight and starlight proceed from the incandescence of a solid, a liquid, or a dense gas or vapour. Again, supposing instead of looking at the sun or the stars we observe the moon, as Fraünhofer

did, as I told you in my last lecture, what happens? We get a second edition of sunlight, in exactly the same way as we should get a second edition of the sunlight in the case of a reflection of it from a mirror; and, therefore, if proof of such a thing were needed, the spectroscope is perfectly competent to show us that the moon gives us sunlight second-hand. The same with Jupiter, Venus, Mars, and other planets. If we study them and observe the dark lines, we find that the lines which we observe are in the main the same as those which we find in a spectrum of the sun. There are other points to which I shall have to draw your attention on a future occasion, but, in the main, the result is that all these planets are lit up by sunlight.

But we have not yet exhausted the wonders of the celestial field; we have dealt merely with the sun and moon, the stars and planets. What about the nebulæ, those strange weird things, dimly shining in the depths of space, both to the eye and in the telescope obviously and distinctly different from anything in the shape of the sun or stars? A very good image of the nebulæ in Andromeda, as seen in a large telescope, is now on the screen. You see in a moment that you have there something very different from the sun or moon. What is it? You all know as well as I do that ever since nebulæ were discovered mankind have wondered at them, and wanted to know what they were; and you all know again as well as I do that it was not settled, and could not be settled before the advent of the spectroscope, but that it could be settled in five minutes after that advent. We now have a representation of the spectrum of a nebula on the screen. Mr. Huggins, who first observed the spectrum of a nebula, found that, instead of the continuous spectrum with which you are familiar in the case of the sun and the stars—always asking you to neglect the Fraünhofer lines, which I shall explain afterwards—the light which he got from the nebula consisted merely of three lines. He was exceedingly astonished, so much so that he thought the instrument might be out of order. However, it became perfectly clear to him in a very short time that there was no mistake at all, and that all that the poor light which came from the nebula could do was to give him these three faint lines. No doubt you have anticipated my explanation. The nebulæ are composed of tenuous gases or vapours. After what I have said about the way in which the spectroscope at once picks out the difference between a solid or liquid, and a vapourous or a gaseous body, you will see at once that these three bright lines indicate that the nebulæ, instead of being composed of solid, liquid, or densely gaseous bodies—of being things like the sun or stars—are really composed of tenuous gases or vapours. Mr. Huggins was enabled, in fact, to determine the gases in two instances, for one of the lines you see on the screen he found was coincident with one of the principal lines in the spectrum of nitrogen, and another with one of the principal lines in the spectrum of hydrogen; and now comes another extremely important point, showing the importance of studying the most minute changes in gaseous spectra, for Mr. Huggins, who knew the spectrum of hydrogen and the spectrum of nitrogen well, and who knew how extremely complicated those spectra are at times, was much astonished at finding only one line of hydrogen and one of nitrogen, and attempted to account for the singleness of the lines, first, by assuming a condition of the gas different from anything we meet with in our laboratories, and again by assuming an absorbing medium in space. But after Dr. Frankland and myself had made some observations on the spectra of hydrogen and nitrogen, we found it was perfectly easy to obtain, and sometimes when one did not want it, a spectrum of hydrogen or of nitrogen giving only one line, or nearly so; so that by comparing the conditions which were necessary to obtain these conditions in our tubes with the conditions of the nebulæ, it was quite possible to make at all events a rough guess at what is the constitution of the nebulæ, as far as the temperature and pressure go. We find, for instance, this single line of hydrogen, and this nearly single line of nitrogen, when the pressure is so slight that you would say that the tube really contained nothing at all, and when, moreover, the temperature is extremely low. Now, not only is this a fact, which we are quite prepared to assert, merely on the evidence rendered us by these tubes, but I think you will acknowledge that it is entirely in accordance with everything we know astronomically on this subject.

For the next application of the spectroscope in this direction, let us take a comet. A representation of Donati's comet is now on the screen. Although, as you know, that comet appeared not more than ten years ago, unfortunately it came too early for us to learn anything about it by means of the spectroscope. We have, first of all, an extremely bright nucleus; then a kind of semi-lune of greater brilliancy than the rest of the head; then what is called the coma, and here is the beginning of the tail. The question which the spectroscope had to put to the comet was—of what is the nucleus composed, and of what is the tail composed. Professor Donati, and Mr. Huggins especially, to whom we owe so much for his work in this direction, has made some observations on a small comet—I am sorry it was not larger—with great success. He finds that in the comet he examined, the head gave out a light which very strongly indeed resembled the spectrum of carbon vapour. I will now show you the spectrum of carbon taken in olive oil, and in olefiant gas, and here is the spectrum of the comet of 1868. Here, again, is the spectrum of another comet of 1868. You see, in a moment, how very nearly the spectrum of this comet agrees with these two carbon spectra which are very faithfully represented in the upper part of the diagram. You see, therefore, how very fully justified Mr. Huggins was in asserting that the head of this comet was in some way composed of some compound of carbon. I should like to draw your attention, if there were time, to the way in which these spectra of the carbon spark, taken in oil and in olefiant gas, differ.

So much for the sun as we see it every day in its uneclipsed state, stars, nebulæ, comets, and the whole family of moons and planets. But I have not yet completed all I have to say on the subject of radiation. This tube, containing incandescent hydrogen, which you see gives out a red light, may remind you of some other specimens of radiation which is supplied us by the skies. I allude to the red prominences which are seen around the sun, not in ordinary times, but when the sun is eclipsed. This representation gives you a good idea of what really is seen when the sun is eclipsed. Here, you see, we have as it were a black sun instead of a bright one, which is really nothing but the body of the moon. Around this we have a ring of light, which is called the corona, and here and there in this corona we have what are called red flames or red prominences. Here, then, it was quite possible that if the newly-invented spectroscope were set to question these things, we should see at once whether they were solid or liquid, or whether they were gaseous or vapourous. If we got a continuous spectrum from these red things, we should know they were either solid, or liquid, or densely gaseous. If, on the contrary, we got a bright line spectrum we should know we were dealing with a gas or vapour. You also see that, as the light is red, the chances were that they were not solid or liquid, and then you further see that if the things do consist of a light which does give us lines, a determination of the exact position of the lines, and a comparison of the exact position of the lines with those of hydrogen, sodium, magnesium, barium, or anything else, would teach us what these things were. And another point was also very obvious to those who are familiar with these inquiries, namely, that with a spectroscope on the scene it was perfectly unnecessary, as I pointed out in 1866, to wait for eclipses at all. This, however, is a long story, and one which I have no time to further

touch upon, as I am anxious to show you the last results of the spectroscope as applied to radiation in the celestial spaces. M. Janssen, who was sent out, as you know, by the French government to observe the eclipse which was visible in India in 1868, Major Tennant, and others, had no difficulty in recognising in a moment, when the sun was eclipsed, that these things really did consist of gases or vapours, and M. Janssen a very careful observer had no difficulty in determining that the gas in question was really hydrogen gas. I was also enabled to do this before M. Janssen's observations were known in this country, and by observations on the uneclipsed sun, a new method of observation which was also successfully and independently employed by M. Janssen in India. Now, allow me to conclude my lecture by showing you four slides, representing the different lines, ordinarily visible in the spectrum of these solar prominences, and explaining how the new method is employed. This method is very easy to understand, if you will be good enough to bear in mind the diagram of the large spectroscope in the observatory. If we wish to examine the regions round the sun, the light of the sun is allowed to fall on the slit in such a way that one half of the slit is occupied by the brilliant image of the sun on the screen, at the focus of the object-glass of the large telescope, and the other half is fishing, so to speak, around the limb or edge of the sun, so that if there is anything at all around the limb, the spectroscope, in the apparently unoccupied part outside the image, really picks up this something, and gives us its light sorted out into its proper bright lines in the spectrum of the region surrounding the sun. This diagram represents the red end of the spectrum. Here is a black line, which, by repeated observations, we know corresponds in degree of refrangibility exactly with one of the lines given out by the glowing hydrogen which you saw in those tubes. When, therefore, we get any substance around the sun reporting its light to us, it is perfectly obvious, I think, that if the bright line really be coincident with this dark line, that that something is probably hydrogen. This was one of the first lines determined by M. Janssen in the eclipse of 1868. There you see is another bright line absolutely coincident with a dark line known to correspond in refrangibility with another line given out by hydrogen in the green part of the spectrum. There, then, is more proof in favour of hydrogen; and now notice a great difference between the shape of this line and the red line which I drew your attention to just now. If you will bear in mind what I told you about the effect of pressure in altering the spectrum of the hydrogen spectrum, that one of the most obvious effects of increased pressure is to increase the thickness of what is called the F line—the line now on the screen, you will see that that curving of the F line, the green line of hydrogen, really indicates a thickening due to pressure. In that way we have been able to determine approximately the pressure of these circum-solar regions which the spectroscope has determined to be occupied by an envelope of hydrogen gas, mingled sometimes with other vapours, which envelope I have termed the Chromosphere. When the pressure of the chromosphere is completely determined, we shall be probably enabled to determine the temperature of the sun. Such are a few of the practical applications of the spectroscope as applied to the radiation of light. There are other classes of facts relating to the absorption of light, and these will form the subject of my next lecture.

SEVENTH ORDINARY MEETING.

Wednesday, January 19th, 1870; Professor OWEN, F.R.S., in the chair.

The following candidates were proposed for election as members of the Society :—

Barber, Captain Harley, 20, Great George-street, S.W.
Brooks, William, 9, Stratford-green, Stratford, Essex.
Corner, William W., Macclesfield.
Dixon, James Willis, Cornish-place, Sheffield.
Gumpel, Charles Godfrey, 49, Leicester-square, W.C.
Hankey, Rodolph A., 9, Suffolk-place, Pall-mall, S.W.
Hudson, Robert, F.R.S., Clapham-common, S.W.
Jessen, Carl Ferdinand M., Whetley-grove, Manningham, Bradford.
Macnair, George, 44, Hamilton-terrace, N.W.
Mort, Laidley, 135, Fenchurch-street, E.C.
Nash, Samuel, 44, Renshaw-street, near Liverpool.
Saddler, John, 6, Southampton-street, Fitzroy-square, W.
Taylor, Arthur Edmund, 14, Basinghall-street, E.C.
Tufnell, Thomas Robert, Belmont, near Uxbridge.
Wayland, Alfred, 104, Campbell-road, Bow, E.

AND AS HONORARY CORRESPONDING MEMBER.

Locke, Richard Langford, Suddya, Upper Assam.

The following candidates were balloted for, and duly elected members of the Society :—

Bowles, Thomas G., 88, St. James's-street, S.W.
Marchant, William J., 106, Great Russell-street, W.C.
Olsson, Martin, 69, Richmond-road, Barnsbury, N.

The Paper read was—

ON THE PEARL, CORAL, AND AMBER FISHERIES.

By P. L. SIMMONDS, F.R.C.S., F.S.S., &c.

Having promised to furnish a paper this session on the Commercial Products of the Fisheries, upon consideration I thought that perhaps a notice of those products which are sought for chiefly for their use in personal decoration, might prove the most generally interesting, and therefore I have restricted myself to the Pearl, Coral, and Amber fisheries.

The earth and the sea are alike laid under contribution for objects to ornament the person, chiefly, however, of the fair sex. For them

> "The diamond sleeps within the mine,
> The pearl beneath the water."

If we mine for diamonds, and rubies, and gold, we also dive down into the depths of the ocean for other adjuncts to beauty; and pearls, coral, and amber are articles highly valued in nearly every country.

I scarcely know what is the strict limitation of the term "gems and precious stones;" probably it is only restricted to mineral products embowelled from the earth, and therefore submarine substances are shut out from the generic classification.

Professor Tennant, in his lecture "On Gems and Precious Stones," delivered before the Society in March, 1852, after the first Great Exhibition, certainly did not touch upon pearls; and coral and amber can scarcely fairly come under the designation of gems and precious stones, however valuable they are esteemed for personal decoration. But I think many a fair lady does, nevertheless, include pearls and amber ornaments among her trinkets and gems; and coral has the hardness and brilliancy of the agate; it polishes like gems, and shines like garnet, with the tints of the ruby.

THE PEARL FISHERIES.

I commence with an account of the pearl fisheries, and shall, for convenience, class these under the three subdivisions of Eastern, American, and European pearl fisheries. Until I commenced to look into the subject, I was not aware that the pearl fisheries had been lately brought before the members of the Society by Mr. Markham;* for, having been officially occupied at Paris

* "The Tinnevelly Pearl Fishery," by Clements T. Markham, vol. xv., p. 256.

during the Exhibition of 1867, his excellent paper only recently came under my observation. As, however, he limited himself to a notice of the Tinnevelly fisheries, it still leaves open a wide field for description.

Tennyson, in his "Idylls of the King," speaks of

> "The fair pearl-necklace of the queen,
> That burst in dancing, and the pearls were spilt;
> Some lost, some stolen, some as relics kept."

And no doubt the splendid necklace of 36 fine pearls, presented to his bride by Prince Frederick of Prussia was, the admiration and envy of many a noble lady who saw it. But the most beautiful collection belonged to the Dowager Empress of Russia. Her husband shared with other fancies also that for fine pearls with her, and sought for them all over the world. They had to fulfil two conditions rarely to be met with. They must be perfect spheres, and they must be virgin pearls, for he would buy none that had been worn by others. After 25 years' search, he at last succeeded in presenting his empress with a necklace such as the world had never seen before. This admiration for fine pearls has been the common weakness of man in all ages and in all countries; and pearls are repeatedly cited in Holy Writ for the most solemn comparisons, and to denote the highest degree of perfection.

Pearls are obtained from several kinds of shells, and, like the shell itself, are always formed of a large number of concentric coats. According to the position the pearls occupy, they partake of the character of the shell near which they are formed. Thus, the pearls from the centre of the nacreous shells are of the usual pearly structure of those shells, while the pearl formed on or near the outer coat of the *Pinna* are of the same brown colour and prismatic texture as that part of the shell. Those from the *Tridacna gigas* are dull opaque white; those from the *Placuna placenta* of a lead colour; while even from the true pearl oysters (*Avicula margaritifera*) they are frequently of a light, semi-transparent, straw colour. Those formed on the part of the common mussel shells are of a bluish colour.

Pearls of a considerable size are sometimes found attached to the shell, and, being carefully detached and filed, are strung with the perfect pearls, as the convex part of the pearl which was in contact with the shell is often of the same size and perfect form with the part which projects beyond the surface of the shell. Pearls of this description, but not so perfect at the point of contact with the shell, serve the jeweller equally well for the purpose of setting as the perfect pearl. Some of these on the shell, and others detached, may be seen in the fine collection of Mr. Beresford Hope, at the South Kensington Museum.

The dark-coloured pearls are usually little esteemed; in general they are procured from the black or smoky mother-o'-pearl shell. It was formerly believed that pearls were only obtained from bivalve shells, and it was therefore difficult to understand what shell it was that yielded the pink pearl, for no known bivalve has such a coloured inner surface. It is now ascertained that the pink pearl is produced, among others, by one of the porcellanous or chank shells (*Turbinella scolymus*). All doubt on this head is set at rest by a specimen of this shell in the British Museum, where a fine large pink pearl has been caught and embedded in the shell, near its aperture, just as it was about to escape. The pearl is exactly like the internal surface of that shell. These pink pearls are also said to be yielded by the giant *Strombs*, the common fountain shell of the West Indian seas, and are known in commerce as conch pearls. Some very fine ones were shown from the Bahamas, in 1862.

The value of the pearls obtained in different quarters of the world is considerable. Lieut. Wellsted, in his "Travels in Arabia," states that the pearls obtained in the Persian Gulf fishery are estimated to be worth £400,000; they are even said to form there the principal source of revenue of the Imaum of Muscat. In the six years ending with 1858, the value of the pearls imported into the United Kingdom was £55,000; in the next three years, the imports reached £100,000 in value, but since then the annual average has only been about £57,000.

The practice of forcing the mollusc to produce pearls seems to have been known in the first centuries of the Christian era, and acted on by the ancient people who inhabited the coasts of the Red Sea. For we are told by the philosopher Apollonius that "the Indians dived into the sea, after they had rendered it calm, and perhaps clearer, by the pouring in of oil. They then induced the mussels, by means of some attractive baits, to expand their shells, and having pricked them with a sharp pointed instrument, the liquor which exuded from the wound was received into a perforated iron, when it hardened gradually, formed pearls of the finest water." Now there is enough of truth in this statement, and in the spikes or wires noticed by Philostratus as being used by the ancient people who inhabited the banks of the Red Sea for the purpose of pricking mussels, to lead to the belief that they were acquainted with an artificial mode of producing pearls. And this opinion is additionally confirmed by the method still in use among the Chinese, who retain the arts and customs of their ancestors.

Very full accounts of the mode employed by the Chinese for forming these artificial pearls have been communicated to the Society by Sir John Bowring and Dr. Macgowan.*

Looking at the example of the Chinese, and from the investigations and experiments of Dr. E. F. Kelaart, a scientific man who was engaged by the Ceylon government, there seems little doubt that means can be discovered of transporting the molluscs to favourable localities, of feeding and cultivating them there, and of compelling them to yield their glittering treasures in the form and quantity which their owners may require.

The errors propagated with regard to the period which divers can remain under water, and as to the alleged unhealthiness of the occupation, should no longer be allowed to circulate. Thus, in an old work, "Mortimer's Commercial Dictionary," it is stated:—"The best divers will keep under water near half-an-hour, and the rest do not stay less than a quarter." A recent traveller, in an account of "a journey from Bombay to Bushire and Bussora," speaking of the fishery in the Persian Gulf, says he was told that the divers remain under water five or six minutes. Now, a more reliable authority, Lieut. Whitelock, of the Indian Navy, in an account of the pearl fishery of the Gulf of Persia, published in Captain Stewart's work, says "the divers continue down about 40 seconds, in ordinary depths of water; I never saw one of them remain above a minute." The same misinformed writer, whom I have already quoted, adds:—"The poor Arab diver, his body covered with sores, and every joint racked with rheumatism, his eyes bloodshot and very weak, finds an early grave." The divers do suffer here from inflamed eyes, for which they apply antimony as a remedy, but that is all.

Another writer (Mr. Lebeck), in an account of the pearl fisheries on the coasts of Ceylon fifty or sixty years ago, stated that experienced divers, after long practice, will remain under water seven minutes! Now, these are gross errors which require to be dispelled. The longest period which a diver has remained under water, as timed by Capt. Stewart, who was inspector of the Ceylon pearl fisheries for about thirty years, was 87 seconds. And with respect to the occupation of the diver tending to destroy life, the contrary is the fact. The professional divers are men of expanded chests and plenteous muscle. They are divers from childhood, either for the chank shells, or for other purposes, and when a pearl fishery is announced, they flock to it as a scene of pleasure and profit, for instead of earning a daily wage of 9d., a diver's daily share of oysters averages in value about 9s.

* "Pearls and Pearl-making in China," by Dr. Macgowan, vol. ii., p. 72.

Seed-pearls are often ground down in the East, to be given in medicine as an electuary, or to be used by the wealthy natives of India, as a component in their betel-nut masticatory. In China, they frequently form an ingredient in the formula for conferring perpetual youth. The pearl-powder of the apothecary was a sovereign remedy for many diseases in this country not a century ago. The story of that dissolved in vinegar, drank by Cleopatra, valued at £80,000, is well known, while Clodius, the glutton, swallowed one worth £8,000. Even in sober England, Sir Thomas Gresham ground a pearl, which had cost him £15,000, into a cup of wine, to do full justice to the health of his queen.

Eastern Pearl Fisheries.

The Arab fishery off the island of Bahrein, in the Persian Gulf, has been long renowned, and still yields a large revenue from the pearls obained there, which are found, too, in deeper water than in the other principal pearl fisheries. As many as 1,500 boats are employed there; Lieut. Whitelocke says 3,000. The fishing commences in June, and is continued until September. The value of the pearls obtained throughout the Gulf during one season Lieut. Whitelocke calculated at forty lacs of rupees (£400,000), about a quarter a century ago. Lieut. Wellsted cites the same figures, but we have no recent data that can be relied upon.

Mr. Markham has so fully and ably described the fisheries of Southern India, on the Tinnevelly banks, and Tuticorin on the Madras side, that I need only confine myself to the Aripoo banks on the coast of Ceylon. The fishing there usually takes place in the month of March. The banks are about twelve miles from the shore. Every boat has five diving stones, and two divers to each stone. One diver goes down with each; the other holds the signal rope, watches the motions of his comrade, draws up first the stone, then the net in which the oysters are lodged as torn from the banks, and then the diver himself comes up. At a given signal, the boats all strike work and make for the shore, to turn out their oysters.

The revenue derived from the pearl fishery in Ceylon is uncertain and precarious, but worth fostering. The Dutch had no fishery for 27 years, from 1768 to 1796, and they were equally unsuccessful from 1732 till 1746. From 1799 till 1802 inclusive, the average yearly produce ranged from £12,000 to £55,000 per annum, but in 1814, the proceeds were £105,187. There was no fishery from 1820 to 1827. In the next five years, from 1828 to 1833, it averaged about £30,000. In 1834 there was no fishery. In 1835 it brought in upwards of £40,000. In the next two years it declined to £25,800 and £10,600 respectively, and then the fishery was not resumed until 1855, when about £11,000 was realised.

The pearl fishery of 1859 was, as regards revenue to the government, the most successful that has taken place since the fisheries were resumed. It realised £48,216, and but for the change of weather which set in at the end of March, and the outbreak of cholera which ensued, there is every reason to believe that the proceeds would have reached £60,000. The great increase in the selling price of the oysters was owing to the profit (which could not have been less than 300 per cent.) made by the speculators in 1858. The fame of this brought all India into the field as competitors. Money was as plentiful as buyers, and the same oysters which averaged £1 19s. a thousand in 1858, in 1859 produced an average of £4 10s., the highest rate paid being no less than £8 8s. There is no reason to doubt that, even at these prices, large profits were made.

STATISTICS OF THE CEYLON PEARL FISHERY.

Year.	No. of Fishing Days.	No. of Oysters Fished for Government.	Highest price per 1000.	Lowest price per 1000.	Average price per 1000.	Total Produce.	Cost of Fishery.	Net Produce.
			£ s. d.	£ s. d.	£ s. d.	£	£	£
1833	..	..	..	..	..	32,059	7,657	24,402
1835	..	..	..	..	..	40,346	5,724	34,622
1836	..	..	..	..	..	25,816	5,922	19,894
1837	..	..	..	..	..	10,631	3,177	7,454
1855 (March 12 to April 12)	20	5,012,108	2 18 0	1 10 0	2 4 0	10,922	2,632	8,290
1857 („ 9 „ 24)	23	24,380,308	1 12 0	0 12 0	0 16 8½	20,551	4,416	16,135
1858 („ 5 „ 3)	18	12,353,049	3 2 0	1 12 0	1 19 0	24,120	4,742	19,378
1859 („ 8 „ 7)	18	6,391,549	8 8 0	3 14 0	4 10 0	48,216	4,830	43,385
1860 („ 12 „ 31)	14	2,733,954	18 0 0	2 10 0	13 4 0	36,682	2,038	34,645
1863 („ 9 „ 28)	15	5,191,000	8 8 0	4 10 0	6 14 0	51,017	..	..

There has been no fishery since.
In 1854, £906 was spent, and in 1856, £906, although there were no fisheries.

There are vast beds of mother-o'-pearl oysters in the far eastern seas, and the Sulu pearls are said to be very fine. A companion of Magellan mentions having seen two in the possession of the Rajah of Borneo as large as pullets' eggs. At Moreton Bay, pearls worth from £5 to £10 each have frequently been found. In the Queensland court, at the Paris Exhibition, in 1867, there were a dozen very fine pearls shown; and the advices by the last Australian mail state that the pearl fisheries at Western Australia seem to be progressing. Some twenty-five very handsome pearls had been received at Melbourne, which were being exhibited at Messrs. Brush and Macdonnell's, Collins-street West. Some of these are perfect in shape, and of very fine colour. It is said that one of the largest would fetch £25 in the London market, and there are several others worth from £8 up to £15.

Declared Value of Pearls imported into the United Kingdom.

1853	£60,735
1854	41,000
1855	30,476
1856	56,162
1857	62,805
1858	78,559
1859	108,768
1860	91,785
1861	93,220
1862	89,305
1863	77,055
1864	56,236
1865	45,789
1866	51,816
1867	38,096
1868	36,079

Those interested in the pearl fisheries and pearls generally, I would refer, among other sources, to an account of "The Pearl Fisheries of Ceylon," by Captain James Stewart, 4to., Ceylon, 1843; a paper on "The Pearl Oyster Fisheries of Tinnevelly," by Soubeiran and Delondre, in the "Bulletin of the Paris Société d'Acclimatation," for August, 1867; Dr. Kelaart's report on "The Natural History of the Pearl Oyster of Ceylon;" vol. i. of my *Technologist*, p. 166; an article on "The Pearl Fishery of Ceylon," *Technologist*, July, 1864, vol. iv., p. 546; an article on "British Pearls," by A. C. Blackstone, in *Belgravia* for September, 1869 (vol. ix. p. 343).

South American Pearls.

The average annual value of the pearls collected at King's Islands, in the bay of Panama, is stated to be about £24,000. In 1865, the value was £28,000. A very perfect, pear-shaped pearl, of the finest water, was found here a few years ago. Diving-bells have been tried here, by American and other companies, but given up. Besides the obstructions caused by the irregularities of the sea-bottom to a complete adjustment of the machines, much inconvenience was experienced in moving about from bank to bank, it being necessary on every occasion to unship the derricks and other fixtures so as to enable the vessel to be moved from one fishing-ground to another.

Pearl-fishing has long been carried on off St. Marguerita, or the pearl islands on the coast of Colombia. In 1587, upwards of 677 lbs. of pearl were imported into Seville from China; and Philip II. had one pearl from St. Marguerita which weighed 250 carats, and was valued at £30,000. The banks of Rio de la Hacha and Cubagua also yield good pearls.

When Columbus first discovered some of the islands in the gulf of Mexico, he found Indians fishing for pearls. The necks of the females were adorned with strings of pearls, which they were induced to exchange for the more attractive novelties of porcelain ware, painted and ornamented with gaudy colours.

The fishermen here, as in the Persian Gulf, open the oyster with a knife, and search for the pearls by crushing the flesh with their fingers. This is a slower process than that practised in Ceylon, but it is asserted that by this plan the pearls preserve the freshness and purity of their waters. The South American pearls are either very white or of a leaden hue, according to the soil from which the nacre is coloured. These pearls are principally sent to Spain.

In the lower part of the Bay of Mulega, near Los Coyetes, Gulf of California, pearls have been found of rare value and astonishing brilliancy. It was in this bay that Jeremiah Evans, an Englishman, towards the close of the last century, obtained those magnificent pearls of which the collar was made for the Queen of Spain which evoked so much admiration at St. Cloud and Windsor Castle. In many parts of North America very fine fresh-water pearls have been recently obtained. In New Jersey, Messrs. John and Jacob Quackenbush, of Paterson, exhibited, a few years ago, twenty-one pearls, obtained by them in the streams of the Passiac and Bergen counties, regularly graduated in size for a necklace, and of beautiful tints and clearness, valued at £300, and they also obtained one of the size of a musket-ball, worth nearly £200. They had realised more than £800 by the pearls they had obtained. In Dano river, in Texas, about 10,000 pearls were obtained in a short period. In the province of New Brunswick, a very fine pearl, of unusual size, was obtained from a river mussel. It weighs 27grs., is perfectly spherical, without flaw or defect of any kind, and was valued at about £30.

European Pearls.

Mr. Robert Garner, in a paper on the formation of pearls, read at the Linnæan Society, in December, 1861, stated that, besides the really beautiful pearls occasionally procured from the fresh water *Alasmodonta*, in the upper part of the Conway (as, indeed, in several other British rivers), an inferior kind was found in great plenty in the common edible *Mytilus*, at the embouchure of the river above-mentioned. Only the *Mytili* picked from the bar, however, and not those higher up, or on the seashore, contain the pearls, which are found in the two membranous folds or mouth of the animal. Various opinions have been offered as to the immediate cause of the formation of these pearls. On breaking them, there is found in their centre a nucleus of dark-coloured matter—hard, granular, and of an animal nature. A microscopical examination of the *Mytili* from the bar of the Conway, had led the author to attribute the formation of pearls to the deposit in the mouth of the exuviæ, or secretion, of a small species of parasitical *Distomus*.

Pearls are common in many molluscs, and even in some univalves, and the *Distomus* appears to be the common irritant leading to this deposit; but Mr. Garner thinks it possible they may sometimes arise from other irritants, or even spontaneously, *e.g.*, from the retention of calcareous matter, which is usually thrown off from the so-called sac or renal organ, when not wanted for the formation of shell.

It has long been known to naturalists and antiquaries that pearls of great beauty and size were at one time found in the Scotch streams. Tytler, in his "History of Scotland," states that, so early as the 12th century, there was a demand for Scotch pearls abroad. Those in the possession of Alexander I., he says, were celebrated for their size and beauty. In 1355, Scotch pearls are referred to in a statute of the Parisian goldsmiths, by which it was enacted that no worker in gold or silver should set them with Oriental pearls, except in large ornaments or jewels for churches. They are noticed again in the reign of Charles I., when the Scotch pearl trade was considered of sufficient importance to be worthy of the attention of Parliament. The following extract from "An Accompt Current betwixt Scotland and England," by John Spruel, Edinburgh, 1705, shows that they were then well known:—"If a Scotch pearl be of a fine transparent colour and perfectly round, and of any great bigness, it may be worth 15, 20, 30, 40, to 50, rix-dollars; yea, I have given 100 rix-dollars (£16 9s. 2d.) for one, but that is rarely to get such.......I have dealt in pearls these 40 years and more, and yet, to this day, I could never sell a necklace of fine Scots pearl in Scotland, nor yet fine pendants, the generality seeking for Oriental pearls, because further fetcht. At this very day I can show some of our own Scots pearl as fine, more hard and transparent, than any Oriental. It's true that the Oriental can be easier matcht, because they are all of a yellow water, yet foreigners covet Scots pearl."

These British pearls were well known to the Romans, who, nevertheless, complained that they were small and ill-coloured. "History has preserved the tradition that it was this source of wealth that tempted the Romans to our shores, and more than one ancient writer refers to the shield, studded with British pearls, which Cæsar suspended as an offering in the temple of Venus, at Rome. Tacitus mentions pearls among the products of our island, but adds that they were generally of a dusky, livid hue. This, he suggests, was owing to the carelessness and inexperience of the persons who collected them, who did not pluck the shell-fish alive from the rocks, but were content to gather what the waves cast on the beach. Pliny and others also describe them as inferior, on account of their dulness and cloudiness, to the jewels of the East. Coming down to times less remote, we find Hector Boece, in the 16th century, expatiating upon the pearls of Caledonia with much enthusiasm. They were, he says, very valuable, 'bright, light, and round, and sometimes of the quantity of the nail of one's little finger.'" *

It seems known that Sir Richard Wynn, Chamberlain to the Queen of Charles II., presented her Majesty with

* *Once a Week*

a pearl taken from the River Conway, which, it is affirmed, is still honoured with a place in the regal crown. In the 16th century, several of great size were fished from the Irish rivers. One that weighed 36 carats was valued at £40, and other single pearls were sold from £4 10s. up to £10. This last was disposed of a second time to Lady Glenlealy, who put it into a necklace and refused £80 for it from the Duchess of Ormond.*

Oliver Goldsmith, in his "Natural History," refers to a pearl fishery rented on the Tay; and Hugh Miller has spoken of rivers in the north famous for their pearls. As a branch of industry, however, the Scotch pearl fishery seems to have been well-nigh forgotten, when, in 1860, M. Moritz Unger, a foreigner, then in Edinburgh, conceived the idea of making a tour through the districts where the pearl mussel was known to abound. He discovered that pearl-fishing was not altogether forgotten, and found pearls in various parts of the country, in the hands of people who could not estimate their value. He purchased all he could procure. The consequence was, that, in the following year, many persons —colliers, masons, labourers, and others—began to devote their leisure to pearl-fishing, and some of them were so successful as, during the summer months, to make as much as £8 to £10 weekly. Between the years 1761 and 1764, £10,000 worth of pearls were sent to London from the rivers Tay and Isla, but the trade carried on in the corresponding years of this century was far more than double that amount. M. Unger estimated the pearls found in 1865 to be of the value of about £12,000. In the summer of 1862, which was dry and favourable to fishing operations, more pearls were produced than during any previous year in Scotland, and at this time the average price of a Scotch pearl was from £2 6s. to 50s.; £5 was considered a high price. Since the fisheries were revived, their price has rapidly risen, and they now fetch prices ranging from £5 to £20. One Scotch pearl was bought by her Majesty for 40 guineas. The Duchess of Hamilton and the Empress of the French have also purchased fine specimens at high prices, and M. Unger had in his possession a necklace of Scotch pearls, which he values at £350. The process of fishing is very simple. The fisher having discovered a bed of the fresh-water shell-fish, or oyster, known to naturalists as the *Unio margaritifera*, wades to it with a stick split at the end, between the two parts of which the oyster is seized. When he has collected a sufficient number, he opens them with a knife, and ascertains if there is any pearl inside. Of course, great numbers may be opened without success, and in this respect pearl-fishing resembles gold-digging.

As regards the productiveness of the Scottish pearl mussel, a practical hand states that one pearl, on an average, is found in every 30 shells; but as only one pearl in every ten is saleable, it requires the destruction of 130 shells in order to find one good gem. Of course, shells are occasionally found that contain a great many pearls, but these are an exception to the rule. The Tay, the Don, the Leith, the Garry, and the Tummel are said to abound most in pearl mussels, but it seems they are to be found in a large number of the Scotch streams, and more especially in those of the north and west.

In 1860-61, when a portion of Loch Vennachar was laid dry for the purpose of building a sluice for the Glasgow Water Works, innumerable shells were found, from which the labourers gathered a great many very fine pearls. Lochs Lubnaig, Earn, Tay, Rannoch, and many others further north, as also west and south, are actually crammed with shells. M. Unger states that "he knew some persons who each made several hundred pounds, in the summer of 1863, by pearls."

The river Irt, in Cumberland, was also at one time a famous stream for pearls; and during the last century several pearls were found in the streams of Ireland, particularly in the counties of Tyrone and Donegal. We read of specimens that fetched sums varying from £4 to £80.

* Philos. Trans. Abr. ii., p. 83.

In several parts of Europe, pearls have been found in the river mussels. In parts of Lapland, and in the great stream that runs through Jedderer, in the diocese of Christiansand, Norway, a great number of bivalves are found which often contain large and fine pearls.

A very interesting paper on fresh-water pearls was read before the Paris Acclimatisation Society, in June, 1858,* but it does not present much original information, treating chiefly the mooted question of the origin or cause of the formation of pearl, and of the modes of artificially obtaining pearls, as adopted by Linnæus and the Chinese. In France, it is stated that pearls are obtained chiefly in the *Unio margaratifer*, Rossm.; in the *Alasmodon margaratiferum*, Flem.; in the *Unio sinuatus*, Rossm.; in the *Unio rhomboideris*, Moq.; the *U. littoralis*, Cuv.; the *U. crassus*, *pictorum* and *tumidus*, Philipps; and the *Anodonta cygnea*, Lam.

The pearl-bearing mussel is frequently met with in the brooks and rivulets of the Bavarian wold, and in the mountains of the Fichtelberge. Dr. Von Hessling, of Munich, was commissioned, some years ago, by the King of Bavaria, to make close and minute investigations into the habits of this mussel, with the view of ascertaining whether it might be propagated by artificial means. The rich collection of pearls of Bavarian origin, that was shown at the Munich Industrial Exhibition, was a sufficient evidence that the culture of the pearl in Germany may turn out a considerable branch of industry.

In the River Elster, and several other streams in Saxony, pearls are found of three kinds—the pellucid, semi-pellucid, and the seed-pearl. The following is an abstract of the value of these pearls:—

For the Years.	No. of pearls found.	Value in dollars.
1719 to 1804	11,286	10,000
1805 to 1825	2,258	2,156
1826 to 1836	1,549	893
Total in 117 years	15,393	13,049

Coral.

A small zoophyte, adapted to live in arborescent aggregations, formed of thousands of individuals, who secrete, to sustain the stems and branches which form the common skin of this innumerable association, a phosphatic calcareous matter, coloured of a more or less red tinge. The coral polypes embellish rapidly with their scarlet vegetation the bottom of the sea, from 75 to 100 feet in depth; and submerged objects, whatever their nature, sustain equally this animal seed, and serve as supports for this precious polype. We are still ignorant on many points of the highest importance relating to the production and search of this handsome substance. The little that we do know, however, leads to the belief that the growth of coral is rapid, that its development is simple, and accommodates itself to very varied circumstances; that detached fragments from the bunch or principal stem have a vitality, and will voluntarily attach themselves to certain fixed substances, for continuing their development and forming new trunks; in fact, objects thrown into the sea in the vicinity of coral banks will infallibly be found covered with coral in a few months.† But what is most valuable to be known for regulating the search for coral, and for rendering the return more productive and more certain, is to ascertain at what age coral attains its largest size; how long it takes for an exhausted coral bank to again become rich and flourishing; at what period the eggs are laid; how are the products disseminated, at what period does the budding take place, and how long does it last?

* Observations sur les Perles des bivalves d'eau douce, par MM. J. Cloquet et A. Moquin Tandon, membres de l'Institut, "Bulletin de la Société Imperiale Zoologique d'Acclimatation" (Paris), vol. v., p. 448, 1858.

† "Cavolini, Memorie per servire alla storia de polipi marini," Naples, 1785, 4to, page 32.

These are most important questions, on the solving of which rests the complete regeneration and increase of the coral fishery. These are, however, questions as yet unsolved by naturalists.

Coral is one of the handsomest and most valuable commercial products obtained from the sea. Naturalists range it in the animal kingdom, at the head of zoophytes, or animal plants (*Corallium rubrum*, Linn.) So late as 1825, Blumenbach, writing of them, says:—"The stems appear to be really vegetables merely incrusted with corals. To the fisherman it presents the appearance of a branching shrub without leaves, of a red or rose colour, hard, compact, and solid. The density of the red coral renders it very brittle, and did it not grow in a somewhat stunted form, it would be liable to injury from the violent motion of the water in which it grows." Coral is found more or less almost along the whole length of the Mediterranean Sea.

"Full fathoms five thy father lies,
Of his bones are coral made."

So sang *Ariel*, without, I suppose, intending to lay down any rule as to the depth at which coral may be found. Indeed, it is found at all depths, but that obtained in deep soundings is the handsomest and most diffused. M. Bory de St. Vincent says it is seldom found at less than 100 feet. The value of coral varies considerably. In 1826, when the use of it by ladies had gone out of fashion, it was estimated by the French Customs authorities at but two francs the kilogramme in the rough, or less than 1s. the pound. In 1853, when it had again come somewhat into favour, it was valued on entry at 25 francs the kilogramme, or about 10s. the pound.

The coasts where this valuable zoophyte is found in the greatest abundance are those of Corsica, Sardinia, Algeria, the vicinity of Trapani, and the straits of Messina. In this strait, there was a spot of about six miles in length, whence 12 or 13 tons of ordinary coral used to be obtained. Coral is also found on the shores of Provence, and about the isles of Majorca and Minorca. There are coral fisheries off the coast of Dalmatia, and the fishing was formerly carried on to some extent on the coasts of Rhodes, but has been abandoned for many years, in consequence, it is said, of the rapacity of the Turkish Government functionaries. A discovery of a bank yielding the coral of commerce was reported a few years ago near Balipitye, in the southern provinces of Ceylon. Coral is said to be also obtained off the coasts of Japan and Sumatra. During the last few years, coral fishing has been prosecuted with some success around the coast of St. Jago, in small Italian and Spanish vessels from the Mediterranean; but there is no reliable information to be obtained at present as to the value of the coral gathered. At Jeddah, there is a black coral fishery, and this so-called coral (for it belongs to a different genus) is fashioned by the people into beads and mouth-pieces for cigars. It is only found fifty miles to the north and south of Jeddah; it takes a very fine polish. There is also a white species, which is not quite so hard. The black is sold there at half-a-crown a pound weight; the white a little cheaper, from its not taking so fine a polish.

From a memoir submitted to the Superior Council of Algiers, on the fishery, industry, and commerce in coral, by Messrs. Hayman, Garandy, and Bonfort, of Marseilles and Oran, I glean the following details:—The use of coral dates back to the 15th century, under Francis I. At that period it was fished for on the Algerian coasts. In the time of Charles IX., Thomas Linches and Carlin Dedier, both of Marseilles, bought the right of this fishery on the coasts of the north of Algiers, and formed the establishment called Bastion de France. These first searchers failed; but another French Company took their place, and fished at Cape Roux, at Bône, Collo, Djidjelli, and Bougie, and, in 1594, erected the central establishment of La Calle. In 1604, the Dey of Algiers reserved to the French the exclusive right of fishing for coral from Cape Roux to Cape de Fer (Ras-el-hadid). In 1619, under Louis XIII., the Duke of Guise, governor of the province, purchased the concession of the fishery. In 1628, France greatly extended the fishery; and under Richelieu formed the establishment of Stora, and paid at that time 8,000 crowns, for the right of fishing, to the Dey of Algiers. In 1694, under Louis XIV., an annual subvention of 40,000 francs was accorded to a company which took the fishery for ten years, paying a rent of 105,000 francs to the Algerian Government. In 1719, the Indian Company replaced the French Company. In 1741, a Marseilles association, and then the Company of Africa, re-took the commerce, which had been for some time forcibly interrupted. In 1750, the rent paid for the fishery was 43,360 francs, and in 1790, 60,000 francs. In 1750, the French Company, which prosecuted the fishery, employed 25 boats, which brought in annually from 30,000 to 35,000 kilogrammes of coral, of the value of more than one million francs (£40,000). This coral was re-sold by the manufacturers of Marseilles at the price of five million francs, thus bringing in a profit of £160,000 to the workers. In 1791, the Convention annihilated the national efforts, under the pretext of destroying what was termed a monopoly. They also allowed foreigners to participate in the fishery. In 1798, after the war with Algiers, Europeans were hunted by the Regency, and, being taken captive, were obliged to abandon the commerce. The Genoese and the Neapolitans, after appreciating, in 1794, the profits of this enterprise, in 1805, almost monopolised the fishery. In 1806, England took possession of the fishery, paying to the Dey 267,500 francs, and also an impost of 90 piastres and 3 rottoli of coral per boat. The rough coral was worth, at that time, 7 to 21 ducats the rottolo (1 lb. 12 oz.). In 1817, France once more took possession of the fishery for 60,000 francs; but, in 1820, was forced to pay for the privilege 200,000 francs. In 1822, the right of fishing was given to a Marseilles company, payment being made to the Dey, but little fishing was carried on. Foreigners continued to be admitted to the fishery; but, in 1826, the imposts were removed from the French fishermen, though continued on foreigners. In 1830, the war brought about the destruction of the French establishment at La Calle. At the present time, the French fishery has dwindled to nothing, although the value of the coral annually taken by foreigners is from eight to nine millions of francs.

In February, 1855, Marshal Vaillant, then Minister of War, addressed a long communication on the coral fishery in Algeria, to the president of the Paris Acclimatisation Society, which is published in their journal.* He gives various important statistics as to the result of the fishery. Thus, between 1832 and 1844, there were never more than 10 French boats engaged out of an average total of 200 or more; and between 1845 and 1853, the highest number of French boats in any one year was 19. From the year 1844, the right of fishing was obtained on a payment annually of 800 francs, the fishing-ground extending on the east coast from Cape Blanc to Cape Fer, and, on the west coast, from Cape Carbon to the Zaffarine Islands. Marshal Vaillant states that, in 1853, the boats fishing on the west coasts obtained, on an average, 35,880 kilogrammes of coral each, which was principally sold at Naples, at 60 francs the kilogramme, making the value of the fishery in the waters of Bône and La Calle 2,152,880 francs. A great number of the boats, mostly Neapolitan, whose expenses did not exceed 8,000 francs in all, obtained 400 to 500 kilogrammes of coral each, which, at 60 francs, gave a return of 24,000 to 30,000 francs. M. Ad. Focillon published in a subsequent volume a report from the Algerian committee of the Society on the whole question submitted by Marshal Vaillant.†

* "Bulletin," vol. ii, p. 177.
† "Bulletin de la Société Imperiale Zoologique d'Acclimatation," vol. iii, page 213.

The general size of the boats employed in the coral fishery is from four to six tons. Out of 2,000 men who frequent the waters of Bône to fish for coral, there are not three French, nor one Algerian.

In March, 1832, general rules were established for the coral fishery of Algeria. It was divided into two seasons, the winter and summer. The right to fish was charged at 1,160 francs for the spring season, and 535 francs for the summer. The French boats were freed from all dues or payments; nevertheless, the fishery was exclusively carried on by the Sardinians, Genoese, and Neapolitans; and the working of coral, formerly of considerable importance in Marseilles, was declining day by day, and bids fair to disappear altogether. By an *ordonnance* of 9th of November, 1844, foreign boats were allowed to pursue the fishing, on payment of a fee of 800 francs for the year. There were 4,000 Italians and 2,000 Spaniards engaged in the coral fishery at Alger, Bône, and Oran. The French sailors did not like the hard work and short food, the fishing being carried on night and day.

In 1850, the fishery was prosecuted by 204 boats, of which 26 were French, 3 Sardinian, 121 Neapolitan, 28 Tuscan, and 26 Spanish. According to the Customs returns, these boats obtained nearly 29,000 kilogrammes of coral, valued at $1\frac{1}{2}$ million francs (£60,000). This was obtained at the following localities:—

	Kilos.	Value francs.
Oran	262	12,000
Mers-el-Kébir	307	15,350
Alger	345	17,250
Djidjelli	236	11,800
Stora	218	10,900
Philippeville	76	3,800
Bône	9,237	416,850
La Calle	19,200	960,000
	29,881	1,448,950

In 1856, the rough coral exported from Algeria amounted to but 9,557 kilogrammes, of the value of 477,850 francs; in 1861, it reached 37,118 kilogrammes, of the value of 1,855,900 francs. In 1857, there was sent to France rough coral of the value of 170,000 francs, and, in 1858, to the value of 330,000 francs.

The following figures give the value of the exports of coral from Algeria in six years:—

	Francs.
1855	2,152,800
1856	477,850
1857	661,350
1858	1,369,600
1860	1,448,950
1861	1,855,900

In 1862, 80 boats, of 4 to 6 tons were fitted out in Algerian ports; the foreign boats were of larger tonnage, 6 to 14 tons, and there were on the African and Corsican coasts in all 450 boats and 3,000 men employed in the coral fishery.

About eight or nine millions of francs were obtained yearly. Coral manufacturers, employing a large number of workmen, exist at. Marseilles, but they are dependent for their raw material on Leghorn and Naples. The exports of manufactured coral from Europe, in 1862, were stated to be to the value of fifteen millions of francs. Of this, Marseilles only made about two millions. In 1865, 617 cwt. of coral was exported from Algeria, of which $494\frac{1}{2}$ cwt., valued at £217, was from Stora and Philippeville.

The coast of the quarter of Port Vendres is worked by the coral fishers. Two boats, furnished with divers (*scaphandres*), were employed in 1867. They obtained about 34 kilos. of coral, of which a part was sold in France at 122 francs the kilo. Several Spanish boats were also engaged in it, but we have no information as to the results of their operations.

Genoa, Leghorn, and Naples have been from old times the three great centres to which the raw material has been carried, and where skilful artificers have established themselves, in order to work at its transformation into ornaments.

Four principal commercial varieties are distinguished:—1st., red, which is subdivided into deep crimson red, pale red, and vermillion, which is very rare; 2nd., black; 3rd., clear white; 4th., dull white, which is the most common. The delicate rose, or flesh-coloured, which is the most prized, is sold at very high prices, as it is entirely a fancy article. £80 was paid a short time ago for a piece of uncommon beauty, weighing nine ounces, or double its weight in gold. The ordinary first price is only about £24 the kilogramme ($2\frac{1}{5}$lb.). The price of red coral is about £6 the kilogramme. The white coral, the quality of which is often deteriorated by being worm-eaten, is sold at about £2 8s. per kilogramme.

France does not use much coral for ornaments, but the fashion is, even there, reviving. Italy makes a considerable use of it. In America the coloured population have a great fancy for coral. Morocco buys largely; and coral is even becoming in demand in the Pacific Isles. The most important Eastern depôts for its sale are Aleppo, Goa, Calcutta, and Madras. The caravans transport bijous and jewels fashioned of it in the interior. There, according to religious customs, the dead carry with them to the tomb the ornaments they have worn in their lifetime, and each year sees buried a quantity of coral, more or less considerable, which has to be replaced.

The applications and ornaments made from coral are very varied; negligées, beads (buhls and boutons), bracelets, brooches, earrings, tiaras, combs, hair pins, links, studs, and scarf pins for gentlemen, settings for rings, charms, parasol garnitures, cameos, foliage, corals and bells for children, &c.

The price of the raw coral varies according to the size of the pieces. The smallest, called "Ferraglio," of Sardinia, range from 9d. to 10d. the kilogramme. Those called "Barbarie," from 1s. 10d. to 2s. 2d. Medium size "Fanagliaturo," of Sardinia, 21s. 6d. to 24s. 6d. Large size "Fanagliatura," £4 4s. Large size, of Barbary, £4 12s. 6d. the kilo.

Besides several second-rate establishments, there are in the city of Leghorn four principal manufactories for working in coral. Each of these employs from 250 to 300 workpeople; this branch of industry thus gives occupation to a thousand women. The coral, which is annually wrought into little beads, round, egg-shaped, smooth, or cut into facets, &c., amounts to 25,000 kilos. The greater part is sent to the East Indies, by way of Marseilles; a large portion is exported to Germany, especially for necklaces of an inferior quality, destined to serve as funeral ornaments. It is also sent to Russia, where coral is in great demand. The total value of these exports is not less than £20,000. Naples and Sicily derive an annual profit of £88,000. The quantity of coral brought yearly to Genoa amounts to about 37,000 kilogrammes, worth £480,000. There are twenty-four coral vendors in the city, fourteen of whom have their own manufactories. The greater part of the coral is wrought into beads. This work, which consists of three different operations, cutting, piercing, and rounding, is executed by the country people, and principally by the women of the Val de Bisagno. The manner in which it is distributed among the inhabitants of the different communes of the valley affords a striking example of the principle of division of labour. All the workmen employed in cutting belong to about 100 families in the commune of Assio; those in piercing and rounding, to about 60 families living in other parts of the valley. Each village works exclusively at beads of a fixed size. The inhabitants go to Genoa to procure the raw material from the coral sellers, and to take back the coral which they have wrought. In Genoa, each manufacturer employs from ten to twenty or more women, who submit the coral to a preparatory process before it is given to

the workers of Bisagno. Upwards of thirty men or women are employed in their own homes, in cutting coral with facets. There are, perhaps, also thirty engravers of cameos and coral. It may be safely affirmed that from 5,000 to 6,000 persons in the province of Genoa gain their livelihood, either by fishing for, working up, or selling coral, and that this craft produces a revenue of £80,000. Genoa exports its coral to Austria, Hungary, Poland, England, Aleppo, Madras, and Calcutta.*

The most ancient seat of exploration for coral was Sicily. In the time of Cosmo I. of Medicis, it was introduced by this prince at Pisa, where Sicilian workmen were called, and where, up to the present day, as well as in Leghorn, there is a certain trade in coral. Liguria is also equally celebrated, both for the fishing and working of this substance. The fishing is carried on by Italian sailors in the Mediterranean, on the coasts of that sea, principally on those of Corsica and Sardinia. The parts of Corsica most frequented are situated between the Straits of Bonifacio and the point of Campo Moro, on the south-east coast, especially towards Tizzacco. The coral is more abundant on the African coast, but that on the coasts of Corsica is of a superior quality. The coasts of Provence, those of Africa, from Cape Bône up to the Bay of Bougie, and the Strait of Messina, are abundantly stored with this precious zoophyte, and much frequented by the undertakers of this fishery. In 1865, 8,754 kilos. of rough coral were exported from Corsica. Each year a certain number of sailing boats leave the port of Leghorn for the coral fishery. In 1864, fifteen left. Their exploration extends from January to October. The fishermen of St. Margaret, in the Gulf of Rapallo, in Liguria, take also an active part in the coral fishery. In 1864, forty-eight boats left. The Neapolitan sailors are engaged for the season by an owner who accompanies them, and they frequent chiefly the Corsican seats of fishery. This is the rendezvous of the Genoese, Tuscan, and Neapolitan boats. The crew of of each boat consists of ten men and a boy. The boat owner furnishes the food and the apparatus, and makes them advances, so that the family may be supported during their absence. The Italian boats occupied in this fishery, in 1864, numbered 365, of which 267 belonged to Naples, and the men employed numbered 2,699. The average product per boat was 7,000 to 8,000 francs, so that the total may be valued at 3 millions of francs.

Rough Coral (Italy).

	Imported.	Value.	Exported.	Value.
	kilos.	frs.	kilos.	frs.
1863..	60,917	1,981,000	10,114	329,000
1864..	51,535	1,676,000	1,515	49,000
1865..	34,533	1,123,000	6,760	219,000

Worked Coral.

	Imported.	Value.	Exported.	Value.
	kilos.	frs.	kilos.	frs.
1863..	371	30,000	18,617	1,489,000
1864..	202	16,000	13,371	1,070,000
1865..	614	49,000	12,286	993,000

The general average of the three years was 49,724 kilogrammes, value 1,625,000 francs imported, and 20,888 kilogrammes, value 1,383,000 francs exported.

A recent report to the Italian government stated that "the coral fisheries, which are a great resource for the poorer classes, employ 460 boats, manned by about 4,000 men. The average profits made by each boat are stated at from £280 to £320. The fishing implements, pay of the men, board of the crew, etc., absorb annually about 6,000,000 francs (£200,000), distributed among more than 6,000 persons of different professions. About 160 tons of coral are annually introduced into the kingdom of Italy. The articles made of it and exported are to the value of from 12,000,000 to 16,000,000 francs yearly (£400,000 to £440,000), principally sent to Asia, the interior of Africa, and America."

That which is obtained from the Sardinian coasts is chiefly found in the shallow waters near Carloforte; Alghero, a province situated on the west coast of the island, and the island of Maddalena. At Alghero, where the growth of coral is the most plentiful, it may be estimated that 190 vessels, of which 150 are Neapolitan, 20 Tuscan, and 20 Sardinian, manned by 1,930 sailors, are employed in this fishery, which begins in the month of March and ends during the month of October. The Sardinians and Tuscans send the produce of their fishery principally to Genoa and Leghorn. The value of the coral obtained each year from Sardinia amounts to £60,000. From this must be deducted £45,800, to defray the expenses of the fishery, so that there remains a net profit of £13,000. The quantity exported direct from Sardinia was in the three years ending 1854, 166,163 lbs.; 1857, 200,335 lbs.; 1860, 249,520 lbs.; 1863, 210,577 lbs.

Imports of Coral into the United Kingdom of different kinds, in pounds weight.

Year.	Fragments.	Whole.	Negligés.	Beads.	Total.
	lbs.	lbs.	lbs.	lbs.	lbs.
1855	2,172	285	1,718	..	..
1856	13,270	308	2,780	..	..
1857	28	218	1,872	..	..
1858	645	397	1,840	..	..
1859	1,255	621	2,955	..	..
1860	338	1,134	1,633	3,568	6,673
1861	15,639	84	602	3,654	19,979
1862	1,468	50	1,224	1,427	4,169
1863	183	318	586	1,829	2,916
1864	3,617	758	446	3,000	7,821
1865	2,914	391	258	994	4,557
1866	4,439	276	232	1,385	6,332
1867	7,539	225	115	2,543	10,422
1868	7,120	262	724	4,375	12,481

Computed Net Value of Coral imported Rough, Negligés, Beads, &c.

1860	£38,892
1861	33,403
1862	20,163
1863	22,657
1864	37,659
1865	13,970
1866	17,899
1867	29,487
1868	45,395

Amber.

In a paper "On the Gums and Resins of Commerce," which I read before the Society some years ago,* I incidentally alluded to amber, but spoke then more of its manufacturing uses for varnish and succinic acid than for its ornamental applications. I have now to consider it for decoration, for which it is much esteemed as beads by ladies, and also as mouth-pieces for gentlemen's pipes and cigar tubes. It is a choice and expensive article, from its comparative rarity.

Amber is the resinous exudation of an extinct genus of coniferous trees, formerly existing in great abundance in the northern hemisphere, and now washed or dredged up on the shores of the Baltic, chiefly between Konigsberg and Memel, but sometimes on the coast of Scandinavia. The fossil resins imported from Africa and New Zealand, under the names of copal, anime, and kauri, closely

* Catalogue of the Italian Department, International Exhibition, 1862

* *Journal*, vol. iv., p. 13.

resemble amber in superficial appearance, but they are dug up from the earth, and have not been subjected to the action of water, like amber. At the several International Exhibitions very fine collections of this raw material and manufactured articles have been exhibited by Prussian exhibitors. In several paragraphs which I communicated to the Society's *Journal*, in 1868, derived from the consular reports, some statistics were furnished of the production of amber at the little fishing village of Schwarzort, on the Curish-haff, between Memel and Dantzic, about two leagues to the south of the former place. This locality has acquired, within the last few years, a certain importance, owing to the discovery of a large bed of amber. This bed, which is believed to be extensive, is situated near Cape Korning. Four steam dredgers are employed for the collection of the amber, as well as a considerable number of dredgers worked by hand. The amber is found almost uniformly in separate nodules, with lignite, disseminated in the sand, at a depth of from ten to twelve feet. The dredging is carried on day and night, by shifts of eight hours each. About 400 persons are employed at this work, and their wages are, on the average, 22 silver groschen (2s. 2d.) per shift. The quantity of amber collected is considerable, amounting to about 288 lbs. per shift, and for six days' work 51,184 lbs. The sand, after being dredged up, is sent on shore, when it is washed, in order to find the amber. In 1865, 53,000 lbs. were obtained; in 1866, 73,000 lbs.; and in 1867, 83,600 lbs. Since that year the amber trade has not been very flourishing. The expectation that the business with England would become more important has not been fulfilled. It is most probable that the large quantities of imitated amber which are brought to the English and Asiatic markets, and the price of which is so much lower than that of the genuine article, causes the demand from Prussia to be so small. The anime, copal, and kauri resins, to which I have already alluded, are all used, I believe, to some extent, in imitation of real amber—but they are instantly detected by judges—especially for mouth-pieces of pipes and cigar-holders. The Turks first adopted amber for this use, in the belief that no infectious disease could be communicated through it. The Germans now prefer it for its rich colour, and for its soft, waxy feeling in the mouth. Its value differs greatly, according to its tint and opacity, and herein a novice would be easily deceived. The bright yellow transparent amber is least valuable, however it may catch the eye; dark, evenly opaque yellow has a much higher value, and the best of all is the opaque lemon-coloured.

In 1854, a bed of yellow amber, of some considerable extent, was discovered at Prague, when sinking a well, and pieces weighing 2lbs. and 3lbs. were extracted. At the Great Exhibition of 1851, two pieces were shown for beauty and size, from Konigsburg, weighing, respectively, 4½lbs. and 6lbs.; but the largest block known is in the Royal Cabinet, at Berlin, and weighs 18lbs. 5,000 thalers were offered, in 1851, by some Armenian merchants, for a piece weighing 13lbs.

The greater portion of the amber of commerce comes from the southern coasts of the Baltic, where it is thrown up between Konigsberg and Memel. It is also obtained by mining at a distance of 200 feet from the sea, and at a depth of about 100 feet, and is found in small cavities. After violent storms, it is driven up from the bottom of the sea. Thus, after an inclement winter, the amber gathering, early in 1844, was very abundant, 20,000 thalers worth having been picked up at the village of Kahlberg, in the course of a few weeks. In the five years ending 1853, our annual exports of rough amber averaged 43 cwts., but, in 1867, it reached 60 cwts., valued officially at £227, besides wrought or manufactured amber of the value of £2,645.

The following figures give the value of the amber imported in the last eleven years. This is, however, quite exclusive of the more important article of amber beads, which are mixed up with "unenumerated beads" in the annual returns of the Board of Trade, and probably constitute the bulk of the declared value of about £5,000 or £6,000 a year:—

Declared Value of Amber imported into the United Kingdom.

1858	£1,184
1859	1,290
1860	1,104
1861	603
1862	1,366
1863	714
1864	446
1865	2,013
1866	1,963
1867	2,872
1868	1,961

Without going too deeply into the scientific origin of these marine substances, I have endeavoured to give such a general outline as I hope will have served to convey a better notion of their commercial importance. To compute the total value of the commerce in the three products of the sea to which I have endeavoured to draw your attention, is scarcely possible. At all events, taking merely the very loosely-estimated value of our direct imports into the United Kingdom, which is merely the first cost, or merchant's price, so to speak, the value may be set down annually at:—

Pearls	£57,000
Coral	45,000
Amber	6,000
Total	108,000

The paper was illustrated by a fine collection of coral, pearl, and amber jewellery, and coral in all its hues and stages, shown by Messrs. Phillips, Brothers, and Son, of Cockspur-street; a fine collection of pearl jewellery, from Messrs. Howell, James, and Co., of Regent-street; a fine collection of amber beads, pipe-mouth pieces, rough amber, &c., from Messrs. Inderwick and Co., of Princes'-street, Leicester-square; a fine collection of flies and insects in amber, polished and unpolished, from Mr. T. W. Wallis, Long-acre; pearls, Scotch mussel and other shells, showing the pearl attached, and the Chinese mode of forcing the pearl, from Mr. W. Cutter, 35, Great Russell-street, and some fine specimens of rough amber, one weighing 2¾ lbs., found at Grimsby, shown by Mr. Hart, of St. Swithin's-lane, City, and by some Indian worked goods lent by the India Office.

DISCUSSION.

Professor Tennant said the reason he did not allude to pearls on the former occasion, as mentioned by Mr. Simmonds, was, that the subject then allotted to him was gems and precious stones, under which head pearls could scarcely be included. The articles enumerated to-night belonged principally to the animal and vegetable kingdoms, the two former being more or less animal, and the amber a vegetable substance. He felt much obliged to Mr. Simmonds for having drawn attention to a subject which was scarcely understood by tho public, and he hoped that some valuable results would ensue. With regard to Scotch pearls, they were collected in much greater numbers than was generally supposed, though the somewhat extensive trado now carried on in them was chiefly in the hands of a few persons, who collected them from place to place, and then brought them to the London and Paris markets. He held in his hand some very inferior specimens, mere refuse, in fact, from the Tay, which he had obtained for the purpose of preparing microscopic objects, and in the possession of the person from whom he obtained them he saw some really fine specimens. With regard to amber, he was pleased to find that it was now being searched for in various places, and he had no doubt it

would be discovered in several new localities. For instance, it had been found in the coal in Borneo, which was a tertiary deposit, probably somewhat analagous to those from whence our present supplies were obtained; and, as had been mentioned by Mr. Simmonds, it was also found in small quantities on our own coasts.

Mr. Jones said that some few months ago he received a small parcel of pearls from a district near Newfoundland. They were sent by a clergyman, who stated that a number of fishermen in his neighbourhood being very much distressed, they had occupied their time in looking for mussels in which pearls were found, and wished to know what was the value of the samples sent. He had returned an answer to the effect that they would yield £5 an oz., but he had heard nothing more of the matter. It might be interesting to the public to know that jewellers very seldom set whole pearls, because, in the first place, it was not very easy to set them securely, and in the second place, in the case of a ring or any small ornament of that character, the convexity of a perfect sphere would be too great. They were very often, therefore, sawn in two, and the half used placed upon plaster of Paris. It sometimes happened that the jeweller did not use pure gold in the setting, and then if persons washed their hands without removing the ring, it was not unusual for the pearl to become stained, green, or even black. By taking the pearls out of the setting, however, and removing the exterior laminæ, they might be restored to their original colour. He might add, however, that whatever the quality of the setting, it was always advisable to remove a pearl ring before washing, because the interior of the pearl was not so hard as the outside enamel.

The Chairman, in proposing a vote of thanks to Mr. Simmonds, said he might be excused for making a few remarks on each of the topics mentioned by Mr. Simmonds. The pearl was a very marvellous object when they considered its beauty and price, and without going into a definition of precious stones, it was evident that if price and rarity were any criteria, the testimony of all ages would include the pearl in the category. And yet, after all, it was but a little albumen and a little chalk, or carbonate of lime. The progressive way in which it was developed, layer upon layer, with the layers of albumen so exquisitely and finely divided that they atomized, so to speak, the particles of carbonate of lime which formed its main substance. In its formation there was a certain delicate striation or modification of the superficies that sustained the hardening particles, so fine and so delicate that it actually decomposed a ray of light, absorbing a certain portion, and reflecting the remainder, which lent the great charm to its beauty. All the conchiferous mollusca, both univalve and bivalve, had the faculty of combining carbonate of lime with their albumen, with this particular modification, which resulted in the pearly appearance which was so beautiful. This property was possessed in the greatest perfection by the bivalves, and when, as in certain species, there was a strong tendency for the secretive surface of the mantle and the folds of the mantle over the *branchiæ* and other parts, to begin that action upon a little nucleus, and if that happened to be on the surface of a free membrane, so as to allow a deposit of layer upon layer, they got the most perfect specimens of pearls, as in a particular species of bivalve, the *Avicula*, where this modification of the sustaining membrane effected the most beautiful dealing with the light, and produced the most splendid pearly colours. In considering the corals, they were led into a wider field, and brought face to face with one of the grand operations of nature, by which the well-being of the earth was secured. Every river carried back to the sea the water which the heat of the sun had evaporated from it, and which had afterwards been precipitated upon the land but in so doing it carried with it a greater or less proportion of lime in solution, which was the cause of the water of most of our rivers becoming hard as it approached the sea. It then held a considerable quantity of caustic lime in solution, which was thus carried into the sea. Now, inasmuch as only pure water was raised from the sea by evaporation, leaving all the salts in solution behind, it was clear that unless there were some great chemical arrangement to counteract it, the caustic soluble lime taken into the sea in the course of those long ages that geology had made familiar to our minds, would ultimately have made the sea unfit for animal life. But so it was, that in favourable localities, at suitable depths, and under certain conditions of solar heat and light, there were myriads of little simple gelatinous organisms living, and because they lived, burning, in other words converting, by the very act of life, a part of their own substance into coal or carbon; and taking this soluble lime, which, with the sea-water, was permeating their delicate tissues, and precipitating it in their interior, combined with the product of their own combustion, and converting this soluble lime into carbonate of lime, which was both insoluble and innocuous with reference to the sea-water about it. Thousands and thousands of different kinds of these delicate little gelatinous polypes precipitated this lime in their own particular fashion, most of them as pure carbonate of lime of a beautiful white colour, such as was often seen in museums, which was very brittle. Mr. Simmonds had alluded to the brittleness of coral, but the truth was, that the great difference between valuable mercantile coral, and the ordinary and much more common description of coral, or madrepore, was that the former was not quite so brittle; it had a certain degree of toughness, and was not quite so fragile, and that property of the red coral, the most valuable of these modifications of the skeletons of these polypes, was due to their precipitating and combining with the lime a small portion of phosphoric acid, and a larger proportion of carbonic acid, so that it was a little combination of both phosphate and carbonate of lime which was the basis of the valuable coral, while its colour might probably come from iodine, or some similar colouring matter. With regard to amber, which was a product of the vegetable kingdom, its value appeared to arise partly from the difference of species in those old extinct miocene trees which yielded it in such great abundance, and occasionally in large masses, but a great deal also must depend upon the long lapse of time during which it had been exposed to hardening and petrifying influences. He was glad to find, seeing that the shores of the Baltic appeared to be the places, when the Alps were rising, which supported these old coniferous or resin-producing trees, the exudations of which had now become petrified into amber, that from that neighbouring coast some portions were washed upon our own eastern coast, and it was somewhat singular to remark that on the coast of Norfolk and Suffolk there were those formations, red crag and others, which came nearest in point of age to that middle tertiary period to which the amber-producing trees belonged. When in Egypt last year he was surprised at the beauty and size of the amber converted into mouth-pieces for the magnificent chibouks of which the Viceroy of Egypt had so grand a collection. Indeed, he was almost afraid to smoke the magnificent pipes presented to him, when he found that, from the value of the amber and precious stones with which they were embellished, they were worth two, three, or four thousand pounds each. Again reverting for a moment to the question of the definition "precious stones," mooted by Mr. Tennant, he would ask that gentleman where he would draw the line, from what they knew of the chemical composition of the diamond, between that and amber. When they examined black diamonds, and found not only that their composition was carbon, but that there was something there which had not got quite to that wonderfully refined condition in which the pure diamond presented itself, he thought it would be somewhat difficult to draw the line. If they

could prove that the diamond did come originally from an organic basis, from the vegetable kingdom, what would become of the definition. In truth, he believed the only meaning of a precious stone was a stone that was precious, and a pearl was certainly very precious and very beautiful. Therefore, in asking the meeting to pass a vote of thanks to the author of the paper, he could not be so ungrateful as not to include those who had so kindly lent the valuable and rare specimens of different kinds of precious stones exhibited on the table.

Professor Tennant, in seconding the motion, said his answer to the Chairman's question was, that by a diamond he understood a crystallised substance. There was nothing which showed more completely a crystalline formation than the diamond. It was capable of being broken readily into an octohedron, however complicated might be the external form. Fortunately, the museums of this country contained some of the finest collections of diamonds known. First in order came the Woodwardian, at Cambridge, a magnificent collection, formed by the late Sir Abraham Hume, and this was undoubtedly the finest. Secondly, there was the collection in the British Museum, which was very magnificient; and within the last few months a very valuable collection had been bequeathed to the South Kensington Museum, containing not only the natural crystals, but many examples of polished gems. This was the collection formed by the late Mr. Hare Townsend, which, for completeness, was hardly to be surpassed.

ART OF UNCIVILISED COUNTRIES.

At a missionary exhibition, now held at Manchester, Mr. Cole, C.B., lately delivered an address upon "Abyssinian Art especially, as well as upon the Art of Savage Nations and People considered Uncivilised." He said, after commending the general arrangement of the exhibition, that principles of decorative art exist in all art, however uncivilised the producers of it may be. Taking woven fabrics, such as the carpets of Turkey and Persia, he pointed out that the harmonious arrangement of colour, and the suitability of design to the material are unsurpassable. Anyone who desired to ascertain the reason for the superiority of Persian and Turkey carpets should read Mr. Owen Jones' "Canons of Decorative Art," which he published in 1853. Showing a Burmese gentleman's girdle, he defied the Royal Academy to improve its harmonious colouring. A Chinese vase is always an agreeable thing, although the flowers are not realistic, and tho human beings are out of drawing, and very awkward. He should better like to see his wife in the shawl from the Fiji islands, made of paper, than in any of the Paris abortions for shawls. Turkey carpets are always quiet and unobtrusive, whilst French carpets, from the nature of the designs, generally made up of scrolls, huge pictures, flowers, wooden forms, &c., are vulgar and corrupting, particularly those in vogue at the time of Louis XIV. and Louis XV. He expressed his opinion that art is an expression of the feelings, temperaments, and morals of a country, and that Turkish art is more permanent, truthful, and consistent than French. When Europeans have attempted to improve Indian carpets they have always spoiled them, producing no result better than detestable abortions and hybrids. The present exhibition showed visitors to it how invariable the rule is that the art works of savage tribes are based upon some system of principles. In certain points their art is perfect. The Hindoo woman, in her Dacca muslin, is surely a vastly more beautiful, tasteful, and natural creature than the fashionable French lady, padded all over, with her dark Celtic complexion so painted and her black hair dyed that she looks like a golden-haired Saxon. Instinctively, savages never sin against the nature of things; the English often do so, following very bad examples. A hair-pin from Benin River (a sort of narrow wooden comb, about 15 or 16 inches long, Mr. Cole pronounced to be much better as an ornament than a chignon cropped from a dead body and dyed. It appeared to him that the most of the examples of the art of the 18th century are unnatural, artificial, false, and corrupting, and are mere symbols of an age of revolutions and wasteful expenditure of millions in unchristianlike wars. With respect to Abyssinian art, the specimens exhibited that evening ought to interest those present, from the mere fact that the cost and difficulty of collecting them exceeded, by a long way, the cost and difficulty in obtaining any other similar curiosities ever brought to this country. Never have there been such costly curiosities. The Kohinoor cost nothing compared to Theodore's crown, which was obtained from Magdala by a Prussian *attaché*, and graciously sent by the King of Prussia to this country. Abyssinian art has some distinctive types of its own, but much has been borrowed from other countries. Mr. Cole then read from "Antonius Fernandez," written 300 years ago, a passage showing that the people had remained much in the same state respecting art for three centuries. He found in the Abyssinian objects a certain propriety of ornament, and proceeded to point out the merits of the workmanship in the crown, which is of the Byzantine type of ornamental work. The armlet seemed to him to have been inspired by Greek, Genoese, and Maltese motives. He also referred to a blue dress in the collection, the ornament on which is somewhat similar to that on St. Patrick's bell, which was made in Ireland in the eighth century. He recommended any one who had the time, to pursue an inquiry into the reasons why a Dublin goldsmith of the present day could not produce such a work of art as that bell, a thousand years old, but was able only to make a wretched copy of it. There is no question that the worst art found in Abyssinia was European art. Some vile modern gaudy silk patterns, which were taken amongst other things from the Royal Treasury, are essentially European, having been probably produced at some French or Italian silk manufactory. Again, the Seal of State was made in Pall-mall, and bears the name of its maker (Strongitharm). Sooner than find such things, Mr. Cole stated his preference for a genuine native seal or even a butter print. The moral which he drew from an examination of savage art was, that it very often taught them true principles. He found throughout that art great modesty, and occasionally great aptitude; and he was therefore rather obliged to the savages than otherwise for such a lesson. The teachings of that art had been useful, and he hoped that the Committee of the Exhibition would aid the nation in an endeavour to perpetuate the teaching which was to be derived from it. It would be his duty to represent to the Lord President of the Council that there ought to be at the South Kensington Museum a section for showing this humbler kind of art, such as it was, in order that even savages might afford instruction.

POSTAGE OF LETTERS BETWEEN ENGLAND AND FRANCE.

The following extract from the *Times* (Money Article) relates to the contemplated change in the postal rates with France :—

3, Ingram-court, Fenchurch-st., London, 4th Dec., 1869.

"Sir,—It has been stated—and although not officially, yet with some degree of authority—that the English Post-office has concluded a provisional arrangement with the French office to alter the whole system of weights in use between the two countries, and to establish in England one-third ounce as the rate of the single letter, instead of extending the single rate to the half-ounce. It is added that the arrangement is not to be considered complete until approved by the French Legislative Assembly, but there seems to be no such reservation as to approval by the English House of Commons. We venture to hope that the proposed arrangement will be reconsidered.

"The half-ounce is now the weight of a single letter from England to every country in Europe (indeed, throughout the world) excepting France and one other country, which is of necessity served through France, viz., Spain. Even to Belgium and Switzerland, whose system of weights is precisely the same as that of France, the weight of the single letter is the half-ounce. As regards Belgium, the same is the case with letters sent through France, and hence arises the extraordinary state of things that the same letter which may be sent *viâ* Calais to Belgium for 4d., would, if sent to Calais itself, be charged 8d. To Belgium direct, *viâ* Ostend, the rate is 3d. the half-ounce. The same is also the rate to Switzerland and Holland, and will, it is expected, soon be the rate to Germany.

"The half-ounce and 15 grammes, which are nearly equivalent, have long been in use for letters between the two countries, but as the double not the single rate. The English Post-office has been anxious to extend the single rate to the half-ounce, which would much simplify matters, by enabling both countries to dispense with the weights now in use of one-quarter and three-quarter ounce, and 7½ and 22½ grammes respectively, without adopting in either country any additional weights, and it would be a great boon to merchants on each side of the water; but to this simple and reasonable proposition the French Post-office objects, wishing England to adopt one-third ounce as the single rate. This complete change would necessitate the furnishing new weights of one-third and two-thirds of an ounce to every town and village post-office throughout the United Kingdom; also, that all merchants corresponding with France should provide such extra weights for their own offices, merely for letters to France.

"The reason assigned by the French postal authorities for urging the adoption here of the one-third ounce weight is—that being taken as equivalent to 10 grammes, it would accord with the French internal rate. It is represented as a concession to the decimal system. Now, we have a great admiration for the decimal system, but we cannot carry that admiration so far as to wish, in order to promote its adoption, that English merchants trading to France should be definitely taxed a higher postage than those trading to Belgium, Holland, and Switzerland. We use the word 'definitely' advisedly, for if the French Post-office should once abandon the weight of 15 grammes now in use, it is more than problematical if it would ever be resumed. It is to be observed that the enthusiasm of the French Post-office for the figure '10' is confined to weight, even as regards their internal arrangements; for a single letter from one part of France to another is charged, not ten, but 20 centimes, which, compared with the English internal rate, is in the proportion of about 3d. per half-ounce. It is to be feared that this high rate has been the great obstacle to cheap postage between the two countries. The postal authorities on the other side of the Channel are, we are told, afraid that if the postage of letters from France to England were reduced to 30 centimes for 15 grammes, the internal rate must ultimately be reduced to 10 centimes for 10 grammes.

"If the French Post-office distinctly decline to continue the use of the 15 grammes weight, and to make it the single instead of the double rate, deciding to stop short at 10 grammes, may it not be possible, instead of enforcing this weight here, to adopt the following compromise? As almost all letters are now prepaid (owing to the penalty of double postage if sent unpaid), let the English Post-office tax the merchants here 3d. per half-ounce for prepaid letters to France, and the French authorities tax the merchants there 30 centimes per 10 grammes for prepaid letters to England, each country also taxing the unpaid letters it receives according to its own system. In this way there need be no postal accounts between the two countries. We submit this proposition for consideration, if the French Post-office finally adhere to 10 grammes; but we should much prefer that our French friends should have the advantage of the full reduction of the rate of postage.

"The merchants of Switzerland, Belgium, Holland, and the United States of America, have now the advantage of sending letters to England at 30 centimes per 15 grammes, or the equivalent thereto.

"We are, &c.,

"Richd. Symond and Son."

EDUCATIONAL NOTES.

In reference to the subject of education rates, a letter to the *Times*, with the well-known signature of "Felix Summerly," says:—"Popular prejudice against local rates for education would be modified and ultimately removed if the poorest class of ratepayers, small tradesmen, &c., felt that their own children were going to get a positive and direct advantage out of the schools, and that they were not merely paying for the good of a class below them. Hence these rate-supported schools must teach more than the three R's, and be properly graduated. Every group of ten thousand persons should have one good infant school, also one elementary school for reading, writing, ciphering, with geometrical drawing, and music and drill, where all should be taught these subjects. This school should have an upper and lower division. There should be a third school for teaching book-keeping, the English language, and elementary science. The rate of fees should be graduated according to the grade of instruction given. This principle of combined action may be found admirably working at Faversham, Kent, where all denominations concur in it, and each one looks after inculcating its own doctrine."

At the annual meeting of the Halifax Mechanics' Institute, held on Tuesday evening, the 11th January, Mr. E. A. Leatham, M.P., presided, and spoke on the educational question. He objected to the denominational system, but he denounced most strongly the proposal for direct compulsion. He thought it would be unjust to punish a father because he staved off pauperism by the labour of his children. Had it come to this, that we were asked to introduce into this country the odious continental system, which peered and pryed everywhere—a system which made no man's house his castle—a system which planted a policeman at every corner, and a spy upon every hearth? He thought it was enough in such an Educational League to shake the Church of England to its base. Desperate remedies ought not to be talked about until the drawbacks which already existed in the educational system of the country were removed. One great drawback was the religious difficulty, and the only way out of this, which he could see, was to make religion—and at all events sectarian religion—even in denominational schools, an extra—something which was to be taught when it was required, and not unless.

On Wednesday, January 12th, an educational congress, presided over by the Earl of Stradbroke, was held at Ipswich. On the motion of the Bishop of Norwich, seconded by the Rev. Canon Cromwell, it was resolved, "That to complete the present system of denominational education, the following requirements must be embraced:—The primary instruction of the children of the working classes, together with the inculcation of religious and moral truth, under provisions assuring the civil and religious liberty of parents and guardians, and the independent exercise of their responsibility as such." Mr. Corrance, M.P., Mr. Alexander Redgrave, inspector of factories, Mr. H. Biddell, the Ven. Archdeacon Groome, and other gentlemen, addressed the congress, which adopted resolutions declaring that the system of instruction adopted should include the free admission of all children of the pauper and vagrant class; that an ex-

tension was required of the Factory and Workshops Act, including all classes of industrial employments, under provisions applicable to each; and that no religious difficulty could justly be said to exist in denominational education aided by the State.

The Right Hon. W. E. Forster, Vice-President of the Privy Council, in a speech delivered at Bradford, on the 17th inst., speaking of the measure which the government intend to bring forward, says:—"I may be sanguine, but I do believe that when the Government plan is brought forward, it will command the assent, I will not say of all, but almost all those whose real and chief object is the education of the country. I am one of those who think the present time very opportune for an educational measure, and I think I see that the measure that should be passed can be passed this year. I dare say there are many of you who think that I am far too sanguine in saying that. All I ask of you is to wait until you see the measure, and then pass your judgment upon it. Almost everybody in the country sees the importance of the end we are aiming at, and almost all are convinced that that end must be attained at once. As yet men are not so wedded to the particular way of obtaining that end that they would allow themselves to prefer that it should not be reached rather than that it should not be reached by a particular mode. I am not sure how long that state of feeling would last, and therefore I consider the time most opportune for settling the question. We are all convinced this far, that when the work is done it must be done fully and completely. Mr. Dixon told his constituents in Birmingham that he believed it would be ten years before the views of the League would be fully carried out. He had faith that they would be carried out, but he thought ten years would elapse before it was done. I know how earnest Mr. Dixon is in the cause of education, and I know that he, as much as I, would lament more than he could find words to express, if any educational measure were delayed for ten years. We are upon our trial to maintain our commercial supremacy. We have competitors in other parts of the world, and they will beat us in that competition of industry and energy, if our working people are to be overweighted by the better culture of their population. We can only avoid this by laying a foundation, and giving them that elementary knowledge upon which we can give such an industrial culture as will make Bradford, Manchester, and Birmingham a match for the workmen of Saxony and Belgium. So convinced is the country, so convinced is the House of Commons, of the importance and urgency of this question, that no economical, or religious, or irreligious difficulty will be allowed to stand in the way."

On Monday evening, the 17th inst., a public meeting was held in Myddelton Hall, Islington, with a view to the extension of the operations of the National Education League into the North London district. Sir C. W. Dilke, Bart., M.P., occupied the chair, and in opening the proceedings explained the principles of the League; and in speaking of the Bill prepared by it, said it would serve to show to the government what, in the opinion of the League, was the shape which an educational measure should take, and would, moreover, show that the League were not, like the Educational Union, destitute of any plan at all, but that they had a distinct scheme. The League was now receiving enormous accessions to its strength in the shape of Nonconformist and Church ministers, regarding whom he might here state that a proposition had that day been made—and he had no doubt would be adopted by the committee—that a conference of ministers resident in London should be held. Ministers of religion who were thoroughly acquainted with all the bearings of this educational question were coming to see, from day to day, that religious teaching could be better imparted in Sunday-schools or in the bosom of a family, than in a day-school. Mr. Lloyd Jones moved a resolution, recommending that a Bill be introduced into Parliament to provide a free and compulsory education, in which the children of every section of the community will be able, without any sacrifice of principle on the part of the parents, to partake. This was seconded by Mr. C. Clarke, and carried unanimously. The Rev. Dr. Raleigh moved a resolution:—"That this meeting, while recognising the necessity of a scheme of truly national education, trusts that such equitable arrangements will be made with existing schools and teachers as to enable the whole educational machinery of the country to work harmoniously and successfully." This was seconded by Mr. Sinclair, supported by Alderman Lusk, M.P., and carried.

On the evening of Monday the 17th inst., a large meeting in connexion with the League was held at Halifax. Mr. Alderman Shaw, J.P., presided. The Rev. John Ellis, Unitarian minister, moved, and the Rev. W. J. Townsend, New Connexion minister, seconded a resolution, expressing the principles of the League, which were warmly supported by the Rev. R. W. Dale, A.M., of Birmingham, Chairman of the Congregational Union.

A large and enthusiastic meeting of the League was held in Stockport the same evening, the Mayor in the chair, and resolutions approving the scheme of the League were passed unanimously.

An Education Conference for Wales, will meet on the 25th and 26th of January, at Aberystwith. Corporations are invited to send two delegates; churches and congregations, one. Mayors, ministers of religion, and everybody interested in education are invited to attend. The position and prospects of the "University College for Wales," will be discussed.

FUTURE EDUCATIONAL LEGISLATION AND EXISTING SCHOOLS.

The attitude which future legislation will assume towards existing schools is not the least interesting portion of the educational problem. Mr. Charles Buxton, in a recent letter to the *Times*, expresses his opinion that the tendency of the League scheme is towards their annihilation. He thinks that to establish free schools, with an exclusive monopoly of State aid, by the side of schools supported by voluntary contributions and the school-pence of the children, is to set up a competition which could only result in the extinction of the latter, and he does not see any justification for these "revolutionary measures." The machinery of education, he considers, is becoming every day more perfect and more powerful, for every year there is an increase in the number of schools, in the number of children in attendance, and in the amount of the claims on the government grant.

The *Standard*, in commenting on Mr. Buxton's letter, says:—"We are satisfied that true economy and real efficiency will be consulted by the extension and development of the present system, rather than the establishment of a new and untried one in its place, and we are glad to find a practical Liberal like Mr. Buxton coming to the same conclusion."

The *Pall Mall Gazette*, to a considerable extent, endorses the objections of Mr. Buxton, though it thinks them somewhat exaggerated. It says:—"If the proposals of the League are adopted, the country will be burdened, not only with the cost of supplementing existing schools, but with a large additional expenditure incurred for the purpose of superseding existing schools," and it believes that "this difficulty is likely to have considerable weight with the public. Here is ample school accommodation, and no hardship to child or parent in making use of it. But because, under different circumstances, hardships might arise, all this accommodation must count for nothing, and new schools be built for children, every one of whom is already receiving a sufficient education." It thinks that "a very large expenditure of public money would be justified if it were indis-

pensable to the redress of a grievance, but the League will do well to bear in mind that a much smaller outlay will be plausibly objected to if the object of incurring it be simply to ensure the theoretical completeness of an undenominational scheme."

The Manchester Education Bill Committee, which, it will be remembered, was appointed at a public meeting held in 1866, held a meeting on the 5th inst., and adopted a report, in which they agree with Mr. Buxton as to the destructive character of the League proposals. They have put forward the outline of two Bills, an Education Bill and a Compulsory Attendance Bill, which are to be introduced in the coming Parliamentary session. The first provides that the school committee of a district is to establish additional schools, by means of a rate, wherever the existing accommodation is insufficient, and these schools are to be free and unsectarian, the reading of the Bible being permitted, but no more than permitted. It is proposed to offer every facility to existing schools to enter into union with the school committee of the district; in other words, to become rate-supported, free, and unsectarian.

The *Times* thinks that the existence of school committees with these powers and aims all over the country must, at least, exert a strong disturbing influence on the existing system; and detects in this report the same singular indifference to the value of existing resources which it has noticed in other schemes. "It is certain," it says, "we now have an army of gentlemen and philanthropists all over the country engaged in forwarding education. But it is by no means certain, to judge by experience, that English ratepayers would display the least enthusiasm in burdening themselves with rates for the free education of the class whose mere physical maintenance is already an intolerable burden to them."

Mr. George Melly, in a letter to the same journal, dissents from the view that the proposals of the League would "undermine and destroy" the existing system. He thinks that "if the education of their children were made compulsory upon all parents, the schools attached to church and chapel, managed by clergyman and minister, subscribed to by squire and shop-keeper, would have the pick of all the children of church and chapel-going parents, even if the cost to the parents were 2d., or even 4d., a-week, and the rival schools were free." He states that of the 96,000 children of school age in Liverpool and the adjoining parishes, "25,000 are in the streets, and attend no school, not because the schools are full, but because the *non-possumus* of religious (!) people has, to this hour, prevented any system being adopted by which they could be induced to attend." There are, he says, about 16,000 vacant places in our Liverpool schools, and this because they "were built, and are maintained by, persons whose principal object is rather the strengthening of a congregation, or the increasing of a party or sect, than the primary education of the children of their neighbours." In concluding his letter, Mr. Melly says that "whatever scheme be adopted, it must be one of the most elastic character, doing what is wanted here and there, meeting the requirements of the place where it is enforced. Rules which would prove perfectly successful in Liverpool, might fail altogether in rural districts, or in towns where the demand for juvenile labour led to the overworking of the youthful population. The measures adopted must be of both a permissive and compulsory character, bearing, by special clauses and numerous schedules, on different varieties of population, and taking due count of the size and peculiarities of different cities."

CORRESPONDENCE.

DR. THUDICHUM'S PAPER ON WINES.

Sir,—I have just looked over the report of the discussion which took place on December 22nd, 1869, at the conclusion of Dr. Thudichum's paper on "Wines, &c.," and finding that a few errors have crept into my statement. I think it advisable, with your permission, to correct them. Page 116, line 4 of my statement, for "that it was a general practice to add, &c.," read "that, according to reports, it was a very general practice to add, &c;" page 116, right-hand column, line 7, for "25" read "26;" line 8, for "26" read "27;" line 10, for "26" read "27;" line 20, for "260 or 270" read "about 290;" line 45, for "The chemical constituents of a wine, &c.," read "The constituents of a wine on which its physiological action chiefly depends were, however, &c.;" same page and column, line 56, for "for the acid would mask the sweetness" read "in which case the acid would mask the sweetness;" lastly, page 117, left-hand column, line 14, for "port, sherry, and madeira," read "sherry and madeira." With these corrections the report very fairly represents my statements, with one important omission in the first sentence, at the end of which should stand, "I may state, however, that in the course of my researches I have not, as yet, met with a German wine to which glycerine had been added."—I am, &c.,

A. Dupré.

Westminster Hospital, January 10th, 1870.

PATENT LAWS.

Sir,—Much discussion, *pro* and *con*, has taken place as to the possibility of making a just and efficient patent law. My own view has long been, that patents, so-called, are but a technical detail of a larger national, and I may add international, question—the right of property in mental origination extending over the whole range of matter, as applied to the uses of humanity and the progress of civilisation. Laws are made technically by lawyers, but the basis of a law must be public perception of its necessity expressed in many ways. To bring this perception to the test, on the question whether originators should be regarded as helots or as benefactors, I have draughted a bill for the consideration of your readers and the public generally, which I shall be glad to have published in the *Journal*, leaving it to them to decide whether it be just in principle and practical in operation, and to criticise it accordingly.—I am, &c.,

W. Bridges Adams.

Draught of a Bill for a Code of Law for the better Promotion of National Progress by the better Security of Mental Property.

Preamble.

Whereas it has been found, by long experience amongst the various nations of the earth, that the institution of individual property, under the safeguard of laws, has been a needful condition of human advancement, not merely to the individual, but to the aggregate of individuals constituting a nation, and that such advancement has kept pace in proportion to the perfection of such laws. And whereas the materials of the earth inhabited by man, and given by the Creator for man's general use, have been more or less appropriated by individuals, or small associations of individuals, in their crude condition, as land for the growth of animals or for the cultivation of fruits, corn, and vegetables; and that wild forest land set apart as common property for the growth of game has only conduced to maintain limited numbers of wild men in a state of strife with each other, tending to lessen the numbers both of men and game. And whereas mankind generally have been willing to give up their share of the crude material of the earth to individual appropriation, in the conviction that thereby a greater usufruct would be obtained by means of enclosure, and consequently a larger amount would be divisible amongst the mass, the owners becoming partially directors and trustees of the processes, whereby accumulation is in-

creased. And whereas, in addition to the appropriation of the surface of the earth, whereby the food and clothing of mankind are produced, so also the under surface, with its masses of coal and metals, and minerals and quarries, both above and below, have also been appropriated from the same conviction of its economy, notwithstanding abundant examples of mere appropriation from greed and desire of domination. And whereas the mere crude value of the raw materials of the world, but few of which can be used in their mere raw condition is enormously increased by the processes of human intelligence and reason, whereby the "sweat of the brain" within is substituted for the "sweat of the brow" without, and the power of animal muscles is substituted for that of human muscles, and the giant powers of nature, by the action of heat in the form of wind, or its indirect action in running streams, or elastic vapour, and the various processes of chemistry, have rendered the attainment of comfort and the elegancies of life a possibility for the masses, as well as for the select few. And whereas these processes and results are conditions of continuous human thought, and labour, and improvement, it is desirable that those who possess the faculties inducing these conditions, should have mental enclosures granted to them, analogous to the physical enclosures of land, wherein to pursue their avocations, as a mental property secured by law in original mental productions. And whereas the individual appropriation of land was originally a process of physical force, supplemented from time to time by very inefficient laws, gradually amended and improved, as lawsuit after lawsuit demonstrated their flaws and defects, and the landholders, who were the chief law-makers, insisted on their improvement. And whereas the authors of mental improvements, giving greatly increased value to matter, had but little influence on the legislature, no laws were made to give them security, or mental enclosures as a property. But their faculties of giving increased value to property called to them the attention of influential men, notably courtiers, who obtained from the king exclusive grants, on similar conditions to those of patents of nobility, not as a right but as a gift by grace and favour. And whereas the motive for the grant was ostensibly the education of the community in useful industries, a stipulation accompanying the grant that the invention or new knowledge should be made patent, or open, by a written specification, in default of which the grant became void. And whereas inventions are specific, and there were no specific laws to protect and secure the property in them, all disputes connected with them were subject to the operations, practices, and precedents of ordinary law, and thence arose enormous expenditure, giving a great advantage to a wealthy capitalist to oppress a poor inventor, to a far greater extent than in ordinary lawsuits between rich and poor men. And whereas by the absence of plain and efficient laws, skilful and poor men were deterred from obtaining protection for their skill and labour, inventions have become practically a monopoly for the benefit of rich capitalists and manufacturers, thus giving a lessened measure of national progress. And whereas the object of capitalists as such, is simply the desire of profit without regard to progress or improvement, it is for their interest to keep back improvements rather than to adopt them, unless involving a decrease in value of existing establishments, and an increased outlay of capital, and under such circumstances the manufacturing production which may be most profitable to the individual manufacturer may be to the disadvantage of the community at large; and a system of laws which would give the greatest encouragement to a large number of manufacturers of moderate means, might nationally be far preferable to their resulting in a small number of manufacturers of large means; and whereas the tendency of men in trade is to excessive competition, and to take advantage of the labour and reputation of their neighbours unfairly for their own profit, this produces a reaction in secrecy, and an impediment to general industrial progress and education, which would not be the case under a system of legal security for the property in ideas; and whereas the property in ideas is recognised by the law in the case of the copyright in books, and in designs, while the property in what are called patents is treated as a monopoly by those who wish to trade on their neighbours' skill and industry. And whereas trade-marks, and styles, and titles of firms, and names of books and publications are properties recognised by law, it is sought to set up a distinction between copyright and patent-right, and, while affirming the facility of protecting copyright, to assert that it is impossible to define patent-right other than as a monopoly. And whereas the whole question of mental property resolves itself into the same category as material property—a money value; inasmuch as the copyright of a book or a newspaper, as defined in an action for damages, consists in the right to sell copies, and so of music, or engravings, or paintings. And whereas before legal protection for designs existed, it was common for manufacturers of printed or other fabrics to try to pirate their neighbours' designs by bribing each others' artists, and that the practice ceased after the Designs Act was passed. And whereas nearly all the difficulties regarding patents have arisen from defective laws, and that there is no reason why laws should not be made effective for the protection of mental as well as material property, for ideas stamped in matter, as well as printed in type or painted in pictures. And whereas the chief difficulty in litigation has arisen from legal technicalities or disputes as to titles which may easily be simplified; and in order that all mental faculties of the originating class may be duly employed for the general benefit of the nation, without regard to the condition of the individual, whether rich or poor, it is hereby enacted that:—

1. That from and after the passing of this Act, which shall be known as the Mental Property Act, a separate court of justice shall be appointed, to be called the Mental Property Court, with appointed judges in sufficient number to prevent delays; and to this court all questions of mental property title shall belong, from the first grant to any subsequent dispute. And that competent assessors shall be appointed to assist the judges in the various branches of mental property that may be brought before them.

2. That from and after the passing of this Act, it shall be lawful for any person of legal age to apply for and obtain a grant of property in any idea, or invention, or contrivance of his or her own producing that may be advantageous to the community, whether the same be a written or printed book, or musical composition, or a work of art, such as painting, sculpture, architecture, or engraving, or a chemical or mechanical production or discovery.

3. That the application shall be for an original production, *i.e.*, it shall not be in actual use, and shall not have been in actual use during the term of thirty years preceding the application for a grant of property, any record, print, memorandum, model, or description notwithstanding.

4. That it shall be competent to the applicant to lodge a provisional or preliminary specification six months before the completion, or a completed specification or sample, at his or her option.

5. That the judges, assisted by those assessors duly appointed, shall determine as to the originality of any application.

6. That, nevertheless, it shall not be competent for an applicant to be refused a grant absolutely, on any consideration whatever. The law officers shall be bound to point out to the applicant, within a short interval, any reason occuring to them why a grant would not hold good, but leaving it optional to the applicant to obtain it on payment of the fees.

7. That in all cases, after the lodging of a provisional or complete specification to which objections have been taken, it shall be competent for the court to put it on

public trial, and, if defective, to expunge it in due course.

8. That a printed specification, under numerous and sufficient heads, shall be supplied from the office, leaving as little as possible contingency open to mistakes, or confusion of language, or wilful mystery, on the part of the applicant.

9. That no model shall be required on lodging an application, as involving the risk of discovery by workmen.

10. That no model shall be required on lodging a completed specification, as involving a possibly unfair expense to the inventor.

11. That applicants shall be deemed first inventors in the order of succession by date and number, unless shown to the contrary.

12. That no complete specification shall override a previous provisional, unless in material details not contained in the provisional.

13. That a completed specification shall describe, and illustrate by drawings when needed, the invention claimed as succinctly as possible, in such mode as to be understood by those commonly practising the trade or profession to whichever category the inventor may belong, and that the claim or claims to originality shall be distinctly set forth.

14. That the office shall provide a catalogue and description of the varieties of inventions which may form the subject of separate applications.

15. That in the case of complex machines, involving the use of more than one mechanical appliance, the claims may cover the machine as a whole, and every separate originality may be the subject of another claim, covering its use in other machines.

16. That in case of the deposit of a completed specification, it shall be examined by the proper officer of the court, and notice given of any invalid claim or description, which it shall be at the option of the applicant to withdraw, or if not, the court shall proceed to try the question in public, and expunge the grant and specification altogether, or in part if proved invalid.

17. That the fact of an invention having been in use previously shall not invalidate a grant or specification, if the use shall have been private, and confined to one or more establishments as a piece of private trade knowledge. In such case, the individuals or firms shall have the right to continue their practice, but shall have no right to license or claim royalties from others, which right shall belong to the grantee in virtue of the instruction he has imparted to the public by his specification.

18. Any individual or firm shall have the right to obtain a grant for any origination they may have had in use for any length of time, provided it has not become a public use.

19. The duration of the grant shall be for a period of fourteen years from the date of the grant, and then to be renewed from seven years to seven years, after the expiration of the first fourteen, at the option of the granter, till it shall number up a total time of twenty-eight years, a duplicate of the original fee payment being made at each seven years' renewal.

20. During the first fourteen years the grantee shall not be compelled to licence other persons to use his invention, for the purposes of manufacture or sale, for the reason that the reputation of the invention may be damaged by wilfulness, carelessness, or ignorance. Nor shall he be compelled to licence till he has got his invention fairly before the public. But if his invention be fairly in use at the expiration of the first fourteen years, he shall then be compelled to licence at a rate of royalty not exceeding the average he has charged during the first fourteen years, and if, at the end of the first fourteen years, he has failed to get his invention into use, and demonstrably to the court by no fault of his own, his grant shall then be renewed for another fourteen years, with the right to another fourteen years on the same terms as the first grant.

21. The amount of fees to be levied shall be regulated, not for the purpose of giving a revenue to the State, but to pay the costs of the court, in granting and confirming titles, and the salaries of the officers.

22. The court shall be the only tribunal to deal with the question of title, and in case of an allegation against the validity of a grant, the objector shall apply to the court for a public trial, and, failing to make out his case, shall pay to the court such costs as it may levy for the time occupied uselessly by the public officers, and a fine for similar inquiry if such be established.

23. In case of an alleged infringement, the grantee shall apply to the court to obtain an injunction by due examination, and such injunction shall be a confirmation of title not to be questioned in any court where an action for damages may lie. If the grantee fails to make out out his case, and is convicted of overstraining his claim, he shall be liable to a payment of costs and a fine.

24. That the law of mental property being a matter in which the public is deeply interested, suits shall be conducted at the cost of the general fee fund, and not of individual suitors, even in such cases as the court considers oppressive; and thus the poor inventor will be on the same footing as the rich capitalist.

25. The site of the court shall be in the metropolis, for the purpose of granting and confirming titles and settling all disputes as to titles and specifications, the fiat of the court being available in all ordinary courts of law, or before magistrates, for the recovery of damages.

26. That the State shall have full right to use all inventions protected by grant for State purposes, such as vessels of war, naval or military, machinery for harbour uses, State railways, chemical or other inventions, paying a per-centage on economical inventions bearing a proportion to the savings, or in other cases such a royalty as may be awarded by the court as arbitrators.

27. That inasmuch as there are a large class of inventions in their nature ephemeral, as administering to a temporary condition of public demand, it shall be competent to an inventor to apply for and obtain a grant for a limited period of seven years, capable of renewal for another seven years, at one-half the fees payable for the longer period, and subject to the same general conditions, *i.e.*—

28. That inasmuch as there are some philosophic discoverers who bring to light principles existing in nature not before known, and which principles are convertible to man's uses by processes of chemistry and mechanism, it shall be lawful for these philosophers to obtain a grant of mental property in those principles, and to claim a certain proportion of royalty from practical men, who may bring the principles into every-day use. And it shall be competent for any one to obtain a grant for the application of any principle long known but never applied to use, on the score of originality.

29. That the producers of original books and works of art shall, in depositing a copy or description, obtain a grant of property in them for the whole term of their lives, and to their heirs for the term of fifty years after their death. The fees to be paid thereon the same as in other cases. And they shall be allowed a limit of seven years before making application for the grant.

30. That the present various offices for the registration of books and publications, works of art, patents, and designs, in their various branches, shall be gathered together in one collegiate establishment, wherein libraries and illustrations of every needful kind shall be supplied, the whole being under the jurisdiction of the judges appointed by law. And such an establishment will form the best training school for that alliance of mind with matter which is essential to national progress, in everything pertaining to the creation of national wealth, and the growth of mind.

31. That the officers hitherto employed in the various offices above quoted shall continue their employment at their own option in the combined office.'

32. That all former laws on the subject of mental copyright shall become void, and all injuries arising from mental property existing under them shall be dealt with by the new court.

FORTHCOMING PUBLICATIONS.

The "Food Journal."—A journal especially devoted to the food question will make its appearance in a few days. Mr. Phillips Bevan is the editor, and Messrs. Johnson and Sons, Castle-street, Holborn, the publishers.

The Journal of Applied Science.—A monthly newspaper, edited by P. L. Simmonds. (*Hailes and Company*, 6, Wardrobe-place, Doctors'-commons.) This publication would seem to be a resumption, on a more extended scale, of the *Technologist*, carried on for many years by Mr. Simmonds, and discontinued in consequence of his lengthened absences on official duties at the different international exhibitions. *The Journal of Applied Science* aims at a wide range of utility, since it professes to deal, among other topics, with art, agriculture, chemistry, commerce, construction, domestic economy, engineering, manufactures, navigation, technical education, and telegraphy.

GENERAL NOTES.

Failure of the Guns of the "Monarch."—Besides the failure in the guns of the *Hercules* reported in the *Times* of 19th January, it is currently reported that five out of the eight guns which have been placed in the *Monarch* have failed in various ways, one having actually burst. These guns are rifled after the plan borrowed from the French, and fired with chilled shells, and are supposed to represent the newest opinions of the Ordnance Committee.

The Trigonometrical Survey of England and Wales, on the scale of one inch to the mile, has just been completed, having been begun in the year 1791.

Iron Trade.—It is said that the iron trade is very active on the Continent at the present time. Krupp is erecting additional furnaces for one thousand crucibles. Skilled labour is, however, greatly wanted.

International Exhibition at Turin.—At a meeting of the General Commission of the proposed great international exhibition, which was held last month, under the presidency of the Minister Sella, it was determined to postpone this project until 1875.

Provincial Exhibition in Parma.—The Chamber of Commerce of Parma have given notice to the agriculturists and manufacturers that it is intended to hold an exposition of agriculture and manufactures in that city, in 1870.

Beet-root.—Not only has the cultivation of the beet-root been successfully introduced into the Western States of the American Union, but it has also been introduced into California, and there is now a beet sugar factory at Sacramento.

Cotton in Central Asia.—The Russian Society for the Development of Commerce and Industry has sent deputations to the Grand Duke Constantine and Prince Gortschakoff recommending the government to take steps for the cultivation of cotton in Central Asia.

Queensland Cotton.—The season has been highly favourable for cotton-planting, and many have planted who might not have done so under less favourable circumstances. The ginning season is nearly over, and some of the crop is now on the way to market. The general quality of the article is very fair, but next season, from the care devoted to the present planting and the selection of seed, an improvement is confidently looked for.

Masters and Workmen in Austria.—The Austrian government has just prepared a bill for regulating the relations between masters and workmen in the empire. Provision is made for restricting the working hours of boys and girls under 16 years of age, but the rate of wages and hours of labour of adults are to be settled, as hitherto, by mutual agreement between tho workmen and their employers. Inspectors of factories are to be appointed to arbitrate in disputes, and exercise a general supervision over manufacturing establishments.—*Eastern Budget.*

Emigration to the United States.—In the third quarter of the year 1869, 116,371 persons arrived in the United States from foreign countries; 101,842 were permanent emigrants, 11,900 citizens of the United States returning from abroad, and 3,039 foreigners not intending to remain. Of the emigrants, 60,959 were males, 40,383 females; 23,291 were under fifteen years of age, 65,070 between fifteen and forty, and 12,981 upwards of forty; 70,986 arrived at the port of New York, 10,621 at Port Huron, 10,238 at Boston, 5,393 at San Francisco, and 1,414 at Detroit. The remaining arrivals were principally at Philadelphia, Portland, New Orleans, and Key West.

Life Saving Apparatus.—A series of preliminary experiments with Mr. J. Banting Rogers' patent apparatus for saving life at sea by means of a tri-fluked hinged or folding anchor, or other projectile, fired from a mortar or other piece of ordnance, have been made under the superintendence of the inventor and the officers of H.M. gunnery-ship *Excellent*, at Whaley Island. The practice showed the accuracy of aim with which the projectile could be thrown. A projectile weighing 12lbs., with double line, the weight of which was 10lbs., was thrown a distance of 198 yards, the quantity of powder used being one ounce and a-half. The whole of the experiments were carried out to the satisfaction of those who witnessed them.—*Trade Circular.*

A Monster Telescope.—Messrs Cook and Sons, astronomical instrument manufacturers, York, have just completed the largest refracting telescope ever constructed. The tube, which is cigar-shaped, is 32 ft. long, and in the centre 3 ft. 6 in. in diameter, whilst the object-glass is 25 in. diameter. A metal pillar upon which it stands is 20 ft. high, and of about 6 ft. diameter at the base. At the top of and within the pillar is a driving clock, the weights of which occupy the lower hollow of the same part of the instrument. The order for the telescope was given over five years ago, by Mr. Newall, submarine cable manufacturer, of Gateshead, into whose possession at the latter place it is now in course of removal. Gateshead, however, it may be stated, is not to be its permanent destination, it being the intention of Mr. Newall to erect an observatory for its accommodation in Madeira.

Nitrous Oxide Gas as an Anæsthetic.—The *British Medical Journal* has ascertained that the use of nitrous oxide gas as an anæsthetic continues steadily to increase over the country, and that the amount made by manufacturers in London cannot be much under 60,000 gallons per annum, representing on the rough the production of anæsthesia in about 15,000 individuals. This increase arises almost entirely from its popularity among dentists. The gas has received comparatively little encouragement from surgeons. This may be easily explained by the great expense of the gas in even slightly prolonged operations, and the cumbrous nature of the apparatus required for its use. Its undoubted safety and rapidity of action, as compared with chloroform and other æthers, and the minimum of annoyance resulting from its after-effects, have been duly appreciated and practically recognised by dentists.

Production of India-rubber.—The *North American Review* states that there are now in America and Europe more than a ndred and fifty manufactories of india-

rubber articles, employing from four to five hundred operatives each, and consuming more than ten millions of pounds of gum per annum. The business, too, is considered still to be in its infancy; certainly it is increasing. Nevertheless there is no possibility of the demand exceeding the supply. The belt of land around the globe, five hundred miles north and five hundred miles south of the equator, abound in trees producing the gum; and they can be tapped, it is said, for twenty successive seasons. Forty-three thousand of these trees have been counted in a tract of country thirty miles long and eight wide. Each tree yields an average of three table-spoonfuls of sap daily, but the trees are so close together that one man can gather the sap of eighty in a day.

American Cheese.—The progress which has been made in the manufacture of cheese in New York is surprising. There was a time when American cheese found scarcely any market abroad. Now it has not only a large sale in England and elsewhere, but sharp dealers sell great quantities of it to American buyers as veritable "Stilton" or "Cheddar," and very few persons would be able to tell the difference between the original and the imitation. New York was the first State which set up a "cheese dairy," nearly eighty years ago. Now nearly six millions of dollars are embarked in the trade. We learn from an official source that two hundred millions of pounds were made in 1867 alone, and since then the demand and supply have both increased. As the merits of New York dairies become more widely known, the consumption of foreign-made cheese will be reduced to a very small amount in this country.—*New York Times.*

Fine Art Exhibition at Brussels.—The accounts of this exhibition have just been published, and possess several points of interest. The exhibition was open for two months and a half, and was visited by 58,000 persons, of whom 3,568 paid two francs; 3,223, one franc; 20,251, half-a-franc; and 9,964, one penny. The number of tickets sold for the whole period, for which ten francs was charged, was 307; and, although the names of the artists were placed on all the frames, the number of catalogues sold reached 7,496. The receipts amounted to 6,000 francs more than those of the previous exhibition, which was held in 1866. The most remarkable result, however, was that of the sales; the works sold by the commission amounted to 121,075 francs (£4,843), and those sold by artists themselves to private persons to 118,925 francs (£4,757). The government also purchased some works, of which the amount is not given, so that the entire sales must have reached, if it did not exceed, £10,000. This exhibition is held alternately in three towns in Belgium.

Suez Canal.—Lord Houghton, at the Royal Geographical Society on January 10th, speculating on the effect which the opening of the Suez Canal would have on commerce, expressed the belief "that it would not have any very great present effect on either British or French commerce; but that it would greatly develop the smaller trade of Turkey, Greece, and the Levant. It would, no doubt, also develop the trade of Austria. Indeed, the Emperor of Austria had told him that he was in Egypt as the representative of Trieste." Mr. James Blow, marine superintendent of the North China Steam Ship Company, says:—"The benefit to England of the opening of this route is, that iron screw-steamers alone will be used to navigate the canal, and that England now builds these for all the world. I know of a large American company in the East, which is now having vessels built on the American plan, as to engines and hulls, on the Clyde; and it is their intention to reconstruct their entire fleet of fourteen large wooden steamers, many of them vessels of 2,000 tons, and build them of iron." Mr. Blow was captain, in 1857, of the first steamer that sailed from Dublin with troops to put down the Indian mutiny, and he now makes this declaration which is worth the attention of advocates of retrenchment, who knows the real cost of keeping up the gigantic troop-ships engaged in conveying soldiers between England and India:—"I will guarantee to carry in an auxilliary screw-steamer of about the *Sin Nanzing's* tonnage, and having two decks, 600 soldiers, with their baggage, &c., and land them on the twenty-fifth day from leaving England at Bombay, and the cost shall be 50 per cent. less than the average cost per head for every soldier landed in India during the mutiny, and the time occupied will be twenty-five days instead of seventy-five."

Above-Ground Telegraphs.—The storm of Dec. 17 has called general attention to the imperfections of the present system of constructing telegraphic lines. While the wires are above ground they are exposed to injury, not only from violent gales of wind, but from innumerable other causes. They may be broken by a sudden change of temperature, and when a frost is severe they are often encased in a crust of ice so thick that they are unable to bear its weight. In the course of from ten to twenty years they are destroyed by rust. The expense of galvanising them is very great, and it is almost impossible to subject them to the processes with such care as to leave no parts unprotected. The influence of damp frequently causes a loss of the current sufficient to disturb communication, or at least to endanger the exactness of the despatches. Lightning is sometimes attracted, and melts the wires or cleaves the posts. Besides this, it is advisable not to forward telegrams during a thunderstorm, as the life of the official may be endangered by his doing so. Subterranean lines are exposed to none of these disadvantages. In 1867, several such cables, which had been buried for ten years and more, were carefully examined, and they were found to be in a state of perfect preservation.—*Cologne Gazette.*

Distance of the Sun.—The distance of the sun from the earth—as founded upon the observations of the transits of Venus over the sun's disc, which took place in the last century—was, until recently, taken as being in round numbers 95,000,000 miles. But modern discussions of the observations then made, and other independent determinations of the sun's distance, less direct, but in the aggregate of considerable value, all tend to show that the true distance does not differ much from 92,000,000 of miles. The most accurate result of all is to be obtained by observing the passage of Venus across the sun on those very rare occasions on which such a phenomenon can be seen. Unfortunately they seldom occur; the last took place in 1769, when various expeditions were sent out to those parts of the earth's surface most advantageously suited for observing the phenomenon. Captain Cook's expedition to Otaheite was one of them. Two transits will again soon occur, and proper expeditions will no doubt be again organised for the purpose of efficiently observing them. The first will take place in the year 1874, the other in 1882, and the results which it is hoped will be obtained on these occasions will be looked forward to by astronomers with some curiosity.

Factitious Gems.—At a recent meeting of the Paris Academy of Sciences, M. Gaudin exhibited specimens, and communicated the results of his researches in the production of artificial precious stones. For this purpose he uses the flame of the oxy-hydrogen blow-pipe, instead of melting his materials in the crucible, as hitherto has been the case. These gems are intermediate in hardness between "strass" (the vitreous basis of factitious gems commonly known as "paste") and the true gem, which they nearly approach in hardness and resistance to wear. Up to the present time, he states that he has been unable to produce the true oriental transparent gem, that is to say a gem composed of alumina alone. In order to give the necessary viscosity to the alumina when subjected to the flame of the oxy-hydrogen blow-pipe, he has found it necessary to add a large proportion of silica, for, when used alone,

the alumina liquifies, and ultimately is dissipated in vapour. This, however, checks the crystallisation and diminishes the hardness. The colouring of the gem is attended with difficulty, as the flame of the blow-pipe has the effect of reducing the oxides of the precious metals used for this purpose, such as gold, silver, and palladium, to their metallic state. Copper appears to be less affected, and by careful manipulation produces every variety of tint; manganese and nickel give an orange-yellow colour.

Indian Tea continues to increase in popularity, and in many parts of the country is rapidly superseding the use of China flavouring teas, such as scented orange pekoe, and scented caper. The deliveries for the last twelve months will not fall far short of 3,000,000 lbs. over those of last year, and there is every probability that this rate of increase will be maintained. The result of this has been a very material rise in prices generally, and owing to the continued scarcity of fine China teas, the better kinds must be in large demand, and prices will probably continue to rule high, thus affording a good rate of remuneration to growers. On the other hand, unfortunately, a large proportion of Indian teas are thin and deficient in flavour, and are generally realised at a loss to the importer, while we believe that, at the same prices, better value might frequently be had in China congou. The tea growers in India appear, however, to be in earnest in their efforts to supply the English market with teas of the right description, and we believe that the occupation, if not already a flourishing one, is each year becoming less disastrous; indeed, we have lately conversed with several growers of well-known standing, who are thoroughly satisfied with the results of their enterprise, and have largely increased their holdings; but these, being practical men, have employed experienced managers on their estates, and have avoided paying for land prices which, under the most favourable circumstances, would prevent the cultivation of tea from being a profitable enterprise. Altogether, we are disposed to view the prospects of the Indian tea trade as encouraging; the bubble companies which were created a few years since have mostly disappeared, and with them a reckless system of management; land is generally to be had at fair prices, and growers have only to study the wants of English consumers to be successful, for Indian teas at present are popular, and have a good reputation, and it rests with the producers to determine whether this popularity shall increase or otherwise.—*Trade Circular.*

Russian Commerce with Central Asia.—The St. Petersburg correspondent of the *Börsen-Zeitung* says:—"The attention of Russian merchants is becoming every day more attracted towards Central Asia, where they have no European competition to fear. Though neither the wants nor the productions of the populations in that region are either very numerous or varied, there is still in those countries a good and profitable market for certain kinds of wares. Hitherto goods have been chiefly transported from Russia by caravans through the Kirgis steppes; but, in consequence of recent disturbances, a new route for merchandise has been sought, and every one has immediately thought of the Caspian Sea. A Russian settlement has been consequently founded on the eastern coast of Krasnowodki Bay, from which place a new commercial track is to lead to the Sea of Aral, and thence to Turkestan. The communication between the Caspian Sea and the Sea of Aral is to be secured by the erection of forts, and it is also proposed to unite them by means of a railway. The shortest distance between them is 300 versts. It is said that two battalions of infantry and a few divisions of Cossacks have already received orders to protect this road. The Asiatic trade of Russia in 1868 was not, it is true, very promising, as the value of the exports was only 8,909,343 silver roubles against 16,498,329 roubles imports. Since 1858, Russia has paid more than 44 millions roubles in gold and silver to Asia. The principal imports from those countries into Russia in 1868 were tea to the amount of 5,723,104 silver roubles, cotton tissues worth 4,254,927 roubles, and fruit to the value of 953,050 roubles. In the same year the following number of travellers passed the Russian Asiatic frontier:—11 Englishmen, 2 Greeks, 7 Italians, 3 Austrians, 8 Germans, 9 French, 8,828 Russians, 9,061 Turks, and 37,985 Persians. Russian goods to the value of 3,529,000 roubles were sent to China in 1868, and 6,265,346 worth were imported from that country. The Russian trade with Persia comprised 1,433,109 roubles exports, and 3,941,718 roubles imports. Goods to the amount of 3,934,470 roubles were sent to Asiatic Turkey, and 6,282,595 roubles were imported into Russia.

The Trade with the Colonies.—The following statement shows the value of the exports to the Australian colonies, of British produce, for the first eight months of the year 1869, compared with 1867 and 1868:—

	1867.	1868.	1869.
	£	£	£
Victoria	2,732,090	3,354,364	4,002,835
New South Wales	1,204,696	1,749,158	2,147,419
New Zealand	979,154	990,208	1,029,395
South Australia	526,590	752,641	946,120
Queensland	192,302	252,013	263,306
Tasmania	153,172	120,065	179,862
West Australia	62,871	74,894	81,046
Total	5,850,875	7,294,343	8,649,983

The following are some of the principal items:—

	1867.	1868.	1869.
	£	£	£
Boots and shoes	362,932	691,834	591,125
Apparel and slops	532,528	605,246	776,153
Millinery	471,346	700,223	799,028
Worsteds	215,754	294,125	396,122
Iron	584,998	611,105	896,819
Machinery	135,475	125,644	206,668
Beer and ale	318,754	350,395	343,013
Cotton goods	461,785	651,346	746,598

The following are the principal imports into the United Kingdom:—

	1867.	1868.	1869.
	£	£	£
Gold	3,863,970	5,236,729	5,942,949
Silver	519	468	2,168
Hides ....cwts.	53,944	38,083	26,078
Copper ore ....tons.	10,839	10,620	11,324
Do. ,,	57,320	77,000	56,200
Tallow ......cwts.	17,574	108,819	147,691
Wool..........lbs.	118,672,805	135,346,569	131,921,572

The Merchant Fleet on the American Lakes.—The magnitude of the merchant fleet of the great northern chain of lakes of America, and the important part it performs in connection with the vast and growing inland commerce of the country, are imperfectly understood and appreciated by those who are not immediately interested. In 1856, the total number of vessels of all classes employed on these inland seas was 1,117, with an aggregate of 319,528 tons, and an estimated value of 12,413,000 dollars. In 1868, this fleet had grown to 2,269 vessels, aggregating 639,303 tons, and an estimated value of 23,000,000 dollars. As these are the minimum rates of valuation, based on assessments, an addition of 10 per cent. may safely be added, which would bring

the value to upwards of 25,000,000 dollars. The proportion of this tonnage belonging to the United States, and the portion belonging to the New Dominion, together with the class of vessels, is as follows:—

LAKE TONNAGE.

AMERICAN.	1868.		1867.	
	Tons.	Value.	Tons.	Value.
		dols.		dols.
Steamers	76,624	1,670,000	27,655	1,671,000
Propellers	82,330	4,527,000	80,751	4,132,000
Tugs	16,506	1,596,000	15,917	1,462,000
Sailing vessels	355,592	10,977,000	364,442	8,556,820
Barges	9,262	209,000	12,624	230,000
Total	540,314	18,979,000	501,389	16,061,820
NEW DOMINION.				
Steamers	18,572	1,176,000	18,041	1,115,000
Propellers	7,565	498,000	7,513	483,000
Tugs	10,190	514,000	10,179	510,840
Sailing vessels	52,943	1,733,000	58,571	1,917,000
Barges	9,809	133,000	20,068	228,950
Total	99,079	4,054,000	114,372	4,254,090
Combined aggregate	639,303	23,033,000	615,761	20,316,510

The greater part of the small harbour tugs and scows, with a tonnage ranging from 15 to 50 tons, and other small craft have not been included, otherwise the aggregate would show a considerable addition to the tonnage. There are also vessels building amounting in the aggregate to over 20,000 tons, valued at upwards of 1,000,000 dollars, which would swell the total amount of money invested in lake tonnage to at least 26,500,000 dollars. Such a fleet as is here indicated, transacting a business on more than 80,000 square miles of water, bordered by a country exceedingly rich in varied productions, teeming with energetic life, gives aid to regions which it brings in contact, and in turn receives the benefit of the commerce which it is mainly instrumental in creating. A suggestive feature of the foregoing statistics is the steady growth of steam carriage on the lakes, which shows that there, as upon the ocean, steam is supplanting sails. In 1856, the steam fleet on the lakes amounted to only 88,000 tons American and 16,000 tons Canadian, comprising mostly steam-tugs; now, there are nearly 180,000 tons American and 35,000 Canadian, some of them built of iron, and equal in size and value to the steamers employed in the Atlantic coasting trade. Since the introduction of steam transportation on the lakes, the industries and commerce that have grown up along their borders almost passes comprehension. Great centres of trade have been created, new enterprises radiate from them, and fresh territory in the far north-west has been rendered tributary to the general wealth of resources.

Amendment of the Patent Laws.—At a meeting of the Manchester Institution of Engineers, held at the Manchester Town Hall, to hear a paper read by Mr. T. Aston. Mr. Platt, M.P., took the chair, and in the course of his remarks said they were aware that many very powerful names were arrayed against the patent laws. Some gentlemen opposed the patent laws on the ground that protection in any form meant opposition to free trade. It was for them to show that granting protection to a man's thoughts or ideas could be defined as an interference with free trade in any form whatever. To his mind, it could not. If Providence had blessed a man with ability and power to develop ideas, the carrying out of which was attended with benefit to the country, it was fair that that person should be so far protected in the possession of the power with which Providence had blessed him, and he maintained most strongly that there was not in this protection anything that was in antagonism to free trade. It was often said that the patent laws formed a question which was peculiarly the working man's, and there was a great deal of truth in the statement that the ideas of patents generally emanated from the brains of our artisans. He did not say that it was so in all cases, but it was so to a great extent. The patent laws, however, as they were at present administered, inflicted this injury upon a poor inventor—that he was allowed to go on with his patents, and be at great expense, before he found that the invention for which he had got his patent was as old as his grandfather. Some means should be taken to prevent a useless expenditure on the part of inventors, when it was or might be known at the Patent-office that there was nothing novel in their inventions. The remedy, however, lay in the direction of amendment, and not of total abolition of the laws. —Mr. Aston, in his paper, said the subject naturally divided itself into three branches—first, the policy of granting letters patent for inventions; secondly, the working of the existing system; and thirdly, the amendments which appear to be needed. He thought the objections to letters patent were partly based on results attributable not to the legitimate use, but to grave abuses of the patent laws, and partly on the mistaken supposition that those abuses were inherent in the system, and without remedy; whereas he contended that they were, in fact, capable of being remedied by amending the existing laws. After defending, at some length, the right of property by an inventor in his own invention, Mr. Aston proceeded to discuss the objection urged against the system in the House of Commons by Mr. Macfie, M.P. for Leith, in the last session, viz., that patents were opposed to the principle of free trade. If this were the fact, he said it would not be easy to answer this objection to patents. But he contended that the patent law, by recognising property in invention, and making it negotiable in the form of a patent which could be freely bought and sold, did not obstruct, but promoted, free trade in inventions. By abolishing the patent law, they would not only prevent free trade, but all trade in inventions; for where there was no property there clearly could be no trade.—Mr. Alderman Curtis moved, "That this meeting considers that the trade in inventions, which is founded upon the granting of patents, is of great advantage to the country, in promoting its industrial prosperity, and that any abuses which exist in the present patent system may be rectified by available amendments." —Mr. Henry Ashworth seconded the resolution, which was supported by Mr. W. Lloyd Wise, and passed.

MEETINGS FOR THE ENSUING WEEK.

MON......R. Geographical, 8½. 1. Mr. G. W. Hayward, "Letter to the President on Central Asia and Pamir Land." 2. Mr. J. L. Palmer, R.N., "A Visit to Easter Island."
Entomological, 7. Annual Meeting.
Medical, 8.
London Inst., 4.

TUES ...Civil Engineers, 8. Continued discussion upon Mr. Grantham's paper, "On Ocean Steam Navigation."
Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."
R. Medical and Chirurgical, 8½.
Ethnological, 8. 1. Mr. J. Bonwick, "On the Origin of the Tasmanians, geologically considered." 2. Mr. H. H. Howorth, "On a Frontier Line of Ethnology and Geology." 3. Mr. G. M. Atkinson, "On the Nicobar Islanders."

WED ...Society of Arts, 8. Dr. Armitage, "On the Modes of Reading in use by the Blind, and the Means of arriving at Uniformity."
Geological, 8. 1. Mr. Joseph Prestwich, "On the Crag of Norfolk and associated Beds." 2. Dr. P. Martin Duncan, "On the Fossil Corals of the South Australian Tertiary Deposits." 3. Mr. J. W. Hulke, "Note on a very large undescribed Wealden Vertebra."
Archæological Assoc., 8.

THUR ...Royal Inst., 3. Prof. Odling, "Chemistry of Vegetable Products."
Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Philosophical Club, 6.

FRI ......Royal Inst., 8. Prof. Odling, "Graham's Scientific Work."
Quekett Club, 8.
East India Assoc., 8. Mr. W. Tayler, "On the Delay of Justice to Indian Appellants in England; its Causes, Consequences, and possible Remedy."

SAT ......Royal Inst., 3. Mr. Scott, "Meteorology."

Journal of the Society of Arts.

FRIDAY, JANUARY 28, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock :—

February 2.—"On Recent Improvements in Small Arms and Ammunition." By Capt. O'Hea.

February 9.—"On Loss of Life at Sea." By J. W. Wood, Esq.

February 16. — "On Emigration." By Thomas Plummer, Esq., late of British North America.

February 23.—"On Economy in the Use of Fuel for Domestic Purposes." By Capt. Douglas Galton, C.B.

March 2.—"On Tramways in Streets." By W. Bridges Adams, Esq.

March 9.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

March 16.—"On Surface Decoration. By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at 8 o'clock.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course will be issued shortly.

EDUCATIONAL CONFERENCE.

The Council propose to hold a Conference on National Education, on Monday, 7th February, with the view of attempting to harmonise, into a measure practicable at the present time, the best features of the Manchester Education Union, the Manchester Education Bill, and the Birmingham Education League proposals. The following letter of invitation has been issued :—

28th January, 1870.

Sir,—I am directed by the Council to invite your attendance on Monday, February 7th, at a Conference to be held here, to discuss the best means for providing throughout the country a national system of education, whereby every child in the kingdom may have opportunities of obtaining elementary instruction, of a character at least equal to that which is within the reach of all in Prussia, Saxony, Switzerland, and other continental countries. Two years ago, the Society of Arts held a Conference on "Technical Education." The Conference was well attended by leading manufacturers, members of Parliament, and others interested in education, and much valuable information was elicited. A Committee appointed at that conference drew up a report, in which the absolute necessity of an improved and extended system of scientific instruction was pointed out. At the same time, it was felt by the Committee, and the Council are strongly of opinion, that it is of comparatively small value to provide means for the teaching of science and art, unless, in the first instance, the people are prepared to take advantage of it by an extended and improved system of elementary or primary instruction. The present time is considered particularly fitted for such a conference as is contemplated. There are several schemes for attaining the object now before the country, tending to one common end, but differing in the means. The Society of Arts takes no political or party view of the question, but sympathises with all who profess to provide for the national education of the people. The Council are desirous of discussing how far the various schemes may be harmonised, and whether the common object, the education of the people, may not thus be attained, and they put forward for discussion the enclosed suggestions, in the hope that they may lead to a practical result, and that an object of such imperative and pressing importance as the education of the people may not be sacrificed in contention over the means. Under these circumstances, the Council hope they may be favoured with your attendance.

I have the honour to be Sir,
Your obedient servant,
P. Le Neve Foster, *Secretary.*

(Enclosure.)

Programme for Discussion at the Society of Arts Conference on National Education, on Monday, February 7th, 1870.

In which it is attempted to combine and supplement, in a scheme practicable at the present time, the best features of the National Education Union, the Manchester Education Bill, and the National Education League proposals.

1. That, in order to secure the education of every child in England and Wales, on which all parties are agreed, it is necessary that a Department of Government, responsible to Parliament, be constituted for the purpose.

2. That such Department have ample and discretionary powers to take all necessary measures to cause proper elementary and secondary education to be placed within the reach of the whole people: also to make economical combinations of existing schools: also to have direction of all grants and public funds devoted to National Education: also to have charge of all national museums, galleries, &c., so that the same may be properly administered in aid of National Education throughout the United Kingdom, and to appoint Inspectors of Education instead of merely Inspectors of particular schools, as at present.

3. That the means of instruction in reading, writing, arithmetic, with moral training, and, where practicable, in drawing, singing, and drill, be provided for all, and encouragement given by government to the higher branches of general culture, science (especially that bearing on health), and art. Infant, primary, and secondary schools, colleges, and universities receiving government aid, to be helped to act in union, as far as possible, as parts of a system.

4. No child to be hired for labour who is under a given age, and not receiving satisfactory instruction. Compulsory attendance at school to be obtained by fining employers (according to the principle of the Factory Acts) if they employ such children.

5. Industrial schools, Union schools, Reformatory schools, and the like, to be brought under one direction,

and compulsory powers given to take and educate children of the vagrant or destitute class.

6. Existing efficient denominational schools to continue to receive parliamentary grants, with government inspection for reading, writing, arithmetic, drawing, singing, and drill.

7. Each denomination to provide for its own religious teaching.

8. Where additional schools or increased school accommodation appear to be wanted, an official inspector to inquire what improved arrangements can be effected: in populous places, by organisation and combination of existing schools, or by the adoption of a half-time or any other system. The locality to be invited to establish schools, giving it the option to do so by voluntary subscription under the existing system, or by rates administered by a local board according to rules; but if the locality neglect to do so, then government to establish the necessary schools, charging the cost of buildings, and a proportion of the annual expense, on the rates of the locality. Existing schools to be free to adopt this system.

9. School fees to be maintained, and be applicable to the augmentation of the incomes of the teachers, who will thereby be stimulated, and the schools kept efficient. Fees of destitute and pauper children to be paid out of the rates.

10. Existing training schools for teachers to be consolidated as early as practicable, and, if need be, enlarged.

11. Parliament to give provisionally large and general powers to the Education Department, whose work, until a national system has been matured and is in action, must be tentative.

The Conference will commence at 11 o'clock, adjourning at 1·30 for half-an-hour. The Discussion will be resumed at 2 o'clock, continuing till 5, when it will be adjourned till 7 o'clock in the evening.

ART-WORKMANSHIP COMPETITION.

In response to the offer of prizes issued by the Council in 1869, one hundred and forty-three specimens have been received for competition in the various subjects for which the prizes have been offered. These articles are now arranged for exhibition in the Society's Great Room, and the Catalogue will be issued in the next *Journal.*

SHIPS' LIFE BOATS.

The Council have decided to offer the Society's Gold Medal for an improved Ship's Life Boat. The terms and conditions of the offer are referred to a Committee to settle.

LIBRARY.

The following works have been added to the Library:—

What is doing for the Blind; by James Gray.

The Education of the Blind, Deaf, and Dumb; a Lecture; by Alfred Payne.

Lives of the useful Blind; by Mrs. H. Van Landeghem.

Charity Misapplied; by Hyppolite Van Landeghem.

(The above works were presented by Jas. Bird.)

The Oxford and Cambridge Local Examination Record; by F. S. De Carteret Bisson; presented by the author.

The Science and Art of Arithmetic; by Messrs. Sonnenschen and Nesbit.

Our Domestic Fire-Places; by Frederick Edwards, junr.

Our Primary and Technical Education; lecture by Dr. Lyon Playfair, C.B., M.P.

Pamphlet on the Atlantic and Pacific Steam Service.

A Fortnight in Egypt, at the opening of the Suez Canal; by Sir Frederick Arrow, Deputy-Master of the Trinity House; presented by the author.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

POSTAL COMMITTEE.

The Postal Committee have resolved to urge upon the Government the adoption of a halfpenny rate of postage for printed matter under four ounces weight.

The following information, relating to the rates of postage on newspapers and printed matter in foreign countries, has been forwarded for the use of this Committee:—

The facilities which have been for a long period enjoyed by foreign countries for transmission of printed matter through the post, are shown by the following statement:—

Belgium.—A rate of postage on newspapers $\frac{1}{10}$th of a penny each; on other printed matter, one penny for any 10 sheets.

Brazil.—Newspaper $\frac{1}{4}$d. each, and printed matter one quarter the letter postage.

France and Italy.—Newspapers and printed matter can be transmitted through the post at as low a rate as $\frac{1}{10}$th of a penny.

The Netherlands.—Newspapers $\frac{1}{4}$d. per sheet; other printed matter $\frac{1}{2}$d. per sheet.

Portugal.—Newspapers $\frac{1}{4}$d. each; other printed matter $\frac{1}{2}$d. per ounce.

Switzerland.—Newspapers $\frac{1}{3}$ of a farthing per ounce if published in the country, and $\frac{2}{3}$ of a farthing if foreign; other printed matter $\frac{1}{2}$d. for two ounces.

Tuscany.—Newspapers $\frac{1}{4}$d. per sheet; other printed matter $\frac{1}{2}$d. per sheet.

United States.—*Newspapers.*—The standard single rate is four ounces avoirdupois. Daily, 30 cents per quarter; tri-weekly, 15 cents per quarter; semi-weekly, 10 cents per quarter; weekly, five cents per quarter. *Periodicals.*—The standard single rate is four ounces avoirdupois. Semi-weekly, 6 cents per quarter; monthly, 3 cents per quarter; quarterly, 1 cent per quarter. One copy of a weekly newspaper may be sent free by the publisher to each subscriber who resides in the county where the paper is published.

Wurtemburg.—On political newspapers postage of 50 per cent, and non-political 25 per cent on the cost of publication, the post-office acting as newsagent.

EIGHTH ORDINARY MEETING.

Wednesday, January 26th, 1870; Sir CHARLES TREVELYAN, K.C.B., Member of the Council in the chair.

The following candidates were proposed for election as members of the Society:—

Francis, John, 11, Burghley-road, Highgate-road, N.W.
Hambling, Thomas C., 7, Westminster-chambers, S.W.

The following candidates were balloted for, and duly elected members of the Society:—

Brown, Thomas, Grammar School, Grimston, King's Lynn.
Russell, John, Scotch School, New-road, Woolwich, S.E.
Witt, John Charles, Hamlet-road, Upper Norwood, S.E.
Worthington, James, Sale-house, Sale, near Manchester.

The Paper read was—

ON THE MODES OF READING IN USE BY THE BLIND, AND THE MEANS FOR ARRIVING AT UNIFORMITY.

By Thomas Rhodes Armitage, Esq., M.D.

The subject I have to bring before your notice this evening is one which, though lying somewhat out of the beaten track, is nevertheless one of national and indeed world-wide importance. The sufferers from blindness are widely dispersed, and their number is, therefore, liable to be under-rated. Speaking in general terms, we may assume that one in a 1,000 of the population is blind, which gives about 30,000 as the number of the blind in the United Kingdom, and when we consider that this proportion prevails throughout Europe, and is probably higher in countries where the science of medicine is less advanced, it is easy to see that the blind form a very appreciable part of the population of the world. It is very sad to reflect that the majority of cases of blindness probably arise from preventible causes. Ophthalmia of infants is a very common cause, and ought never to terminate in loss of sight, which always, in these cases, results from neglect and dirt. Claucoma is also a fruitful source of blindness, invariably causing loss of sight if left to itself; but, thanks to Professor Grafe's brilliant discovery, these cases are generally curable, if operated on early. Another very common cause of blindness is serious injury to one eye, which is thus lost, and if not at once removed sympathetic inflammation and destruction of the other is very apt to follow, resulting in total blindness; whereas, if the injured eye be at once removed, the other is generally preserved. Loss of sight from small-pox is now comparatively rare, owing to the general practice of vaccination, but much undoubtedly may still be done towards diminishing the frequency of blindness, by further advances in the art of treating eye disease, and especially by spreading among all classes a knowledge of what has already been done in this direction.

But we have now to consider the best means of educating those who have had the misfortune to become blind, and thus to mitigate in some degree the dreadful calamity of having "wisdom at one entrance quite shut out," and that the most important entrance. The principal channels left for conveying ideas to the blind are the senses of hearing and touch, and it is with the modes of education which address themselves to the sense of touch that I wish to occupy your time this evening. Reading is to the blind as important as to the seeing. I have had very great experience among the blind of the poorer classes, and have always been struck by the great improvement in cheerfulness, as well as in intellect, which ensues on the acquisition of the art of reading; and I can speak from experience, in my own person, of the great pleasure of reading for myself, after having been for some years almost entirely dependent upon others.

It is, however, extremely important that the method adopted for reading should be well considered. I would lay down, as the objects to be aimed at in the selection of any system of embossed characters for general use among the blind:—1st. That the characters should be as clear to the touch as possible. 2nd. That the size should be as small as is compatible with perfect and instantaneous recognition. 3rd. That correct spelling shall not be interfered with. 4th. If any means exist for shortening the process of reading they should be adopted. 5th. That, if possible, the written should be also the printed character.

It will facilitate the comprehension of the numerous systems of embossed printing to divide them into three great classes:—1st. Line alphabets, which are varieties of the ordinary Roman letter. 2nd. Line alphabets deviating more or less from the Roman letter. 3rd. Dot alphabets, in which letters are represented by various combinations of dots.

The happy idea of printing on paper letters recognisable by the touch is due to M. Haüy, of Paris, who printed his first book in 1784, and founded the Institut des Jeunes Aveugles, Paris. The type he adopted was the script, or Italic form of the Roman letter. This was introduced into England by the present Sir C. Lowther, who printed the Gospel of St. Matthew, in 1832, with type obtained from Paris, and followed it with other portions of the Bible. In 1834, Gall, of Edinburgh, printed the Gospel of St. John in Roman capitals, in which, however, all curves were replaced by angular lines, and the lines themselves were serrated, which changes, he believed, gave greater distinctness to the letter.

Alston, of Glasgow, adopted Fry's plan of using ordinary Roman capitals. Dr. Howe, of Boston, U.S., makes use of the small Roman letters, giving them angularity according to Gall's idea. The Philadelphia type does not differ much from Alston's. The combination of capitals with small letters have also been tried, and a society has recently been formed at Worcester, with the intention of printing on a large scale in this type. In Germany, various modifications of the Roman letter exist, the principal of which, the so-called Stachelschrift of Stutgart, consists of Roman capitals formed by finely dotted lines. All these modifications are suggestive of the strong tendency among those who have attempted to benefit the blind to retain for them the form of letter to which the seeing are accustomed, while the constant change of form indicates a fact with which most blind persons are familiar, from personal experience, viz., that none of these modifications are satisfactory as to the primary condition of being easily felt. A better form than any which has obtained currency was suggested 20 years ago by Mr. Welch, a blind man, who has been the pioneer of education amongst the blind of London, and this is almost identical with one independently worked out by Mr. Littledale, of Cheltenham.

The second great class is made up of alphabets, deviating more or less widely from the Roman letter, and consists of a stenographic shorthand invented by Mr. Lucas, a phonetic shorthand due to Mr. Frere, and a full-written system introduced by Mr. Moon, in which the Roman letter is retained in a more or less modified form whenever he considered this could be done compatibly with easy recognition, the simple line signs employed by Mr. Frere being used to replace the more complicated of the Roman letters, It will be necessary to examine these systems in detail, and it will facilitate this examination if we compare them with each other in the following particulars:—(*a*) As respects the shape of the letters; (*b*) as respects the advantage of conformity with the Roman letter; (*c*) as regards the reading from left to right, and from right to left, alternately; (*d*) advantage of a shorthand as contrasted with a full-written system.

(*a*) *As respects the shape of the letter.*—Mr. Lucas

and Mr. Frere brought out their systems about the year 1838, Lucas preceding Frere by a few months. They employed at first almost identically the same character, but unfortunately could not agree to represent the same sound by the same symbol. Mr. Frere had the advantage of having his plan carried out by a very ingenious and sensible blind man, who soon discovered that the letters formed by lines and curves upon which dots were placed were too similar to those formed by the corresponding lines and curves without dots; he, therefore, changed all his dotted characters, replacing the dotted curves by angles of 45°, and the dotted lines by lines in which a short line is substituted for the dot.

The result of this change is, that Frere's character is now far superior to Lucas's in the quality of easy recognition. Mr. Moon's character, in the large size which is used by him is quite as easily distinguishable as Frere's, but in the form in which he now prints his characters, his right-angles are not true right-angles, but are rounded. In the size which he uses, this defect is of very little importance, but it effectually prevents any considerable diminution, because, if this is attempted, the rounded right-angles cannot be distinguished from the hooked lines.

The importance of using a character as small as is compatible with easy recognition may be readily understood from the following statement:—The largest type used by Mr. Frere is that employed in the Gospel of St. John. The character is $4\frac{1}{2}$ sixteenths of an inch long, and is about the same size as Moon's character. The pages occupied by the Gospel of St. John, in Frere, are 96. In his medium type, in which the length of the letter is 4-sixteenths of an inch, the same matter would go into 67 pages; and in his smallest type, in which the length of the letter is $3\frac{1}{2}$ sixteenths, it would occupy 46 and a third pages. It has been found, by an experience extending over 27 years, and embracing many hundreds of individuals of all ages and conditions, that all those who can read the largest type can read the medium, and almost all can read the smallest. The medium type is very generally preferred, as being more pleasant to the finger, and many with delicate touch prefer the smallest for the same reason. Thus it will be seen that, by selecting a well-devised character, not only can a very considerable saving be made in the size, and therefore in the cost of books, but by a diminution of size, within certain limits, the character is rendered absolutely more legible. The Gospel of St. John, in Moon's type, occupies 140 pages.

(b.) As respects the advantage of conformity with the Roman letter.—Much has been said and written on this subject. A favourite argument with the advocates of the Roman letter is, that by its use a blind man can be assisted in his reading by those around him who are possessed of sight. This, no doubt, would be valid if no simpler character for the blind had been invented, but when we have to choose between a character in the reading of which the blind can be assisted by the seeing, and one which is so simple that no assistance is required, there can hardly be a doubt as to which ought to be used. Another argument in favour of a Roman character is, that if the blind use a different character from the seeing, their isolation is thereby increased. It is difficult to understand how this dreaded isolation can be produced by using a character thoroughly well suited to the touch, easily learned, and read with rapidity and comfort, instead of one which possesses none of these advantages. Another plea for the use of the Roman letter is, that by its means the blind can write in a character understood by everybody. This writing is, as we shall presently see, a very imperfect process; but this argument is undoubtedly of some weight. These remarks apply simply to the existing systems in which the Roman letter is employed. It is probable that a much more legible alphabet might be constructed, but, after our 96 years of experience and experiments with the Roman letter, another failure may well be feared. The small angularised Roman letter of Dr. Howe, of Boston, which is used in most of the United States Asylums, is probably as good a form as any, and, if printed in a larger size, would not be difficult to feel; in its present size, however, it is far too small, and has signally failed in America. We have valuable statistics on this subject. The American asylums are all State institutions, and have to furnish accounts to their respective State legislatures of the work done by them. Out of 664 pupils in seven asylums, where the Roman character of Dr. Howe is used, one-third learn to read fluently, one-third by a process of spelling, and one-third fail altogether. In the Missouri Institution, where the French dotted character is used, two-thirds learn to read fluently, one-third by spelling, while none fail; and it must be borne in mind that those who learn to read by this system also acquire an admirable method of writing. Moon's system retains those Roman letters which can be easily distinguished, and thus makes a transition between the systems in which the Roman character is used and those which employ purely arbitrary signs. For this reason, and from its great simplicity of construction, it is more easily learned than any other, and therefore is well suited to the great mass of the poor, who, from want of intelligence or of application, cannot learn one of the short-hand systems. Its great bulk, however, involving costliness of production and comparative slowness of reading, is a serious obstacle to its general use.

(e) As regards the advantage of reading from left to right, and from right to left, alternately.—In Frere's system the lines are read from left to right and from right to left alternately, an arc of a circle taking the finger from the end of the upper to the beginning of the lower line. The plan may be illustrated by imagining the letters to be fixed on the upper edge of a long string. Let it be supposed that this string is doubled backwards and forwards upon itself in such a way that the letters always occupy its upper edge. This will give a good idea of Frere's method of reversing the line; not only is the line reversed, but every letter in it is also reversed, so that the finger, when moving forwards, whether towards the right or towards the left, meets the characters in the same position, and is, in fact, never moving backwards, in the same manner that a person may walk to the end of a room, turn and walk back, yet is moving forwards in both directions. Moon, on the other hand, while borrowing the reversal of the line from Frere, retains the letters in the returning line in the same position as the advancing, so that the finger in the return line meets the characters in the opposite direction from that in the advancing line; and to those accustomed to Frere's simpler method of reversal an unpleasant feeling is produced, exactly comparable to walking backwards. The following example of both modes of reversal, in which Roman capitals are used, will make this clear:—

Frere's Method.

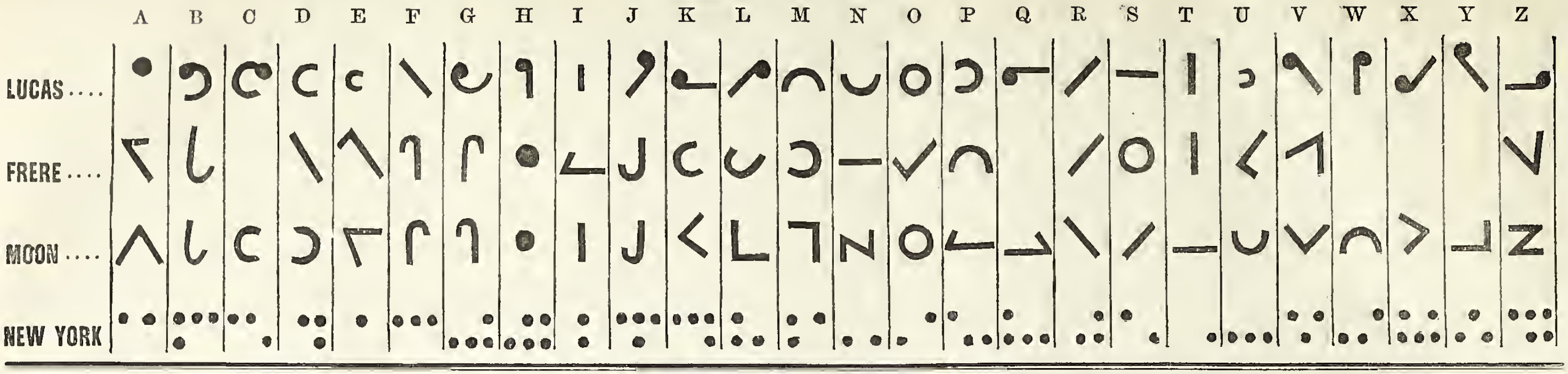
I WILL MAKE DARKNESS
.MƎHT ƎЯOFƎᗺ THϽIᒧ

Moon's Method.

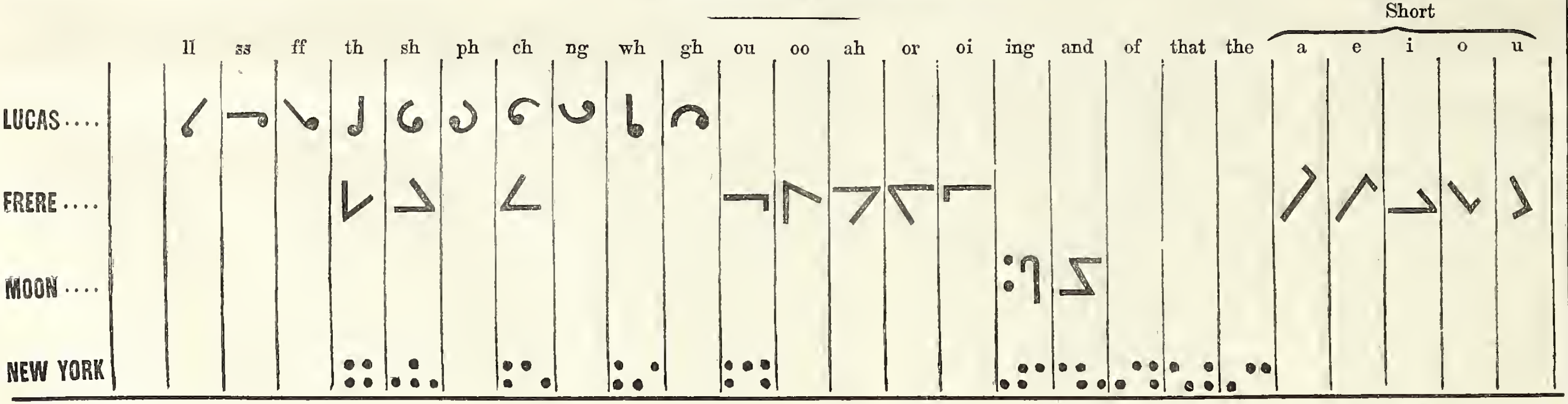
I WILL MAKE DARKNESS
.MEHT EROFEB THGIL

No doubt habit will accustom a reader to either plan, and probably there is not much difference in the difficulty of either, but, as we shall see by-and-bye, it is absolutely necessary for writing that the pupil should thoroughly understand that, whichever way he goes, he is moving forwards; it is, therefore, wise to

ALPHABETS USED BY THE BLIND.



ADDITIONAL SIGNS.



*** Frere's characters are purely phonetic, but have been included in this table for the sake of comparison. The first ten signs in the second part of the table are used by Lucas for numbers. A similar use is made by Moon of Frere's long and short vowels (with the exception of and which stand for P and Q respectively). stands for "1"; O for "0"; N for "tion"; for "ment".

accustom him in reading to a process which he will have to follow in writing. Opinions differ widely among the blind whether it is best to read forwards in one direction and backwards in the other, or forward in both; there seems, however, among those who have had experience of the return line, that there can be no doubt of its great value, as by its use no time is lost by the reading-finger having to return from the end of the upper to the beginning of the lower line; the left hand also need not be engaged in keeping the place, by marking the beginning of the lower line, and this setting free of the left hand enables it to follow the right in reading, to take its place or to rest.

(*d*) *Advantage of a short-hand as contrasted with a full written system.*—By a short-hand system, reading is more rapid, and a nearer approach is made to the way in which the eye takes in a whole word at a glance, than in a full written system. The books are also more manageable and less costly, but the stenographic method is destructive of correct spelling, and in the phonetic method this is not even attempted; yet it is advisable, for many reasons, that the blind should be able to spell. The short-hand systems seem, therefore, to be of the same use to the blind as to the seeing; not being of universal application, but extremely useful to those who have to read much, or *viva voce*, as for clergymen, Scripture-readers, &c. Both short-hand systems are very defective. The character of Lucas's, as was before observed, is unsatisfactory, and the mode of contraction in many instances is objectionable; while in Frere's, whose character seems to surpass every other in distinctness, the rules are unnecessarily complicated, and ambiguity sometimes arises from an attempt at over contraction.

In all the systems which we havo hitherto considered, the letters, whether Roman or arbitrary, are formed by raised lines. The method employed for writing them is as follows:—Small cubes of wood are used with projecting pin points, so placed as to assume the form of each letter. The paper to be written on being laid on a soft surface, the pin point letters are pressed into it; each point carries some of the paper before it, forming a little prominence on the reverse side, and as the pin points are very close together, the series of little prominences formed by them feel to the fingers like serrated lines. This plan ought rather to be called printing than writing; it requires great practice, and is at the best very slow and imperfect; yet it has its uses, as by employing Roman capitals the blind can correspond with the seeing. The letters, however, are not sufficiently distinct, and I must confess that when receiving communications from blind correspondents written in this manner, or with pencil, I always think that it would have been more satisfactory, both to writer and reader, if the letter had been written from dictation. Printing from the Roman letter (not embossed) can be effected by the blind with considerable rapidity by means of Hughes's typograph, or Foucault's writing machine, but the blind writer cannot read what he has written, and the apparatus is so costly that it is not procurable by the poor. Various plans exist to enable the blind to keep their lines when writing with a pencil, or with a stile on carbonised paper, but such writing can only be used for correspondence with the seeing, and cannot, of course, be read by touch.

We now come to the third class of systems, viz., those in which the letters are formed by a combination of dots. These are:—

1. The Braille system, universal in France both for writing and printing, and very much used for both purposes in Switzerland, and employed as the *written* character in almost all countries, with the exception of the United Kingdom.

2. The Carton type, which was introduced into Belgium by the Abbé Carton, who sought to retain, as far as possible, the form of the Roman letter. This has not been very effectually done, and has only been attempted in about half the letters of the alphabet. This endeavour to reconcile a dotted written system with the Roman letter is mainly interesting, as showing how tenaciously a clever man clung to the Roman letter, even while abandoning it.

3. Hughes's system consists of large and small dots, and lines placed in different positions. It never obtained much currency, and seems never to have attracted the attention which its ingenuity merited.

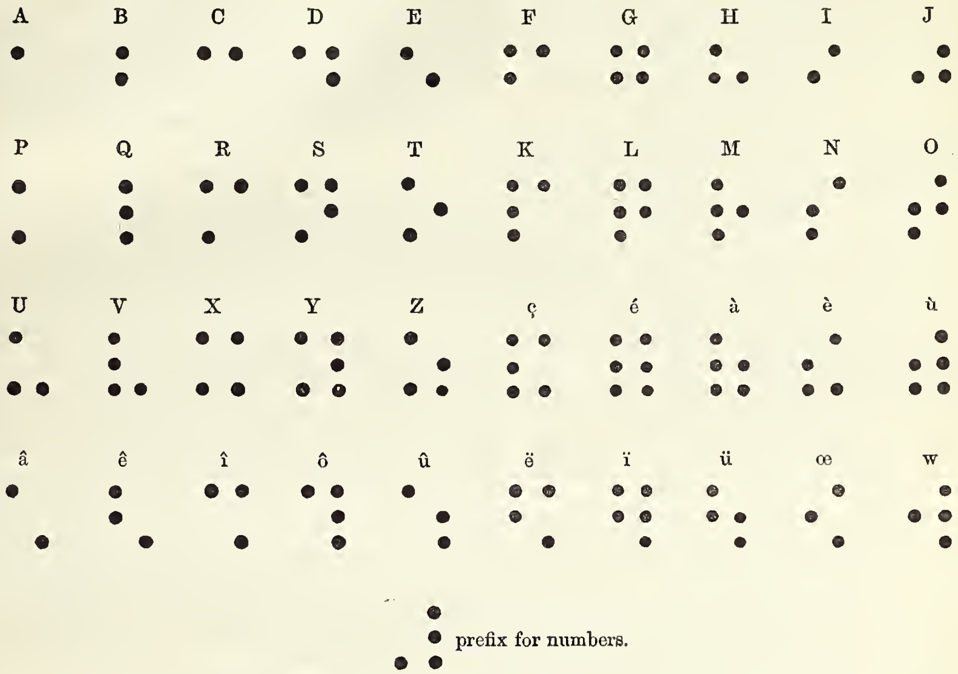
4. A modification of the French method has been lately proposed in New York, and seems to have much to recommend it. To begin with the French method. This was invented in 1834, by M. Braille, a blind pupil of the Institut des Jeunes Aveugles. It spread with great rapidity, and has, as we have before seen, become almost the universal written language of the blind. Its signs are purely arbitrary, and consists of varying combinations of six dots placed in an oblong, of which the vertical side contains three, and the horizontal two dots. For writing, a frame is used consisting of a grooved metal bed, containing 10 grooves to the inch; over this is fitted a brass guide, punched with oblong holes, whose vertical diameter is three-tenths of an inch, while the horizontal diameter is two-tenths. This perforated guide is fixed into a light wooden frame, like the frame of a slate, which is attached to the grooved metal bed by hinges. The paper is introduced between the frame and the grooved bed. The instrument for writing is a blunt awl, which carries a little cap of paper before it into the grooves of the bed, thereby producing a series of little pits on the side next the writer. When taken out and turned over, litttle prominences are felt, corresponding to the pits on the other side. The reading is performed from left to right, consequently the writing is from right to left; but this reversal presents no practical difficulty as soon as the pupil has caught the idea that, in reading and writing alike, he has to go *forwards*. The brass guide has a double row of openings, which enables the writer to write two lines; when these are written, he shifts his guide downwards until two little pins, which project from the under surface at its ends, drop into corresponding holes of the frame, when the writer writes two more lines, and this operation is repeated until he arrives at the bottom of the page.

The first ten letters, from "a" to "j," are formed in the upper and middle grooves; the next ten, from "k" to "t," are formed by adding one lower dot behind to each letter of the first series; the third row, from "u" to "ù," is formed from the first by adding two lower dots to each letter; the fourth row, from "â" to "w" similarly, by adding one lower front dot.

The first ten letters, when preceded by the prefix for numbers, stand for the nine numbers and the cypher; the same signs, written in the lower and middle grooves, instead of the upper and middle, serve for punctuation. The seven last letters of each series stand for the seven musical notes, the first series representing quavers; the second, minims; the third, semibreves; the fourth, crotchets. Rests, accidentals, and every other sign used in music can be readily and clearly expressed, without having recourse to the staff of five lines which forms the basis of ordinary musical notation, and which, though it has been reproduced for the blind, can only be considered as serving to give them an idea of the method employed by the seeing, and cannot, of course, be written. By means of this dotted system, a blind man is able to keep memoranda, accounts, write his own music, emboss his own books from dictation, and carry on correspondence, which last, however, seems to me to be the least valuablo part of the invention, since the embossing is liable to be effaced by transmission through the post; it is, however, a privilege highly valued by the blind.

The extreme value of teaching music thoroughly to the blind does not lie only in the circumstance of the great pleasure derivable from it, but still more in the fact, too much neglected in England, that the profession of music,

BRAILLE'S ALPHABET.



and especially that of tuning, is almost the only means by which a blind man can thoroughly maintain himself—at least this is found so in Paris. No accurate statistics on this subject have been published, but I believe I am not far from the truth when I assert that, out of 150 blind boys in the Paris Institution, 60 per cent. become sufficiently good musicians to earn their living, and rather more than 30 per cent. become first-rate tuners and organists, by means of which occupations, and especially by the former, they are enabled to live most comfortably, while following a pursuit congenial to their tastes. The unfortunate remainder, who have no musical tastes, have to live partly by handicraft and partly by alms, as is the case with the great majority of the blind in this country. It is, indeed, sad to see many blind musicians in London, who are perfectly capable of maintaining themselves by tuning, absolutely starving from want of employment; and this arises partly from the imperfect education resulting from the want of a written musical character, and partly from the prejudice which still unfortunately exists against the blind among our pianoforte makers. This has, in a great measure, disappeared in Paris, where there are, indeed, several blind manufacturers employing seeing workmen.

But this French system, though extremely useful, is not perfect. The letter is too small for ready recognition by the unskilful or hard-handed, and if this is sought to be remedied by increasing the size, the reading finger does not cover the whole of the letter, and has to proceed up and down, feeling out each letter, instead of following the even gliding motion essential to good reading. The modification proposed in New York (see table, p. 197) remedies this defect, though this does not appear to have been the intention of its promoters. It proceeds on the principle that the letters occurring most frequently in the English language should be represented by the fewest number of dots, and that the letters should be so spaced that a letter composed of one dot should not, as is the case in the French system, occupy the same room as one with six dots. For this purpose the oblong, consisting of six dots, composing the root-form of the letter, is placed horizontally instead of vertically; the greatest vertical depth of any letter is two dots instead of three. From these two changes results a saving of about one-third in space; this involves a saving of about one-third in the price of printed books; writing is rendered more rapid; and, as the size can now be increased, owing to the diminution of the vertical length of the letter, it can be made sufficient for the dullest touch. Ten-word and part-word signs have been introduced, which effect a further saving of nearly one-third, while they no not interfere in the least degree with correct spelling. These advantages make it well worth while to consider whether this modification of the Braille system ought not to be adopted as the written system of all English-speaking blind, but before such a step is recommended, the question should be carefully considered in all its bearings on musical notation as well as on ordinary writing; and this leads me to notice the movement which has lately taken place in England to determine the best form of raised alphabet, and which is the more hopeful as it has originated among the blind themselves, who know from personal experience what are the requisites of a raised alphabet. A Society has been formed, under the name of the "British and Foreign Blind Association," for improving the embossed literature and promoting the employment of the blind. We are engaged this evening only with the first of these points, which has to be investigated by the executive council, who are all totally blind, with the exception of myself. It is required of each member of the council that his defect of sight shall be such as to oblige him to use the

finger for the purpose of reading. He must be able to read at least three systems, and must not be pecuniarily interested in any. We have now been at work in concert for about eighteen months. We have carefully investigated with our own fingers each system that has obtained a permanent footing either here or in foreign countries, and we have had before us the most intelligent of the blind of London, and have carefully taken down what they have had to say about the advantages and disadvantages of the systems with which they were acquainted. We are also in correspondence with many of the best informed, both in Europe and America, and we hope that, by continuing this method of investigation, we shall be able to propose something worthy of general adoption. It is high time that some such step should be taken. The Bible, or the greater part of it, is printed in English in five different systems, while portions of it exist in several others. This want of concert occasions great unnecessary expense in production, at the same time that the large circulation, which would tend to reduce the price of embossed books in the same way that it tends to cheapen ordinary printed matter, is effectually prevented by different institutions teaching and printing in different characters, so that the blind who have been educated at one institution cannot read the books printed at another, and to produce a literature available for all, the same books have to be printed in five or six different systems; and, as if the existing confusion were not already sufficiently great, a society has lately been started at Worcester, with the object of printing the Bible and other books in a sixth system. While, notwithstanding all this well-intentioned misdirected energy, the blind of England have as yet no plan of writing worthy of the name, and are in this respect far behind France and other civilised countries. It so happens, however, that this utter want of concert, which has hitherto prevailed in this country, gives us an unusual abundance of material for deciding the points under consideration. As each system is defective in some particular, the most intelligent of the blind learn several, and thus we have something like an enlightened public opinion among our blind, which probably does not exist in any other country. It is very remarkable how in this, as in most subjects, those who know least are the most decided and uncompromising in their advocacy of the method with which they happen to have come in contact, while among the blind themselves, who know different systems, there is, if not agreement, at least an approach to it, and great diffidence in expressing a decided opinion. We have hitherto been almost exclusively occupied with the methods of reading and writing, but the same want of harmony exists in the methods used for imparting a knowledge of arithmetic, geography, &c. There are several forms of calculating boards used in different institutions in England, some of which are very superior to others, but all seem to me far better than that used in Paris. Here, again, we see the necessity of a central society to examine into the various inventions, and to bring into general notice that method which appears upon the whole to be the best. The same observations apply to the method of embossing maps and geometrical problems, which appear to be susceptible of very great improvement. Not the least advantage of an organisation like the British and Foreign Blind Association is, that a central source of information is thus established, to which all supposed new inventions for the use of the blind can be referred. If, as often happens, the invention is one which is already well known, and has been superseded by something better, much time and trouble may be saved by its being possible to ascertain this at once, while anything which is really new, and which promises well, may be worked at with vigour by a number of skilled men acting together. Whether the present association is destined to produce harmonious action among those interested in the blind throughout the civilised world, time alone will show. We have already met with an amount of success which, when we began our labours, we were told it would be Utopian to expect; and I believe that, with sufficient time and cordial co-operation among the blind themselves, that our most sanguine hopes will be realised; in the meantime, the work upon which we are engaged is one which brings its own reward, for I cannot conceive any occupation so congenial to a blind man of education and leisure as the attempt to advance the education, and improve the condition of his fellow-sufferers, for which work the very calamity which has unfitted him for most other occupations, has made him peculiarly well-suited.

DISCUSSION.

The Chairman said he was sure no one would think that Dr. Armitage had detained them too long. Nevertheless, their time had nearly passed, and the Secretary informed him that there would be no leisure for discussion, without protracting their proceedings beyond the usual hour. He would, therefore, confine himself to a very few words, chiefly in acknowledgment of Dr. Armitage's services that evening. He was sure that the expectations which had been reasonably raised had been fully realised. He had made the fullest use of his combined science and experience, and it might be said that in him the advantages of the seeing faculty and the advantages of blindness were united. The good sense, the logical sequence, and the conciseness and clearness of his statement were very creditable to him indeed, the more so because, while making it, he had no assistance from notes, but spoke entirely from his memory of a well-digested paper, which he had written previously. He was sure that they must all desire to encourage him to go on and prosper. He could not help being struck with the remarkable similarity between the case of Dr. Armitage and that of a man of a much greater name—Milton, who said—

> "When I consider how my life is spent,
> Ere half my days, in this dark world and wide,"

and then he expressed precisely that misgiving which Dr. Armitage had just confided to them:—

> "And that one talent, which is death to hide,
> Lodged with me useless."

But Milton was animated with a desire to do his duty, and he added:—

> "Although my soul more bent
> To serve therewith my Maker, and present
> My true account, lest he, returning, chide.
> . . . . . . Yet I argue not,
> Against Heaven's hand or will, nor bate a jot
> Of heart or hope; but still bear up and steer
> Right onward."

They knew the result of this determination to do his duty, and to exert his remaining faculties to the utmost of his power, in the case of that great man, and they had reasonable ground for expecting, from the ability of various kinds, though in a totally different line, which Dr. Armitage had exhibited, that he also would perform a noble part in life for the benefit of his fellow-men. His lecture teemed with interesting questions, all of which might be illustrated by analogies drawn from the written and printed advocates of various countries, according to the various systems; but he could not enter into the consideration of these, as time would not allow. He would only make one observation as to the extreme importance of having one uniform system, first of all, in reference to the blind themselves. At present their minds were disturbed, their spirits were discouraged, and they were confused by a variety of systems, and the least thing they could do for them was to give them one uniform system to learn, and no other. He would then have them observe the immense practical importance of having only one system in regard to providing the blind with the means of study, because the faculty of reading would be of but little use to the blind unless the ample stores of literature were opened to them. He

need not dwell upon the enormous importance of reading to the blind. They all knew the story of Sir William Jones—that most wonderful and accomplished man—who, when he was a boy, used often to go to his mother to ask questions of her, and the reply she always made was—"Read, and you will know." If those silent stores of the knowledge of all the great men of every age were of great importance to those who were able to go about and mix with their fellows, and to use all their faculties in the acquisition of knowledge, how very much more important were they to the blind? And yet they could not be provided for them so long as there was a variety of systems; whereas if one system were fixed upon, the necessary funds would soon be supplied by benevolent individuals, by government, by donations, by bequests, and in all sorts of ways, and he should not despair of their being able to provide, in a few years, a library for the blind, containing all that was useful and interesting in literature, poetry, prose, history, science, and everything else. The only essential condition for this was, that there should be one uniform system agreed upon; and he conceived that it was of far more importance that the system should be a uniform one, than it was that the system adopted should be the most perfect system possible. The most advanced existing phonetic systems of Europe were far from perfect, and he was sorry to say that our own system was one of the least perfect; they could pick a hundred holes in it, drag a coach and horses through it in every direction, and yet they had seen how much they could do with it, and how much they had profited by it. He contended that their object should be not so much to obtain a perfect system as to obtain a uniform system. He could go on for an hour over the same ground, giving a variety of illustrations, and putting the matter in a variety of aspects, but it would be taking up their time unduly if he were to do so, and he begged to be allowed to move a vote of thanks to Dr. Armitage.

Mr. Colmer asked permission to make one or two remarks. Although he was not unmindful of what the chairman had just said respecting the time, and that no discussion could be permitted, yet the gravity and importance of the subject were such, that he could not refrain from saying—as a blind man himself, having been so for thirteen or fourteen years past, and as having had to do, probably, more with blind people than any other person in London—that the subject was one of very much more importance than the general public really understood it to be. The fact was, that the present systems were very conflicting, and as there had recently been an attempt made to obtain money from the public for the purpose of printing a system for the blind, which the blind at large could not possibly avail themselves of, if that attempt were successful the effect would be that the £10,000 asked for would nearly all be squandered. The blind population belonged mostly to the artisan and labouring classes, who went blind when advanced in life, and they had not a touch sufficiently delicate to enable them to read some of the systems proposed. The Roman character, of all other characters, was the worst, and was of no use for general reading. It was an easy matter to produce books, but quite another matter to enable the poor persons for whom they were intended to read them. His experience amongst the blind had been very extensive, and he therefore knew their wants and their desires. There were 3,000 of them in London, and though he did not mean to say that he represented the whole of them, yet he knew some 700 or 800. He had made extensive inquiries among them, and knew others who had done the same, and as the result, he could state the general opinion of the London blind was that the Roman character was totally useless. What might be said about modifications of it was another matter; but, as it was, it would be entirely a failure, and it would be indeed a thousand pities if any large sums of money were expended upon such a work. He would add that the council which had been referred to had the sympathies of the blind. It was a very easy thing, and nothing more natural than for sighted persons to say that, if they were to become blind, they would like to feel the letters they had been accustomed to see, but the experience of the blind was entirely opposed to that, and, in fact, it was one thing to feel, but a very different thing to see.

The vote of thanks was then passed.

EDUCATIONAL NOTES.

Meetings have been held during the last few days in various parts of the country, for discussing the Education question. The principal ones may be briefly referred to.

Several League meetings took place on Monday evening, the 17th January. At Worcester, a large and influential meeting was held in the Guildhall, under the presidency of the Mayor. Mr. R. E. Barnett, Mr. G. Dixon, M.P. for Birmingham, and the Rev. Canon Melville, were among those present. To a resolution in favour of the League, the Rev. Canon Melville moved, as a rider, that the motion was defective, inasmuch as it made no provision for religious education.—At Halifax, a large meeting in connection with the League was presided over by Mr. Alderman Shaw. The Rev. John Ellis moved, and the Rev. W. J. Townsend (Methodist) seconded, a resolution in favour of compulsory, unsectarian, and free education, which was carried.—On the same evening an enthusiastic meeting was held at Stockport, the Mayor presiding. Resolutions approving the scheme of the League were unanimously carried. —An enthusiastic meeting in support of the League was held in the Temperance Hall, Sheffield, under the presidency of the mayor, Mr. T. Moore. Mr. A. J. Mundella, M.P., and the Rev. Charles Vince, of Birmingham, attended as a deputation on behalf of the League. A resolution to the effect that the state of national education in this country calls for immediate action on the part of the government was carried.

An enthusiastic meeting was held at Bolton, on the 20th January, on behalf of the League. Mr. H. Lee, president of the local branch, presided. Among the speakers were Mr. Henry Ashworth, Mr. Mellor, and Mr. George Dixon, M.P.

On the 24th January, a meeting was held in the Town Hall, Canterbury, for the purpose of hearing an address from a delegate of the League, and resolutions were passed approving its objects.

On the same day, a public meeting was held in the Stratford (Essex) Town Hall, to hear addresses from Sir C. W. Dilke, Bart, M.P. (who is chairman of the London Branch of the National Education League); Mr. Andrew Johnston, M.P. for South Essex; Mr. W. Fowler, M.P. for Cambridge; Mr. Antonio Brady, J.P.; and other gentlemen, on the education question. A resolution, approving of the objects of the League, was carried with acclamation.

A League meeting was held on the 25th instant, at Stroud. Mr. Dixon, M.P., and Mr. Winterbotham, M.P., having spoken, Sir W. Guise, in seconding a resolution in support of the League, said the present biblical lessons given in day schools never did anybody any good. All that was really wanted in these schools was to teach the child to be honest, truthful, and conscientious.

A conference of leading Nonconformists has been held at Newport, Monmouthshire, at which resolutions in favour of free, secular, unsectarian, and compulsory education were passed. The conference expressed their deliberate opinion that religious teaching, as imparted in schools, was of little value, and might safely be left to parents and pastors. The importance of establishing advanced schools, in addition to elementary ones, was agreed upon.

An important conference of Nonconformists has been also held at Leeds, under the presidency of the Mayor, at which ministers from various towns in that part of

Yorkshire were present. Upon the whole, the principles of the League were accepted by the meeting, with some difference of opinion on points of detail.

A meeting of ministers of all denominations has been held at Chester, to discuss the subject of education. The Dean of Chester presided. The discussion disclosed divergent views on the part of Church of England and Nonconformist ministers; and ultimately it was unanimously agreed that delegates from the League, the Union, and the Manchester Committee should be invited to attend a public meeting, and explain the different schemes.

Delegates from the Liverpool Trade Societies held a meeting there recently, to hear an address from Mr. Geo. Howell, and to confer with regard to the position to be taken up by trades' societies towards the present educational movement. Considerable difference of opinion was expressed, particularly on the religious question, but in the end, Mr. Melly, M.P., submitted a document which was adopted. This affirms the policy of compulsion, the insufficiency of voluntary effort, and the establishment of schools supported partly by local rates for gratuitous education; also that any injury to the existing schools which may arise from the competition with the new free schools be met by an increase of government aid, and that the new schools should be unsectarian, that is, that no doctrinal teaching of any sort should be allowed during school hours—the recognition of religion in an undogmatic form (including the reading of the Bible at certain hours) being left in the hands of the local authorities.

A conference of clergy and laity was held at Shrewsbury, on the 17th January, at which Archdeacon Allen presided. Resolutions were carried to the effect that the meeting was not indisposed to accept a conscience clause, in villages and other places where the parents have not a choice of schools, on the principle of perfect liberty of teaching to the teacher, and of perfect liberty of withdrawal to the parent; that no paupers should be allowed permanent out-door relief unless their children, if under 11 years of age, were sent to school; and that the Factory Act regarding children under 12 years of age might be usefully extended to other employments.

On the 18th January, a conference of clergy and laity was held at Leeds, to consider the subject of middle-class schools for Yorkshire, in connexion with the Church of England. Lord Wharncliffe occupied the chair, and among the speakers were the Dean of York, the Vicar of Leeds, Sir A. Fairbairn, &c., and resolutions were passed in favour of establishing additional public schools for the various grades of the middle-class in Yorkshire, in connexion with the Church of England, opinions being expressed that such schools ought to receive State aid.

A preliminary meeting of supporters of the Union has been held at King's College, London, under the presidency of the principal, the Rev. Dr. Barry. It was attended by clergy of various denominations, and a committee was formed to arrange for public meetings in London.

The Union held a meeting on the 24th January at Manchester, the Hon. A. F. Egerton, M.P., in the chair. Among the speakers were, Lord Howard, of Glossop, Archdeacon Durnford, and the Rev. E. Bishop (Primitive Methodist). A letter was read from the Bishop-designate of Manchester, expressing the "strongest possible desire to preserve the religious character of the education given in elementary schools," but, adding at the same time, that "sorry as he should be to see us adrift into secularism, he holds that any form of real (even if it be partial) enlightenment is both better in itself, and more hopeful for the rightly understood interests of religion, than the darkness of ignorance."

The Earl of Dartmouth presided at a meeting at Wolverhampton, on the same day, in favour of the support and extension of the present system of national education. An important letter was read from Lord Lyttelton. He expresses himself in favour of indirect compulsion, and is disposed to make the principle of the Factory Act universal. He objects to gratuitous education, as a rule, and thinks that the argument that parents who pay rates would thus pay for their children's education, might be used to justify a man who pays poor rates, and throws the support of his family on the parish. His lordship fears that, if secular schools were established as a rule, we should get a much worse class of schoolmasters, as they would be forbidden to introduce religious teaching, and also because the present invaluable schools would thus be gradually swept away. He assumes that the League schools would be "secular," and attaches no value to the use of the word "unsectarian." He regards the phrase "unsectarian Christianity" as "about the most utter nonsense that ever was obtruded on the notice of the public."

The Bishop of Exeter, in a speech at Torquay, speaking of the various educational schemes, says:—"I shall do my very best to support that which seems to me most likely to give general education over the whole country; and so far as is consistent with general education, I wish the education to be thoroughly religious. I am distinctly not afraid of secular education at all. I believe that secular education is, even by itself, a very good thing; but I believe it is by no means the best thing, and I am quite sure that we ought to get the best thing if we can, and if we cannot get it, then as far as we can."

An important educational conference for Wales has been held at Aberystwith. A large number of delegates were present. The Rev. F. S. Johnstone, of Merthyr, read a paper advocating compulsory education. The Rev. Dr. Davies, of Haverfordwest College, read a paper on the best means of providing religious instruction to the young, supposing a national system to be adopted. Resolutions were submitted to the conference to the effect that — 1st. Any system of national education, fully meeting the requirements of Wales, must be free, secular, unsectarian, and compulsory. 2nd. The direct religious teaching now imparted in day schools is of but little value, and the spiritual training of the young may be fully and safely entrusted to the parents and the Christian Church. 3rd. Religious liberty being the birthright of every individual, no national scheme of education should enforce attendance at denominational schools, or levy rates for sectarian or even religious instruction. Resolutions with reference to advanced schools, and also as to arrangements for the union of existing schools with the national system, were also laid before the conference, but there was great difference of opinion, and a very stormy discussion took place, especially on the religious question. Ultimately, however, it was agreed that religious education might safely be left to the parents and guardians of children taught in public schools.

It is remarkable that the *Daily News*, in a recent leader, expresses a doubt as to the policy of attempting to settle the Education question in the coming session. "It is possible," it says, "that members of the Cabinet may differ from Mr. Forster as to the ripeness of the question for immediate settlement. We believe with Mr. Forster that the religious difficulty is vanishing; but if Mr. Gladstone and the Cabinet should not share this opinion, and should think it is only diminishing, but not yet sufficiently diminished to render legislation possible; if they should tell us that, in their belief, another year will find the country better prepared for a final and satisfactory settlement, on the widest and most truly national basis, it might be possible to admit that a case for delay has been made out."

On the other hand, a very advanced Liberal, Mr. T. B. Potter, M.P., in a recent address to his constituents, said, that while he was in favour of a purely secular system, and would give no State money to teach sectarian doctrines, he thought that Parliament was bound to consider, not what was abstractedly the best measure, but

what was actually practicable, and they would be obliged to carry the best Bill they could under the circumstances. He hoped every inducement would be tried before resorting to compulsion.

Mr. Stansfeld, in addressing his constituents at Halifax, recommends all Liberals to press forward the question, and he believes that the government are prepared for any additional expenditure that may be necessary to secure the blessings of education for the people.

At Marylebone Workhouse, an educational test has been invented by the guardians, for paupers who are above the class of the ordinary labourer. Hitherto, stone-breaking and oakum-picking have been the sole tests; but they are not only hard on people unused to severe manual work, but are ill-adapted to that class. It is now arranged that a man—other than a day labourer—applying for relief shall be put to a "school" and not a "labour" test. He is to go through six hours' instruction—his submission to school discipline and confinement testing his real need. It is calculated that no grown man, able to earn subsistence, would willingly "go to school" again; and it is believed that only starving men will undergo the ordeal.

THE EFFECTS OF EXTENDED EDUCATION.

The Bishop of Exeter, in a recent address to the Friendly Societies of Devon and Cornwall, warns us not to be too sanguine as to the immediate results of any educational measure that may be passed. However well the system may be organised, unless the parents of the children "really care about the education—unless they make the children feel that education is in their eyes a matter of the utmost importance—then, depend upon it, there will be no result worth getting." It is well that this view of the bishop's, whose warm interest in the subject and whose enlightened views are so well known, should meet with every consideration, for exaggerated expectations, when disappointed, are too often fatal to steady and continued effort. The parent must be brought to believe that education is such a benefit to his child as to be worth the sacrifice of the present value of the child's labour. No doubt by educating the children we shall be able by degrees to convince the parents of the value of the knowledge imparted, but this will be a work of time, and here compulsion of some kind seems, for the present at least, clearly necessary.

Another aspect of the question, which has been recently revived by a leader in the *Times*, is perhaps even more important, and that is, how far the increase of education will produce discontent. The journal referred to says:—"The opponents of education, in the time of our grandfathers, used to declaim against it because it would make the poor discontented with their position in life. Their protest was overruled, and very properly overruled; but in their main assumption they were undoubtedly in the right. Education does make, and has made, the poor discontented. There is nothing more striking in the comparison of the England of to-day with the England of eighty years since than the different view the labourer takes of his life. Hard, painful, and unremitting toil was then accepted as his inevitable lot. He was a mere drudge, and, as long as he had a possibility of living, never questioned the propriety of the arrangement that made him a drudge. Traces of this submission may be still be found both at home and on the Continent, but it was once universal. Ireland probably afforded the most exaggerated form of it. How did the Irish peasant of Miss Edgeworth's time live? His hovel possessed the architectural pretensions of a pigsty. His food was of the coarsest quality, and not abundant in quantity. His dress was rags. His subsistence was beggary. Yet he was satisfied, and in a way happy. But the labourer has now tasted the fruit of the tree of knowledge; he has learnt of other worlds than his own, of spheres where the rudest toil meets with a recompense greater than he enjoys; and the consequence is a demand on his part to possess a better lot." No one would now pretend to advocate that on this account we ought to relax our efforts in the cause of education, but at the same time we ought to be prepared for the increased discontent which must inevitably arise from a wider spread of knowledge, and our efforts for the amelioration of the physical condition of the working classes should be more than ever earnest, so as to avoid the serious evils that might otherwise arise.

CORRESPONDENCE.

MR. P. L. SIMMONDS'S PAPER ON PEARL FISHERIES.

Sir,—On reading Mr. Simmonds's interesting paper (page 175), I notice that he adopts a story about Gresham's grinding a pearl which had cost him £15,000 into a cup of wine, to do full justice to a toast to Queen Elizabeth. This history is quite apocryphal. No doubt it took its origin from the dramatist Heywood, who, in his play, in two parts, "The Troubles of Queen Elizabeth," printed in 1606 and 1609, or about thirty years after Gresham's death, introduced the fantastic incident of Sir Thomas swallowing the powdered pearl:—

> "Here fifteen *hundred* pound at one clap goes!
> Instead of sugar, Gresham drinks the pearl
> Unto his queen and mistress; pledge it, lords!"

The real price of pearls in Gresham's time might easily be found in the contemporary State papers. "Burgon," vol. ii., page 354, has explained how purely fabulous was the history of the pearl swallowing. Richard Clough, Gresham's correspondent, as appears from the State paper office letters, elsewhere quoted by Burgon, was looking out, in 1566, for a pearl for Lady Gresham, and wrote to his principal, "As touching the perle, it shall be goode or ells I wyll not buy it." But as to pearls worth hundreds, to say nothing of thousands, of pounds, not a word is found of such extravagances in the correspondence. In November, 1566, Clough seems to have had difficulty of mind about giving as much as five *shillings* for each of 20 pearls. Writing from Antwerp, he observed (see Burgon, vol. ii., page 179), "And for the perles for my Lorde of Sussex, I cannot fynde in all thys towne so many as my lorde wolde have, and to match with his; for that his are very faire for the fashion. And in some places where I have found 200 or 300 of that fashion, I cannot find 20 that wold lyke my lorde; and yett they wyll not be given for five shillings, so that I have made brokers to seke out so many, an if they be to be had in all thys towne, whereof I wyll wryte you by my next."—I am, &c.,

Frederick Hendriks.

GENERAL NOTES.

Russia and Persia.—A telegram from St. Petersburg announces that the Shah of Persia has accorded Russian merchant vessels free entry into the Persian ports on the Caspian Sea.

Utilisation of Sewage.—This question was again discussed at the Surveyors' Institute. A general opinion was expressed that the application of town sewage to land would ultimately be found the most advantageous way of meeting a difficulty which has so long existed.

Prints and their Production.—The collection of prints, recently exhibited at the Society of Arts, will shortly be opened to the public as an exhibition at the South Kensington Museum. A descriptive and explanatory set of labels will be attached to the examples, for the information of visitors.

Fire Clay Bricks as the Backs for Domestic Fire-places.—The ironmongers have now adopted the practice of selling unburnt fire-clay bricks, so that the public can, by moistening the bricks, mould them into the required shape for their own use.

Observatory on Mount Ararat.—*Cosmos* states:—The Russian government have resolved to establish an astronomical and meteorological observatory on this mountain, situated near Tiflis, in consequence of the excellent report given by M. Piazzi Smyth of the fitness of such high situations, deduced from his experience in the Pic de Teneriffe.

Free Trade in France.—There has been a debate in the French Senate on free trade. The argument was all on one side. M. Rouher, who, though out of office, has great influence, declared "in his soul and conscience, and after long study, that free trade was the law of the future, and the condition of high civilisation, and that the commercial inquiry would show that the peace of the world depended on free trade."

Army Railway Corps.—The Austrian War Office has entered into an agreement with the railway companies of the empire, in pursuance of which such railway *employés* as are liable to military service will, in case of war, not be summoned to the ranks, but form a military transport corps, which will be stationed on the lines of railway in the vicinity of the field of battle, and direct the transport of troops and war material.

Artificial Porphyry.—It appears that MM. Sepulchre and Ohresser have perfectly succeeded in utilising the slag of the iron blast furnaces for the manufacture of paving-stones, which withstand a crushing weight of more than 400 kilos. per square centimetre, and have answered for the purpose of paving several streets at Brussels and Paris, and stood heavy traffic far better than even the celebrated Quenast stones. The streets paved with this material at Brussels have a heavy gradient.

Candles.—The first step to introduce the tallow candle was taken in the twelfth century, when the tallow torches came into use; during the following century the tallow candle was brought before the public, much in the same form and shape which it bears at the present day, only they used a flaxen wick, cotton being unknown at that age. These candles were, however, considered a great luxury, and used only by persons of high rank. Some fifty years later, the wax candles were manufactured for the courts and royal palaces. When they were first used in churches their cost was enormous. A wax candle offered on the altar to the praise of God was considered a royal gift.

Sugar Products.—The beet sugar manufactory at Fond du Lac, Wisconsin, turns out 1,000 pounds of sugar per day. The product of this factory is already in the market, and is highly spoken of. The sugar harvest of Louisiana is generally finished, and the yield, according to the New Orleans *Crescent*, will not much exceed that of last year. Whatever increase there may be, will be due to the larger area of cane planted. The product per acre is not equal to that of the last crop. The sugar, however, is of excellent quality, though the prices are not what were expected, from the disorder and waste in the island of Cuba. Despite the destruction of many plantations in the process of the revolution, the imports from other countries continue to increase in such ratio as to keep down the prices of the home product. Careful estimates place the sugar crop of the United States at 100,000 hogsheads this year, against 80,000 in 1868. Although the acreage was much larger this year than last, the season thus far has been less favourable. The sugar crop of Cuba is put down at 8,313,000 boxes of 450 pounds each, a reduction of about one-eighth, as compared with the crop raised just before the revolution in the island began.

Plumbago.—A Ceylon paper says, that if the world wants plumbago, and is willing to give a good price for it, Ceylon can supply the want. Fresh discoveries of the mineral are constantly made. Should mining continue at the rate of the past few years, government will have to regulate the pursuit with reference to the safety of the people, otherwise lives will be lost from foul air and the collapse of badly-formed pits. We observe that the Chamber of Commerce found the specimens of this mineral sent some time ago from Hambantotte to be defective, from the presence of "rust," or, as the natives call it, "water mark." The progress of this staple export has been from 46,000 cwt. to, in round numbers, 200,000. The quantity has considerably more than quadrupled in five years, and more than doubled in the past as compared with the previous season.

Postal Telegraphs.—The final transfer of the property and undertakings of the telegraph companies to the Postmaster-General commences this day, and will be completed by the morning of the 5th February, when the Post-office will assume the conduct of telegraph business throughout the United Kingdom, and the uniform shilling rate will come into operation. A list of the offices and stations in the United Kingdom, which are to be opened for telegraphic business by the department on the 5th February, will be published in the *Postal Official Circular* of the 31st instant. On the night of the 4th February, the notice plates, inscribed "Postal Telegraph Office," which have already been supplied for the purpose, must be exhibited conspicuously on the outside of the offices named in the list above referred to. The notice plates having been duly affixed, the change of system and the introduction of the uniform shilling rate will take place at eight a.m. on Saturday, the 5th of February. The necessary notices to the public are in course of preparation.

The Neutrality of Ocean Cables.—The subject of the neutrality of ocean cables in time of war, as well as the means by which their destruction is to be prevented, is one which will attract the speedy attention of all maritime powers. The United States Government has taken the initiative in these questions, and the administration is preparing to open negociations for a treaty between the nations interested. The diplomatic representatives of the United States have been instructed to submit for the consideration of foreign governments the propriety of holding a convention, the object of which will be to provide that no exclusive concessions of right to lay submarine cables shall be granted by any government; that no government shall have the right to *vise* messages transmitted through the cables; that they shall be treated as neutral property during war; and that their destruction at any time shall be an act of piracy. At present, there is no law for the punishment of persons seeking the destruction of the wires.

Collection of Customs.—Of the 132 custom-houses, which collect a gross revenue of £22,700,000, not fewer than thirty-four are worked at a loss, for their expenses amount to £90,305, while the whole of their proceeds are only £48,000. A few instances may be given. Scilly collects £1, at the cost of £1,143. A nice time of it must the Scilly custom-house officers have in collecting so much a year. Ryde collects £5, at the cost of £1,236. Stornoway collects £11, which costs the Exchequer £1,353. Aberystwith does better, £73 being collected at the cost of £1,913, and yet the loss in this case is greater than in the others. There are eleven ports in which the net yield is less than £1,000 each. In one class of instances, £24,641 were spent last year in collecting £29,135. In another class twenty-nine ports yield only £172,000, at the cost of £100,000. It is very clear that such ports should be closed without delay, and the custom-houses be sold. No private individual would thus conduct his business at a loss; and the great officers of State are now applying the principles of private business to that of the nation.—*Daily News.*

Large Steamers for the Jute Trade.—Messrs. Alex. Stephen and Sons, shipbuilders, Dundee, who had the credit of first introducing the steam-screw into the whale and seal fishing trades, have resolved on building a large steam vessel, specially adapted to run through the Suez Canal, for the importation of jute from Calcutta to Dundee, *alias* "Jutopolis." A model of this vessel has already been made, and the iron of which she is to be built has been contracted for. Her draught of water has been fixed with special reference to the most reliable reports respecting the navigation of the Suez Canal and the Red Sea. In her construction great care will be taken, with the view of securing that the cargo shall be carried and delivered in good condition. That she will be of very large size may be inferred from the fact that she is to carry 1,700 tons of dead weight. This experiment will doubtless be watched with much interest. The rule at present with sailing vessels is to occupy nine months on the average in making the voyage out and home again. It is expected, however, that the steamers by the Suez Canal route will make the double journey in three months. The importance of the jute trade is at once seen when it is mentioned that during last year, till the end of November, the imports into the United Kingdom were 102,098 tons, of which about 82,000 tons were imported into Dundee.

Modern Therapeutics.—The *British Medical Journal* says:—" Various old and doubtful remedies have fallen into merited disrepute. Our shelves have fewer bottles; but we decant from them most liberally. We are gradually substituting arms of precision for the old blunderbuss. More iodide of potassium has probably been swallowed during the last year than in any corresponding period; and, amongst the results, we may boast the disappearance of radesyge in Norway, of yaws in our West Indian colonies, and of most of the severe forms of tertiary syphilis at home. Arsenic holds its ground—probably gains more. Mercury may perhaps have a little diminished in quantity, but has been directed with better aim. Belladonna and digitalis as specifics, where needed, still enjoy the unbounded confidence of those who know when to prescribe them. Of quinine, steel, and the rest of the unharmful tonics, it is needless to speak. Amongst remedies which are nearly novel, we might mention the use of Calabar bean for tetanus. The bromide of potassium is now manufactured in England alone, for medicinal use, at the rate of a ton a week. Part of this is exported to America. This marvellous salt appears to possess sterling virtues and no vices, and to be adapted to the control of precisely those forms of nervous disease which are common in high states of civilisation. Many of these are of the most distressing character, and appear to be influenced for good in the most undoubted manner by this remarkable drug. Many facts respecting it still wait investigation, but as yet it is gaining repute in all directions."

Silk Reeling in England.—This industry, the importance of which cannot be over-rated, is likely soon to come before the public in a practical form. Among the many operatives now deprived of work by the continued depression in the silk trade, people who have been all their lives accustomed to the manipulation of silk, there will be found many who, with a reasonable amount of instruction, will acquire readily the most improved methods. The prevailing opinion appears to have been that the process was impossible in this country, because of the climate; another opinion has been that our operatives could not reel. As regards the first objection, the fact is, that the cocoons are reeled in hot water, in an artificial atmosphere, conditions which are available anywhere; and, as regards the second, it is not surprising that our people do not understand a process they have never seen nor been taught in any way. There would be no difficulty in teaching the art in England any more than in China, Japan, or different parts of Europe. In India, the reeling as it at present exists, shows the immense advantage that the introduction of European machinery and educated labour has over the native, the one producing a beautiful thread, suitable in every way for the most delicate fabrics, while many of the native skeins have the appearance of a coarse hemp, not at all clean. We believe there is a proposal to form a company, and to test the thing thoroughly by means of machinery of the most approved description, and we hope the effort will be successful.—*Journal of the Silk Supply Association.*

Drawback on Sugar.—The following declaration regulating certain points connected with the execution of the Convention concluded at Paris, on November 8, 1864, relative to drawbacks on sugar, was signed at Paris on the 27th of December last:—The governments of Great Britain, Belgium, France, and the Netherlands being desirous to regulate, by common agreement, certain questions connected with the execution of the Convention of the 8th of November, 1864, relating to the sugar system, the undersigned, duly authorised to that effect, and after having taken cognizance of the final protocol signed on the 5th of October of the present year by the Commissioners of the four governments assembled in conference at the Hague, have agreed upon the following arrangements:—Article 1.—The period granted to the French government by the declaration of the 4th November, 1868, for establishing an exact correlation between the duties to be levied on raw sugars, and the yields fixed by the declaration of the 20th of November, 1366, is extended to the 30th of June, 1871. Article 2.—Provisionally, the duty on the importation into France of refined sugars coming from the other contracting States remains fixed at forty-eight francs eighty-five centimes (48f. 85c.). Article 3.—The limit of exportation of pieces produced from sugars admitted under the system of temporary importation, which was fixed by the second paragraph of Article 10 of the Convention of the 8th November, 1864, is lowered from standard No. 10 to standard No. 7. Article 4.—Each of the contracting governments shall be at liberty to subdivide the classes of raw sugar mentioned in Article 1 of the Convention of the 8th of November, 1864, and to create sub-standards corresponding to such subdivisions, without, however, having the power to modify the limit of any one of the actual classes, nor to lower the average yield of the different qualities of sugar comprised in those classes. Article 5.—The present arrangement shall come into execution from and after the 1st of January, 1870.

Lectures to Working Men.—Mr. Ellis A. Davidson, lecturer on engineering and architectural drawing in the City of London Middle-class Schools, and author of Cassell's "Technical Manuals," is about giving a series of practical lectures to artisans at the various institutions and large works in London and the suburbs. The subjects of these lectures will be the various branches of linear drawing, as applied to trade, manufactures, and design, and will include practical geometry in its different branches, perspective, projection, development of surfaces (of so much importance to the metal-worker in finding the shapes metal or other material must be cut, so that when folded or bent the required objects may be formed, with the apertures for the reception of solids, by which they are to be penetrated); building construction, and the drawing required by workmen in the different branches of the building and other trades (as masons, carpenters, joiners, bricklayers, cabinet-makers), mechanical drawing, including the projection of the screw, teeth of wheels, &c., &c. The lectures will be of the most elementary character, so as to bring the instruction within the grasp of men who have not previously had opportunities for such studies. The subjects will be worked out to a large scale on the black board, and will be further illustrated by numerous models, &c. The object of the lectures is to show working men the necessity of scientific and technical education, so as to enable them to compete with foreign artisans, and to

urge them to avail themselves of the advantages held out to them by the science and art classes already established by the government, or to exert themselves in forming others in their respective localities. The conditions on which these lectures are to be given are such as will enable institutions and groups of workmen to receive them on very favourable terms. Similar lectures are to be given to schoolmasters, who wish to introduce preparatory technical instruction in their schools. With the view of introducing technical instruction into the army, it has been arranged by the authority of the commanding officer, that Mr. Davidson is to give a course of four lectures to the brigade of Grenadier Guards at the Wellington Barracks.

Indian Maize as a Table Vegetable.—Mons. T. C. Brabant, writing to the *Standard*, says:—The use of maize as a table vegetable in a green state (or as "green corn"), though so general in America and elsewhere, and of such value on account of its nutritious qualities, is not, as yet, sufficiently known in this country. As considerable interest has been, however, already shown in this matter both here and in America, I should be thankful for permission to record my experience of two seasons' trial of 20 new varieties (almost all previously unknown in England) which, through the kindness of the American government, were sent to me for trial. The summer of 1868 was remarkably favourable, while that of 1869 was cold, stormy, and adverse, so that a fair conclusion may be arrived at. In both years the varieties ripened perfectly, but in the former year the cobs were sensibly larger. Much ignorance necessarily prevailing here as to the planting and use, it would be well to remember that maize requires a rich, warm soil, and attention to water supply. At the Sewage Farm at Barking Creek, it made the amazing progress of three inches for 33 consecutive nights. The seeds should be sown in boxes under glass, and planted out in fine weather, in May, in a favourable situation. About 15 inches apart is sufficient; and about July the plants should be staked, in all exposed localities, at about the height of three feet from the earth. In October the cobs will be ready for table use; they will then have the grains of about the size and consistency of marrowfat peas, and will take about 30 minutes to boil. Fresh butter is spread over them when ready. For children and invalids they are most nutritious, being, in fact, the basis of all the expensive preparations used. They also supply a valuable table vegetable in the autumn, equal to peas. It may be added that the common yellow maize of commerce is too coarse for table use, and can be imported dry cheaply enough, but these 20 varieties now first introduced by myself are extremely curious in themselves, and the pure white varieties from Georgia, with the pale yellows and pink sorts, furnish a succession of rich and delicate flavoured vegetables of great value in the autumn season.

Canals and Roads.—In the course of his presidential address to the Institution of Civil Engineers, Mr. C. B. Vignoles, in referring to the subject of canals and roads, says:—"In 1758, the celebrated Duke of Bridgewater got his first Act of Parliament, and, says a popular writer of the past century, 'then was awakened a general ardour for similar improvements among the landowners, farmers, merchants, and manufacturers of the kingdom, and although there was not a Louis XIV. nor a Colbert to encourage them, there wanted not engineers equal to Riquet; and England, though late, began to rouse from her lethargic slumber, and pour forth the riches she possessed in her inland provinces.' The rage for making canals became almost as great as ever was the subsequent mania for railways; this continued during nearly forty years, in which time the greater number of our canals were cut, though their construction was pursued, less ardently, for thirty years longer. The aggregate length of our canals is now about 3,000 miles, against 3,154 miles in France, exclusive in both countries of inland navigation by rivers. About the same period in the last century with the introduction of canals, the attention of all classes of the community was directed to the state of the highways. Bills for making turnpike roads were passed every year, to an extent which seems almost incredible, and, in addition, every parish was compelled by the force of public opinion, supplemented by indictments and fines, to improve their ways; this pressure, acting through more than a century, has resulted in our having in the United Kingdom a network of fully 160,000 miles of good carriageable roads, France having at this very day barely 100,000 miles of such roads of all classes. I say nothing of the wonderful improvements and embellishments of every town and suburb in the empire. Thus much for private energy and self-reliance as against centralisation. I may add that the proportionate superficial areas of France and of the United Kingdom are as 12 to 7. I cannot here refrain from a momentary interruption, to express my astonishment at the state of the roads in India. In the Bengal district only, which has an area exceeding 250,000 square miles, or much more than double that of the United Kingdom, there are (should the statistics which I have seen be correct, and I know no cause for doubting them) over that immense district only 1,869 miles of metalled roads, 6,064 unmetalled, and 6,815 unmetalled and unbridged, which last are described in an official report as 'mere tracks, passable in the dry season only.' And this district is stated to have a population of forty millions of people, paying one-third of the revenue of India! In one province only (Patna), where cultivation has wrought beneficial changes, there are reported to exist three or four miles of road to every twenty square miles of country; but in the rest of the Bengal district there is only one mile of track to twenty square miles of territory. In this country there are twenty-six miles of good roads within the same area; in France, as yet, only ten miles.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. United Service Inst., 8½. 1. Dr. J. McGrigor Croft, "The Fish-tail Rudder for all Classes of Vessels." 2. Rear-Admiral E A. Inglefield, "Screw-ship Steerage, and a description of the Hydrostatic Steering-gear fitted on board H.M.S. *Achilles*, with the results of Experiments at Sea; also plan of Apparatus fitted on board the Turkish Iron-clad *Fethi Bulend*."
British Architects, 8.
Actuaries, 7. 1. Professor Ludvig Oppermann (of Copenhagen), "On the Graduation of Life Tables, with special application to the Rate of Mortality in Infancy and Childhood." 2. Mr. W. J B. Woolhouse, "On the Proper Method of Loading the Premiums required for the Grant of Life Annuities and Assurances."
Medical, 8.
London Inst., 4.

Tues ...Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."
Civil Engineers, 8. Mr. John Thornhill Harrison, "On the Statistics of Railway Expenditure and Income, and their bearing on future Railway Policy and Management."
Pathological, 8.
Anthropological, 8.
Syro Egyptian, 7½.

Wed ...Society of Arts, 8. Captain O'Hea, "On Recent Improvements in Small-arms."
Pharmaceutical, 8.
R. Society of Literature, 4½.
Obstetrical, 8.

Thur ...Royal Inst., 3. Prof. Odling, "Chemistry."
Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Mr. J. G. Baker, "Revision of the Genera and Species of Capsular Gamophyllous *Siliaceæ*." 2. Dr. Collingwood, "On a New Form of Cephalopodous Ova."
London Inst., 7½
Chemical, 8.
Royal Society Club, 6.
Artists and Amateurs, 8.

Fri ......Royal Inst., 8. "A Talk respecting Verona and its Rivers."
Geologists' Assoc., 8.
Philological, 8½.
Archæological Inst., 4.
R. United Service Inst., 3. Mr. W. B. Lord, "Hints for Travelling and Campaigning."

Sat ......Royal Inst., 3. Mr. Scott, "Meteorology."

Journal of the Society of Arts.

FRIDAY, FEBRUARY 4, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock :—

February 9.—"On Loss of Life at Sea." By J. W. Wood, Esq.

February 16.—"On Emigration." By Thomas Plummer, Esq., late of British North America. On this evening Sir George Grey, K.C.B., will preside.

February 23.—"On Economy in the Use of Fuel for Domestic Purposes." By Capt. Douglas Galton, C.B.

March 2.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

March 9.—"On Tramways in Streets." By W. Bridges Adams, Esq. On this evening Chas. Hutton Gregory, Esq., will preside.

March 16.—"On Surface Decoration. By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

March 30.—"On the Causes and Consequences of High Charges for Passengers by Railway, and the Advantages to be expected from an adoption of Low Fares. By G. W. Jones, Esq.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at 8 o'clock.

Syllabus.

1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat.

2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel.

3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smithery furnaces; means of arresting combustion; extinction of fires.

4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin oil; measurement of light; photometry.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course will be issued shortly.

EDUCATIONAL CONFERENCE.

The Council propose to hold a Conference on National Education, on Monday, 7th February, with the view of attempting to harmonise, into a measure practicable at the present time, the best features of the Manchester Education Union, the Manchester Education Bill, and the Birmingham Education League proposals. The following letter of invitation has been issued :—

28th January, 1870.

Sir,—I am directed by the Council to invite your attendance on Monday, February 7th, at a Conference to be held here, to discuss the best means for providing throughout the country a national system of education, whereby every child in the kingdom may have opportunities of obtaining elementary instruction, of a character at least equal to that which is within the reach of all in Prussia, Saxony, Switzerland, and other continental countries. Two years ago, the Society of Arts held a Conference on "Technical Education." The Conference was well attended by leading manufacturers, members of Parliament, and others interested in education, and much valuable information was elicited. A Committee appointed at that conference drew up a report, in which the absolute necessity of an improved and extended system of scientific instruction was pointed out. At the same time, it was felt by the Committee, and the Council are strongly of opinion, that it is of comparatively small value to provide means for the teaching of science and art, unless, in the first instance, the people are prepared to take advantage of it by an extended and improved system of elementary or primary instruction. The present time is considered particularly fitted for such a conference as is contemplated. There are several schemes for attaining the object now before the country, tending to one common end, but differing in the means. The Society of Arts takes no political or party view of the question, but sympathises with all who profess to provide for the national education of the people. The Council are desirous of discussing how far the various schemes may be harmonised, and whether the common object—the education of the people—may not thus be attained, and they put forward for discussion the enclosed suggestions, in the hope that they may lead to a practical result, and that an object of such imperative and pressing importance as the education of the people may not be sacrificed in contention over the means. Under these circumstances, the Council hope they may be favoured with your attendance.

I have the honour to be, Sir,
Your obedient servant,
P. Le Neve Foster, *Secretary.*

(Enclosure.)

Programme for Discussion at the Society of Arts Conference on National Education, on Monday, February 7th, 1870.

In which it is attempted to combine and supplement, in a scheme practicable at the present time, the best features of the National Education Union, the Manchester Education Bill, and the National Education League proposals :—

1. That, in order to secure the education of every child in England and Wales, on which all parties are agreed, it is necessary that a Department of Government, responsible to Parliament, be constituted for the purpose.

2. That such Department have ample and discretionary powers to take all necessary measures to cause proper elementary and secondary education to be placed within the reach of the whole people: also to make economical

combinations of existing schools: also to have direction of all grants and public funds devoted to National Education: also to have charge of all national museums, galleries, &c., so that the same may be properly administered in aid of National Education throughout the United Kingdom, and to appoint Inspectors of Education instead of merely Inspectors of particular schools, as at present.

3. That the means of instruction in reading, writing, arithmetic, with moral training, and, where practicable, in drawing, singing, and drill, be provided for all, and encouragement given by government to the higher branches of general culture, science (especially that bearing on health), and art. Infant, primary, and secondary schools, colleges, and universities receiving government aid, to be helped to act in union, as far as possible, as parts of a system.

4. No child to be hired for labour who is under a given age, and not receiving satisfactory instruction. Compulsory attendance at school to be obtained by fining employers (according to the principle of the Factory Acts) if they employ such children.

5. Industrial schools, Union schools, Reformatory schools, and the like, to be brought under one direction, and compulsory powers given to take and educate children of the vagrant or destitute class.

6. Existing efficient denominational schools to continue to receive parliamentary grants, with government inspection for reading, writing, arithmetic, drawing, singing, and drill.

7. Each denomination to provide for its own religious teaching.

8. Where additional schools or increased school accommodation appear to be wanted, an official inspector to inquire what improved arrangements can be effected: in populous places, by organisation and combination of existing schools, or by the adoption of a half-time or any other system. The locality to be invited to establish schools, giving it the option to do so by voluntary subscription under the existing system, or by rates administered by a local board according to rules; but if the locality neglect to do so, then government to establish the necessary schools, charging the cost of buildings, and a proportion of the annual expense, on the rates of the locality. Existing schools to be free to adopt this system.

9. School fees to be maintained, and be applicable to the augmentation of the incomes of the teachers, who will thereby be stimulated, and the schools kept efficient. Fees of destitute and pauper children to be paid out of the rates.

10. Existing training schools for teachers to be consolidated as early as practicable, and, if need be, enlarged.

11. Parliament to give provisionally large and general powers to the Education Department, whose work, until a national system has been matured and is in action, must be tentative.

The Conference will commence at 11 o'clock, adjourning at 1·30 for half-an-hour. The Discussion will be resumed at 2 o'clock, continuing till 5, when it will be adjourned till 7 o'clock in the evening. Members of the Society and their friends interested in the question are invited to attend.

ELEMENTARY EXAMINATIONS.

Secretaries of Local Boards desirous of using the questions supplied by the Society, are reminded that they must apply for the same before the 10th inst., stating number of *male* and *female* candidates desirous of being examined in *each* grade.

ART-WORKMANSHIP COMPETITION.—1869-70.

The works sent in in competition for the Prizes offered this Session are now placed in the Great Room, for the inspection of Members and their friends.

The following is a catalogue of the works received:—

FIRST DIVISION.

Works executed after Prescribed Designs.

Carving in Wood.

Class. No.

1 (*d*)— 1. Panel carved in oak, after a work in the South Kensington Museum; by Frederick Moutrie, 219, Stanhope-street, Hampstead-road, N.W. Price £12 10s.

2. Panel carved in oak, after the same design as the above; by Mark Rogers, jun., 111, Tachbrook-street, Pimlico, S.W. Price £10 10s.

3. Panel carved in oak, after the same design as above; by W. T. R. Price £12.

4. Panel carved in oak, after the same design as the above; by J. Osmond, 5, Featherstone-street, Bunhill-row, E.C. Price £14.

1 (*e*)— 5. Carving in wood, after an entablature of a chimney-piece in the South Kensington Museum; by C. H. Line, 41, Prince of Wales-crescent, N.W. Price (when finished with enriched moulding) £14.

1 (*f*)—5a. Part of frame in possession of Henry Vaughan, Esq.; by Thomas Wills, 15, Anglesea-villas, New-road, Hammersmith, W. Price, when completed, £17.

Repoussé Work in any Metal.

2 (*a*)— 6. Work executed in iron, after the *Martelli* bronze mirror-case, in the South Kensington Museum; by A. Dufour, 10, Cranbourn-street, Leicester-square, W.C. Price £15.

7. "The Virgin and Child," iron panel in low relief, after an example in the South Kensington Museum; by A. Dufour, 10, Cranbourn-street, Leicester-square, W.C. Price £9.

8. "The Virgin and Child," iron panel, after the same example as above, by Adolf Ostertag, 24, High-street, Bloomsbury, W.C. Price £15.

9. "The Virgin and Child, copper panel, after the same design as above; by W. Holliday, 14, Nailour-street, Islington, N. Price £15.

2 (*b*)—10. Repoussé work in silver, after a tazza in the South Kensington Musuem; by A. Clark, 29, Gloucester-street, Hoxton, N. Price £5.

Hammered Work in Metal.

3 (*a*)—11. Hammered iron knocker, after an example in the South Kensington Museum; by A. S. Price £6.

12. Hammered iron knocker, after the same example as the above, by John Wilkins, 15, De Beauvoir-crescent, N. Price £8.

13. Hammered and chased iron knocker, after the same example as the above; by Thomas Bayley, 45, Lower Camden-street, Birmingham. Price not stated.

Carving in Ivory.

4 (*a*)—14. Plaque executed in ivory, after one of Silenus and Amorini, by *Fiamingo*, in the South Kensington Museum; by H. Godard, 1, Hargrave-park-terrace, Junction-road, N. Price (when finished) £20.

Chasing in Bronze.

Class. No.
5 (*b*)—15. Work executed after a missal cover in the South Kensington Museum; by H. J. Hatfield. Price £18.

Etching and Engraving on Metal.

6. —16. Niello work, engraved on nickel silver, after an arabesque by *Lucas Van Leyden*, in the South Kensington Museum; by James S. Gill, 26, Moreton-street West, Pimlico, S.W. Price £2 10s.
17. Niello work and inlay combined, after the same example as the above; by James G. Gill, Moreton-street West, Pimlico, S.W. Price £3 10s. 6d.
18. Engraving on metal, after the same example as above; by George P. Smith, 19, Guildford-street, Wilmington-square, E.C. Price not stated.
19. Engraving on copper, after the same example as the above; by Walter James Dyer, Falkner-street, Ryecroft, Gloucester. Price £5 5s.
20. Engraving on copper, after the same example as the above; by John Gittins, 9, Angela-gardens, Hackney-road, E. Price £4.

Painting on Porcelain.

8 (*a*)—21. Painting on porcelain, after a drawing by *Raphael*, in the South Kensington Museum; by John Slater, Field-place, Stoke-on-Trent. Price £5 5s.
22. Painting on porcelain, after the same example as the above; by Thomas Stanway, Bovey Tracey Pottery, Bovey Tracey, Devon. Price not stated.
23. Painting on porcelain, after the same example as the above; by W. J. W. Nunn, 10, Grafton-street, Globe-lane, Mile-End, E. Price not stated.
24. Painting on porcelain, after the same example as the above; by Herbert Simpson, 6, Queen's-road, Bayswater, W. Price £3 3s.
25. Painting on porcelain, after the same example as the above; by Miss E. Henwood, 18, Craven-terrace, Bayswater, W. Price £3 3s.
26. Painting on porcelain, after the same example as the above; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £4 4s.
8 (*b*)—27. Painting on porcelain, ornament after *Aldegrever*; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £6 10s.
28. Painting on porcelain, ornament after *Aldegrever*; by W. H. Slater, 7, James-street, London-road, Stoke-on-Trent. Price not stated.
29. Painting on porcelain, ornament after *Aldegrever*; by Miss E. Henwood, 18, Craven-terrace, Bayswater, W. Price £6 6s.

Decorative Painting.

9 (*a*)—30. Ornament, after *Aldegrever*; by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £7.
31. Ornament, after *Aldegrever*; by Walter T. Morgan, 41, Pelham-street, Brompton, S.W. Price £3 3s.
32. Ornament, after *Aldegrever*; by Charles Hardgrave, 14, Bloomfield-terrace, Pimlico, S.W. Price £3.

Cameo Cutting.

Class. No.
11 —33. Head, after the bust of "Clytie," in the British Museum; by 37, Mornington-crescent, N.W. Price £10 10s.

Die Sinking.

15 —34. Die, sunk after a Wedgwood medallion, in the South Kensington Museum; by A. Walker, 19, Alexandra-cottages, Penge, Surrey. Price £7.

Bookbinding.

16 (*a*)—35. A Writing Case, Mosaic pattern; by Louis Genth, 90, High Holborn, W.C. Price not stated.

Embroidery.

17 —36. Work executed after an Italian altar frontal in the South Kensington Museum; by the Misses Emma and Henrietta Pfänder, 28, Bayham-street, Camden-town, N.W. Price £7.

Illumination.

18 —37. Ornament Border on Vellum, after *Guilio Clovio*—Miniature, "Christ in the Garden of Olives;" by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £9 10s.
38. Ornament Border of MS., after an original in the South Kensington Museum—Miniature, "Birth of Christ;" by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £9 10s.

SECOND DIVISION.

Specimens of the Applieation to Ordinary Industry of Preseribed Art Proeesses.

A. —39. Clock Dial, enamel painted, in colours and gold; by James Thwaites, 25, St. John-street-road, E.C.
40. Do. do., enamel painted, white ground and black ornament; by the above.
41. Do. do., face decorated and painted in enamel, on iron; arabesque; by Charles W. Pfänder, jun., 28, Bayham-street, Camden-town, N.W. Price £5 6s.
B. —42. Frame for a miniature, engraved and enamelled on metal; by Alfred Gray, 41, Brooksby-street, Islington, N. Price £8 8s.
D. —43. Earthenware slab, suitable for insertion in the frieze of a stone or marble chimney-piece; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £5.
E. —44. Tablet, painted with enamel colours; designed and painted by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries; modelled by James Griffiths, 14, Hartshill, Stoke-on-Trent. Price £5 5s.
G. —45—49. Champagne glasses, with filigrani in the cup, stem, and foot; by T. C. E. Barnes, 135, Camden-street, Birmingham.
H. —50. Pair of book covers, decorated by painting and varnishing on both sides, china tints on black ground; and gold ornament, on chromatic ground; by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £10 10s.
51. Ditto, decorated on one side, ornament in box-wood tints and gold on crimson ground; by the above. Price £6 10s.
52. One specimen of book-cover, ornament on black ground; by the above. Price £4.

Class. No.

H.—53. Ditto, ornament in gold, on green and red ground; by the above. Price £3.

54. Pair of book-covers, strap-work, on vermillion ground, with green and gold; by C. W. Pfänder, jun., 28, Bayham-street, Camden-town, N.W. Price £6 12s.

I —55. Set of fire irons; by E. Millward. Price not stated.

J. —56. Silver drinking cup, executed in the Italian style; by Alexander Crichton, 16, Southampton-buildings, Holborn, W.C. Price £20.

L. —57. An envelope case in sycamore and ebony woods; by W. M. Holmes, 101, Dean-street, Soho, W. Price £7.

58. Do.; by Edward T. Grove, 14, William-street, Regent's-park, N.W. Price £5.

R. —59. Design for balcony; by G. Emms. Executed by J. Emms and Sons, 3, Prince's-street, Union-street, Boro', S.E. Price, when finished, £12.

60. Do.; by William R. Smith and Henry R. Smith, 6, Park-terrace, Battersea-park, S.W.

THIRD DIVISION.

Articles sent in for Exhibition, in addition to those in accordance with the Prescribed Designs and Processes.

Metal Work.

61. Mask, repoussé in copper, of one of the Laocoon Group; by G. Deere, 11, Hermes-street, Pentonville, N.
62. Sleeping child, repoussé in copper; by the above.
63. Grotesque mask in copper; by Robert Tow, 36, Aldenham-street, St. Pancras-road, N.W.
64. Group of fighting horses, in copper; by the above.
65. Clock case, design from natural ferns, to form a family portrait stand; by G. Berry, 31, Brewer-street, Golden-square, W. Price £16 16s.
66. Cigar case, engraved; by the above. Price £3 10s.
67. Portrait of His Royal Highness the Prince of Wales, in silver; by W. Holliday, 14, Nailour-street, Islington, N. Price £25.
68. "The Crucifixion," repoussé in silver; by E. Richards, 29, Myddelton-street, E.C.
69. "Hercules and Omphale," embossed in copper; by Joseph C. Day, Church-road, Tottenham, N. Price £10.
70. "Solitude;" by the above. Price £6.
71. Group of flowers embossed in copper; by J. R. Godfrey, 20, Chatham-road, Wandsworth-common, S.W. Price £6.
72. Entablature and upper portion of pilaster, and repoussé work, showing the introduction of wrought metal in furniture; by the above. Price not stated.
73. Inlay of German Silver in Copper, centre embossed in sheet copper; by A. Millward, 7, Hanover-street, Long-acre, W.C. Price not stated.
74. Circular Ornament, pierced in metal; by the above. Price not stated.
75. Wrought-Iron Banister, designed by T. Anson for grand staircase of British and Foreign Bible Society's new building; executed by J. Emms and Sons, 3, Prince's-street, Union-street, Borough, S.E.

Wood Carving.

76. Inlay in various woods, "Moses;" by W. Clayton, 125, Wardour-street, Oxford-street, W. Price £10.
77. Ditto, "Elias;" by the above. Price £10.
78. Walnut-wood Clock Case; by Mark Rogers, 111, Tachbrook-street, Pimlico, S.W. Property of, and lent by, Messrs. Trollope and Sons, Halkin-street, S.W.

No.

79. Clock Case in wood; by P. Meur, 138, Drummond-street, Hampstead-road, N.W. Price £10.
80. Ditto, by E. T. Grove, 14, William-street, Regent's-park, N.W. Price (when finished) £16.
81. Carved Frame in lime-tree wood; by G. H. Bull, 16, Millman-mews, Millman-street, Guildford-street, W.C. Price £18.
82. Conventional frame, for gilding (unfinished); by C. McKenzie, jun., 1a, Bishop's-terrace, Walcot-square, Kennington-road, S.E. Price £5.
83. Panel in oak, for jamb of chimney-piece represented in the drawing accompanying it; by T. Fernee, 22, Werrington-street, Oakley-square, N.W. Price £4 4s.
84. Oak bracket; by R. A. Brangan, 54, Foley-street, Portland-place, W. Price £30.
85. Panel in birch-wood, for a side-board door; designed and executed by William Matthews, Manor-street, Chelsea, S.W. Price £10 10s.
86. Panel in oak; by James Minns, Mariner's-lane, Norwich. Property of, and lent by B. E. Fletcher, Esq.
87. Ditto ditto
88. Ditto ditto

Modelling in Plaster.

89. Bust of Rt. Hon. W. E. Gladstone, M.P.; by John Long, 24, Stangate, Westminster-bridge, S.E. Price not stated.
90. A Patera, modelled from nature; by the above. Price not stated.
91. Bust, "Esperance;" by W. Matthews, 79, Manor-street, Chelsea, S.W. Price, in box-wood, with ebony pedestal, £10; in statuary marble, £15.
92. Ditto, after a head in terra-cotta, in Royal Academy; by the above. Prices as above.
93. Medallion (original), "Cardinal Wolsey;" by G. Morgan, 41, Pelham-street, Brompton, S.W. Price £1 1s.
94. Medallion, modelled from life; by the above. Price £1 1s.
95. Medallion, portrait of Archbishop Manning; by Albert Heness, 3, Egbert-street, St. George's-road, N.W. Price £1 10s.
96. Medallion Portrait of Princess Louisa, to be made in Jasper or Wedgwood ware, for cabinet decoration; by W. Wright, Mrs. Wallis, St. Martin's, Stamford. Price £1 10s.
97. Bust, modelled from life; by E. Renversez, 6, Castle-street East, Oxford-street, W.
98. Medallion Portrait of the Duc de Liancourt, modelled after the photograph accompanying it; by the above.
99. Model of the Florentine Boar in the South Kensington Museum; by W. Marshall, 3, Smith-terrace, King's-road, Chelsea, S.W. Price £2.
100. Wreath of Flowers; by T. Godfrey, 21, Chatham-road, Wandsworth-common, S.W.
101. A North American Indian; modelled by A. Dufour, 10, Cranbourn-street, Leicester-square, W.C. Price £7.
102. Ornament; by James Frampton, 10, Prospect-terrace, Britannia-road, S.W.
103. Bracket; by the above.
104. Ornament; modelled by W. Edge, Park-street, Stoke-on-Trent; and designed by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries; unfinished through accident in the oven.

Modelling in Terra Cotta.

105. Bracket, after original by *Donaletto;* by W. Wright, Mrs. Wallis, St. Martin's, Stamford. Price £5.

MODELLING IN WAX.

No.
106. Ornament; by C. Jahn, 3, Egbert-street, St. George's-road, N.W.
107. Ditto, by the above.
108. Medallion from cameo by *Savonorela;* by G. Morgan, 41, Pelham-street, Brompton, S.W. Price £1 1s.

CARVING IN MARBLE.

109. Bracket; by Samuel Moutrie, 219, Stanhope-street, Hampstead-road, N.W. Price £6.
110. Boy and Grapes; by W. R. Barrett, 2, Alma-terrace, Fentiman-road, S.E. Price £3.
111. Girl's Head; by the above. Price £2 10s.
112. Flower tablet; by J. Welch, 10, Doddington-grove, Battersea-park, S.W. Price £4.
113. "Boy's Head;" by the above. Price £2.
114. Keystone, with head carved in marble; by the above. Price £3.

CARVING IN STONE.

115. Vase for flowers; by Owen Thomas, 66, Harwood-street, Camden-town, N.W.
116. Study in Tidsbury stone, "May;" by J. R. Heath, 2, Tenison-street, York-road, S.E. Price £7.
117. Corbel, in stone, with inlay of marble; by T. E. Jago, 122, Vauxhall-bridge-road. Price £2 10s.

GLASS BLOWING.

118—120. Three coloured glasses; by Joseph Leicester, 13, Tenison-street, Lambeth, S.E.
121. Cream jug; by T. C. Barnes, 135, Camden-street, Birmingham.
122—123. Two plain champagne glasses, with twisted stems; by Elijah Barnes, 135, Camden-street, Birmingham.
124. Vase; by the above.

PAINTING ON PORCELAIN.

125. Tea service designed and executed by Isaac Wild, at Sutherland Works, Longton. Price £13 10s.
126. Children playing with a dog; by H. Brownsword, 48, Salem-street, Etruria, Staffordshire Potteries.
127. Portrait of Tennyson; by the above.
128. Head; by W. P. Rhodes, Newcastle-under-Lyne, Staffordshire.
129. "The First Lesson on the Flageolet;" by Robert Williams, 10, Bethesda-street, Hanley, Staffordshire.
130. "The Lost Boat;" by the above.
131. Slab, "The Burning Heart;" by Miss L. Leila Hawkins, Fossil-villa, Belvedere-road, S.E. Price £5 5s.
182. Do.; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £3.
133. Do., subject, "David the Psalmist;" by John Eyre, 14, Camera-square, S.W.
134. Tray; by the above.
135. Fruit, after Hunt; by William Slater, Field-place, Stoke-on-Trent. Price £4 4s.
136. Slab; by G. F. L., 104, Great College-street, Camden-town, N.W.
137. Do., with figures, after work executed by *Guerin* on the ceiling of the Saloon of Laocoon in the Museum of Antiques, Paris; by W. G. Fenton. Price £5.
138. Do., after a picture by Gerard, "Belisarius;" by the above. Price £6.
139. Do., an original design; by the above. Price £10.

CAMEO CUTTING.

140. Portrait of Dr. Billing, F.R.S., executed from life; by , 37, Mornington-crescent, N.W. Price £15 15s.
141. Portrait of an Italian lady; by the above. Price £15 15s.

DESIGN.

No.
142. Design for an embroidered table cover; by W. Percivall, Polygon-street, Ardwick, Manchester. Price £5 5s.

WOOLWORK.

143. Group of flowers worked in wool; by Mrs. May, High-street, Dartford, Kent.

PROCEEDINGS OF THE SOCIETY.

FOOD COMMITTEE.

The Committee met on Wednesday, at 3 o'clock. Present: BENJAMIN SHAW, Esq., in the chair; Rev. J. E. Hall, Messrs. J. T. Ware, Antonio Brady, W. H. Michael, and Dr. Pitman.

The Committee had before them a specimen of meat treated by Professor Gamgee's process, which has been described in a former number of the *Journal.* The meat, a joint of mutton, stated to have been slain on December 28th, and since the treatment simply hung up in Professor Gamgee's premises, was roasted and tasted by the Committee, and pronounced very successful; but the Committee considered that a test over a longer time, and at warmer periods of the year, was necessary before any decided opinion as to its success could be given. Another joint, slain on the 22nd December, was ordered to be placed in charge of the Secretary, to be tested at a future time.

Mr. Tallerman attended, and exhibited specimens of meat imported from Australia, and showed it both cooked and uncooked. He explained the plan he has adopted, by means of which cheap dinners were prepared from it for the use of the people. A detailed report of Mr. Tallerman's information will be given in a future number of the *Journal.*

Specimens of raw meat from Australia, preserved in tins by Manning's process, were brought before the Committee. The meat consisted of beef steaks, which were cooked for, and tasted by the Committee. The meat, though sound, was not considered satisfactory in flavour.

INDIA COMMITTEE.

The adjourned Conference on the subject of a Gold Currency for India was held on Friday, January 21st, W. S. FITZWILLIAM, Esq., late member of the Supreme Legislative Council of India, in the chair.

Dr. Boycott said at the last meeting, when it was proposed to adjourn the debate on the gold currency for India, I wished that some one better acquainted with India than myself would come forward to consider the subject in relation to the internal trade and condition of the country, and its commerce with surrounding and other Eastern nations. My remarks will be very imperfect, in representing what may be considered an Eastern view of the subject. I should like to be able to tell you what the thousands of native merchants and shopmen in the towns of India would say to the introduction of sovereigns and debased rupees; but they are generally quiet men, and perhaps we ought to be careful not to press too strongly our European ideas upon them. In former times, long before the English people knew India, both the Hindoos and Musselmen had what we call a double currency of gold and silver coins, of relative weights and value, circulating amongst them. At the time of the early Mogul Emperors of Hindostan, gold

must have been plentiful compared with silver, for the relative value of the two metals at that time was only 9·4 of silver to 1 of gold. After the invasion of India by the Portuguese, Dutch, and English, the proportion of gold to silver gradually diminished ("the pagoda trees were well shaken"), and during the unsettled state of the country, for a long time whilst the Hindoo and Musselman rules were declining, and the struggle for the mastery of India by European adventurers was going on, the currency, like all other social relations, was much disturbed. The aristocratic part of the population, who possessed and used gold, gradually died away, so that we find when the East India Company had established themselves, the gold currency had become so diminished that all their contracts were made in silver rupees. In 1766, the value of the gold coin, with respect to the silver, was first fixed by the Government of India, and the former coin declared a legal tender of payment. A gold mohur was struck, and ordered to pass for 14 sicca rupees; the relative value, however, of the two metals was found to be a mistake, being $17\frac{1}{2}$ per cent. worse in payment than the rupees of Bengal, Bombay, Madras, and Surat, so that they were called in. Another gold mohur was struck in 1769, containing a much larger proportion of gold, and its value was fixed at 16 rupees. This regulation seems to have settled the question for a great number of years. In 1818 it was thought advisable to make a slight deduction in the intrinsic value of the gold mohur, in order to alter the relative value of gold and silver of 1 to 14·861 to that of 1 to 15. This last regulation of the government for keeping up a double currency, which seems never to have succeeded, continued in force till 1835, when it was enacted, "that no gold coin shall henceforward be a legal tender of payment in any of the territories of the East India Company." I must apologise for this brief account of a former attempt to establish a gold currency for India. (I beg to refer those who wish for more full particulars to James Princep's "Essays on Indian Antiquities," edited by Mr. Edward Thomas, who has made some very pertinent remarks on our present subject, in a note on the history of the gold and silver currencies of India). My object in introducing it is to show that the East India Company had no objection to a gold currency, and that the experiment for promoting it lasted 67 years, ultimately proving that gold was not wanted as a medium of exchange for commodities, and that silver coins had become, by a sort of natural selection, the established currency of the eastern world. Mr. Cassels, in the early part of his paper, speaks of the inadequacy of a silver currency to the wants of India, and refers to the course of things which occurred in the trade of Bombay, in 1864, as proving it to be so. Admitting that there was, for a time, a difficulty in coining rupees fast enough to satisfy the demand upon the mint, we must acknowledge there was no difficulty in getting silver in England to send out to pay for Indian produce, at $61\frac{1}{4}$d. per ounce; and that the people of India were satisfied to take silver to any amount in exchange for their produce, and certainly, from what we have since learned of the history of the trade and commerce of Bombay during that period, we may safely conclude that a gold currency would not have prevented the crisis which afterwards produced so much misery. The people of India like to possess gold; they must have something to store up their surplus earnings; they cannot buy land, and they have scarcely at present any taste for what we consider household comforts or luxuries; but the practical question is, can we supersede silver, and introduce a gold currency, as recommended by Mr. Cassels and Mr. Hendriks? Looking at that vast country, its poor population, the price of wages, the cost of food and dress used by the millions, we must be sure that small silver and copper coins are most wanted amongst them, and in far larger quantities than they have ever yet enjoyed. The English rule of India has generally been patient and careful. It is only 35 years ago that they altered the coinage, and first stamped it with a decided English character; and there are probably millions of people in the country who have never yet possessed a rupee with a Queen's head upon it. How, then, is silver inadequate to the country? It is cheaper than ever. Merchants are glad enough to send it to India, if trade required them to do so, and it must be evident that it is wanted amongst the people. Before Mr. Wilson went to India, some inconvenience was experienced in sending treasure from one part of the country to another; but with a well-organised paper currency, and better regulations in the government treasuries, we ought to hear no more of this. If there were a gold currency, it would not alter the necessity of occasionally sending treasure; both silver and gold would then be wanted, and larger balances would necessarily be required in all the treasuries and banks. The present prospects for India all tend towards improving the commercial condition of the country, by increasing and improving the produce, making railways and canals, and inducing the people to work and earn wages, so as to enable them to buy English goods. Now, I maintain that silver will do all this better than gold. I would ask the English merchant, if it is not probable that a gold currency would increase the prices of labour and produce? And, if it did so, how will Indian produce compete in the European markets with that of America and other countries. It is important also to consider the Indian trade with other Eastern states, especially China and Burmah, who only use silver currencies. We know that silver bullion plays an important part in exchange operations carried on between them. I can hardly venture to say what would be the effect on such trade by at once stopping the receipts of silver, on the terms now afforded by the Calcutta and Bombay mints. The extension of our trade in the west, north, and east of India still requires more silver; and the established reputation of the rupees of a tola weight must not be done away with, if we wish to keep up our reputation as honest traders. That silver is used by some nations as a legal tender for payment at a fixed standard of value, and gold in the same way by other nations, seems to me a very great advantage; it stimulates the production of both metals, and tends to keep their relative values more equal than they otherwise would be. The calculations also required to arrange exchange operations between nations using different currencies stimulates activity and intelligence, and gives honest employment to a number of people. Bill-brokers and money-lenders seem to be considered evils in the world; they are very necessary ones to honest trade. I have thought it right to question the expediency and practicability of the proposition before us. It is important, before we go into the question of how to establish a gold currency, we should prove beyond all doubt that the silver and copper coins, with a paper currency, is inadequate to the real wants of India as a medium of exchange; and that it is necessary to supersede silver as a legal tender, and establish gold in its place. Nothing that I have heard or read yet convinces me that such a change is at present necessary. When the international coinage of all Europe and America is settled into a uniform plan, perhaps we may be in a better position to recommend India to join the "happy family." The paper currency of India has succeeded to a great extent, and beyond the expectation of many, considering how it was introduced, with limitations of issue, and restrictions as to the convertibility of the note. It was an experiment, and its success warrants that the government should immediately endeavour to establish a universal note, and extend the means of its issue and convertibility. The treasuries all over India should take part in the scheme. Practical men should be employed to work it, so that it may become a convenience and advantage to the public. I regret that objections have been made to the issue of a five-rupee note, advocating as I do the importance of small coins for India. This small note

seems to me most useful, and would soon be well received, if the government will take care to give confidence to the public, by adopting a simple plan of accommodation. My arguments, so far, are not likely to convince those who have entangled themselves in the fascinations of figures and calculations required to make a sovereign equal ten rupees, or how a gold coin fitted to a certain number of rupees, can do their work. I will venture, therefore, to consider some points bearing on the construction of a gold currency for India. We must remember that, to make a currency suited to the internal and external trade of a large nation, the most positive laws and regulations are required; anything like a tentative measure, or partial enactment, is most sure to fail. The late regulations of the Indian government respecting sovereigns is now nearly a dead letter, and it seems to me that it would require a very strong law now to oblige English merchants to send gold to India to pay their debts, when they can do so with silver at a much less cost. In estimating the just and proper quantity of gold the coins ought to contain, to give them a fair relative value of the present rupee, it is not only necessary to consider circumstances now existing, but also the changes of value that may be brought about by the new state of things the law intends to establish. Everyone who has contemplated a gold currency for India must have felt that, if a large quantity of gold should be so absorbed there, important changes in the relative value of the metal may soon follow. We cannot help considering also the peculiar position in which the government of India is placed with regard to this question, in having so much of the business of the country in its own hands, I cannot attempt to go now into any particulars on this point. I draw attention to the fact which requires to be well considered by all those who think of altering the currency. The variety of opinions and difficulties which have been expressed, as to the actual weights and standard value the gold coins ought to have in a new currency, is very perplexing. It seems impossible to settle the point, without great danger of disturbing the commercial state of the country (and perhaps the social). There are no natural, commercial, or social laws or circumstances at present leading into a clear, open way of proceeding. I shall conclude with a few remarks on the elaborate scheme which the author of the second paper read to the Society at the last meeting.* Mr. Hendriks, taking the old Indian estimate of 15 to 1 as the relative value of silver and gold, without considering the present value of the metals either in India or England, but calculating according to the present Indian laws and mint regulations as to seignorage, makes out the present ratio of silver to gold in India to be 15·15306 to 1, and from thence he concludes that there is only two annas and nine pies to be bridged over to make ten rupees and one sovereign of its present weight identical in value. Adopting this calculation, he attempts to form quite a new currency of gold, silver, and copper coins for India, to correspond to the international system. With regard to this long list of new coins, I shall only mention that the new ten-rupee piece or sovereign is not the one his former calculations are based on, but the sovereign he anticipates Mr. Lowe will adopt. Now, the alteration of the English sovereign has been pretty well ventilated lately, and it is still very doubtful what the Chancellor of the Exchequer will do, after thinking over all the advice that has been tendered to him. I should not be surprised if he got out of the difficulty by issuing twenty shilling and ten shilling notes. Seeing, then, that Mr. Hendriks' scheme rests mainly upon a basis not yet established; and, disagreeing entirely, as I do, with the method he has adopted for calculating the proportion of gold that ought to represent a rupee, and also to such an entire change of all the coins of India as he proposes, I cannot help coming to the conclusion that, for the present, we had better leave India without a gold currency.

* *Journal*, present vol., p. 106.

Mr. George Campbell said he could not altogether go the length of Dr. Boycott, and object *in toto* to a gold currency. The arguments with which he (Dr. Boycott) commenced his remarks were not at all conclusive. It was quite true that, some time ago, an attempt was made to introduce a gold currency into India. But that did not fail from the cause stated, but from the fact that the government fixed a wrong value on the gold. It was acknowleged that gold was not unknown to the people of India, and that gold coins had circulated freely, and he did not think there was any *prima-facie* objection to the introduction of a gold currency. What, however he maintained was, that there was no very pressing and immediate necessity to introduce gold in a forcible manner, and they need not unduly hurry about it. It was not a thing that was most urgently wanted. The fact was, that there was an immense mass of silver in India; and his impression was, that for the present purposes of trade it was enough. Not only was it the case that trade had long been carried on in India by means of silver, but the disadvantages with regard to silver has been very much removed of late years. If there had been a gold coinage, there would have been the same necessity for the escort of troops as was required with the silver coinage. If the mass in one case had been lighter to carry, it would also have been lighter for robbers to carry off. There were now, however, railways, &c., which carried it about with extreme facility and cheapness. Then, again, the present currency had been very much facilitated by paper money, and these two things, he considered, very much lessened the urgency of the matter to what it was twenty or thirty years ago. The question was one which ought to be approached deliberately, and not pressed, by asking the government for a measure of very immediate operation. There could be no doubt that gold was better for a currency than silver, but there were also certain disadvantages attending its introduction. The advantages of gold were, 1st, that it was more portable than silver, 2nd, the currency would be the same as all other countries; and, 3rd, by these means they would be sure to steady the exchanges of the world, a most important consideration. But, on the other hand, the disadvantages of gold, under the present circumstances in India, were considerable. First, it was a change, and changes in commercial matters were always disadvatageous, and although the inhabitants had not any great objections to gold, yet it was a great change. Second, the value of gold was a very uncertain quantity, while silver was more equal in value, as its production was more regular, and there was every probability that it would continue to be so. The production of gold, on the other hand, had immensely increased, and there was every reason to believe that it would farther increase in years to come. He read an article the other day, by one of the best political economists of the day, and it stated that, in consequence of the increase of gold its value was depreciating to a very great extent. He was not prepared, therefore, to admit that, as things were at present, gold was a more constant and stable measure of value than silver—he thought quite the contrary. Again, it would be, to a certain extent, a breach of faith if these things were changed. It would be a breach of faith to the creditors who had contracted to receive silver, if they were to be paid in gold instead. He was not one of those who would strictly carry out the words of a contract when the public good was at stake, but still he did think that contracts of this nature should not be changed if it could possibly be avoided. Further, if the gold currency were forcibly introduced by law, this would would be a very great injustice to the holders of silver. It must be remembered that it was a habit in India to hold a great amount of coin, and that this coin was in silver. The coin

was in silver both amongst the rich and the poor and by too rapidly introducing a gold currency, and thus depreciating the silver currency, injustice would be done. This view of the question was one of very great importance, so much so that he said with confidence that, if gold was to be introduced, they must for a long time, and much longer than the five years' proposed, allow both metals to circulate side by side. Well, as he had said, he could not concur with Dr. Boycott, and he believed that most thinkers were of the same opinion. He believed that most thinkers considered it desirable to introduce gold. Applying himself, therefore, to the question as to the shape in which it was most desirable to introduce it, he thought the practical part of the question could be reduced to this:—Was it advisable to introduce a new coin of the value of ten rupees, or to make the English sovereign a tender of the value of ten silver rupees. He was very decidedly in favour of introducing the sovereign. If they compared the two schemes, they would find that a new coin representing ten rupees would be something less than a sovereign in value and weight. The effect of that, in his opinion, would be too immediate. The effect of the sovereign, on the other hand, would be gradual, and not immediate, but that very reason, he thought, one of the reasons for preferring it. To introduce the former scheme would be an evil in itself; such a coin could not circulate in England or France, or any other civilised country in the world. There would be the disadvantage of want of uniformity, and it would have less effect in steadying the exchanges than one of identical value. There was a seignorage in India, and it was proposed to introduce the same in England. Whether that would be an advantage or not, it was not for him to say, but in that case there would thus be a loss on each side. With regard to the discussion at the last conference as to what is the real value of the sovereign, he was not a practical commercial man, but, if they took the average, they would find that the sovereign was not worth so much as 10 rupees 4 annas in the bazaars in India. Its value was often as low as 10 rupees 1 or 2 annas, and sometimes it was nearly as low as 10 rupees. He did not agree, therefore, with the speakers who spoke of its value as 10 rupees 4 annas. As things now stood, it was necessary to bring gold from Australia to India through England; but it was shown some time ago that, if it could be taken to India direct, to find a sure market there, instead of through England, it would be bought and sold cheaper than at present. It seems, therefore, that the present gold sovereign is really but a very small fraction in excess of ten rupees value. Then, it must not be forgotten that there was a proposition to reduce the bullion value of the British sovereign. Far be it from him to give an opinion on this proposition, but he would say that the Chancellor of the Exchequer had deliberately staked his financial character on the reasonableness of the scheme. Well, if that were so, it would make the English sovereign still more nearly coincide with the Indian ten rupees and also with the gold coin of France; so things would be in *rapport* and uniformity with the greater portion of the civilised world. It seems almost as if Providence had placed within their reach a coin that was actually the best to be found, viz., the British sovereign. The difference was so very little, and was, moreover, on the right side. He said that because, of course, any little advantage should be in favour of the old form of contract. Well, then, he thought that the sovereign as it now stood, and as it will probably be reduced by Mr. Lowe, should be made a legal tender of ten rupees. For some time there should be a double standard, but no double standard could be a permanent arrangement, because gold and silver will not always maintain their values in the same proportion. Look at what took place, within his own memory, in one of the most civilised nations on the face of the globe—in France. A great change had taken place there from silver to gold, by reason of a double standard. The double standard was established, he believed, in the time of Napoleon I.; silver was to pass at a certain value, and gold at a certain other value. Then followed what he would recommend should be done in India, namely, the gold standard was a little less in value than the silver; for a time silver had the preference. Then would come about—as did come about in France—and what must be expected, namely, a slight change in the relative values of gold and silver. What was the result of that? Why, without any breach of faith, quietly, almost imperceptibly, gold crept in, the silver went to India, and there was now a gold currency in France. That result was reached by a double standard. That was what he would like to see done in India. They must, however, wait patiently, the thing was not to be thus done in a moment. If Mr. Lowe's reduction of the sovereign did take place, the changes in India might very soon take place; and if Mr. Lowe's reduction did not take place, yet gold was being so quickly discovered that it was merely a question of time when merchants would bring their gold to India, and be glad to sell it for ten rupees a sovereign. The great advantage of this method was, that if we now made the sovereign a tender for ten rupees, probably not a soul would complain. If it be granted that they might, in that way, exchange their currency from silver to gold, the only question that remained was, whether they were forcibly by law to change the contracts which ought to be paid in silver by paying them in gold? But it might be accomplished in this way:—They might provide, in introducing a double standard, as he had suggested, that all debts then existing should be payable in silver, but that all debts contracted after should be paid in gold or silver, and that, in the case of all debts then existing which were demandable after the time of introducing gold, but which the creditor did not demand, he should then be considered to have renewed the debt under the new law, and should be afterwards bound to accept either silver or gold under that law.

Mr. Dadabhai Naoroji said that it was with great diffidence he addressed the conference, having heard what had taken place at the last meeting, and also having listened to the two gentlemen who had just spoken, especially the one immediately preceding him. So far as he could gather from blue books, the question of the necessity of introducing a gold currency was quite settled, and he thought with every reason. Some of Dr. Boycott's arguments had been answered by Mr. Campbell; but with regard to Mr. Campbell's assertion that there was no urgent necessity for the introduction of a gold currency, he could not agree with him. Mr. Campbell alluded to what he described as the gradual change of silver into gold currency in France, but he did not mean, he supposed, there were no losers by it. France had, he thought, also to buy gold largely, to supply the place of silver going out, producing much disturbance in the English money markets. In making any great changes—especially commercial changes—losses cannot be helped; and, in all such revolutions, loss of property to one man, or of some interests to others, must take place. If they were to wait till a change could be made without any loss to anybody, they would have to wait altogether. They must remember that as commerce increased—and it increased very rapidly in India, with the increase of railways, canals, &c.—that to keep up silver currency would be very inconvenient. The body could not be kept healthy in that way. The arterial iron road must be supplemented by the venous gold road, and a proper uniformly rapid circulation kept up, or congestion would set in with all its consequences. So he hoped that, taking time by the forelock, and seeing what had already taken place in England, it would be wise statesmanship to see that, when commerce was rapidly increasing, congestion did not take place, by inducing suitable new life-blood. India was only in its infancy in its material development, and it would be long before it came of age. At present it was

growing rapidly. The monarchs of by-gone times may have, as Mr. Campbell says, been very clever in amassing and hoarding wealth; but they did not develop the resources of the country like they were being, and would be, developed under British rule. Looking at these things the gold currency became an absolute necessity, and should be introduced as early and as efficaciously as possible. During great crises, such as the one of 1866, though it was not quite attributable to the want of a gold currency, being caused by the creation of much fictitious wealth, the want of gold currency would very much aggravate the mischief. It is necessary to be a little forearmed and bold. Just as sometimes happened in the case of irrigation, that one year of famine did more injury, both to money and lives, than the whole cost of irrigation that would have prevented it. As far as all the information and data collected from all sides showed, it was admitted that the natives would like the change. As to the question, was it practicable? Unlike Dr. Boycott and Mr. Campbell, he started upon the proposition that the introduction of the gold currency was a matter of very great urgency, and if that is once admitted, it is the duty of government not to be frightened by any difficulties that may present themselves, but to look them in the face and overcome them. What really were those difficulties? The first difficulty which Mr. Campbell pointed out was, that it would be unjust to private creditors. But in all other kind of property the government, state, or legislature never consider private losses as an obstacle to the benefit of the whole State. Suppose a party dealt largely in tea, and took a large contract for it, and Mr. Lowe clapped on a duty because the revenue required it, do you think he would care at all for the private contractor? Take free-trade itself, for example, which was the great glory of England—and justly so—did it not injure many interests? A war may do mischief to private interests, but that would not be allowed to be a reason if war became imperative for the defence or honour of the State. Private interests are always rendered subservient to public good. Government provides for compensation when property is taken by it, as in the case of the abolition of slavery, or taking land for railway purposes, but the legislature never allows the possible injury to private interests to interfere with public necessities, though no doubt it takes, or ought to take, as much care as it can to prevent the private injury, or to render it as little as possible. He would add no more instances, because he thought everyone there would admit that in everything that was for the public good or necessity private interests go to the wall. That was the case with all kinds of property or goods, and he did not see why it should not be the same with regard to gold and silver. So far as State interests went, there could be no difference whether the property affected were gold, silver, cotton, or houses; all such interests must and do submit to the interests of the State. He maintained, therefore, that, with regard to the gold currency question, private interests in gold and silver must be left to take their chance, just as every other property. There was no other alternative. Next came the payment of government servants. That was a great disbursement by government, and government must take care that the injury done, if any, be the minimum, just as to any other interests. Why should not government have the right to say, "Gentlemen, take your salaries in gold," just as government can impose an income tax, or make retrenchments for State purposes. If in doing that the government can prevent a loss, they should do so, and, if possible, should be liberal in such a way that, in receiving a sovereign, the recipient should gain a little, which would be the case if the sovereign be paid for ten rupees. Then there were a great many government contracts, railways, canals, irrigation works, &c. If those already entered into must be paid in silver, the contractors refusing to receive in gold, well, let them have it in silver, but let all future contracts be in gold or silver at the option of government. The most important thing to consider was the public debt. Government cannot be justified in making any change without the consent of the creditors. Now, let us see what this difficulty really is. Supposing a man mortgages his house for a fixed period, say 10 years, without power of selling, and afterwards there was a large increase in the value of property, and what was worth £1,000 became worth £6,000, as was the case some years ago in Bombay, our supposed friend would naturally go to his creditor, and asking him to compromise, and endeavour to get what benefit he could. Well, then, the most natural plan for government would be to ask creditors if they would transfer their loans from 100 rupees to £10.—[A Voice—Would you pay the 4 per cent. at par?]—No; I mean for every 1,000 rupees, as stated on the loan then, were to be offered to convert into £100. The total public debt was about £100,000,000, of which about £38,000,000 was in sterling money, including proprietors' stock of £6,000,000. The total Indian registered debt in rupees is about £63,000,000. Of this, about £16,000,000 is held in England. The holders in this country will, I think, be only too glad to have the debt converted into sterling money, both because they will then receive their dividends in sterling money instead of in drafts on Calcutta, and also because the quotation of 4 per cent. of sterling debt is £100 when 4 per cent. of rupee debt is £92, shewing that, by changing rupees into sterling money, at a reasonable rate, their property will actually improve. There remains, then, about £47,000,000 of rupee debt to dispose of. Now, the most evident plan to deal with the creditors of the public debt will be, as I have already said, to go to them, say, to issue a proclamation, asking whether, in the event of the Indian government thinking it for the benefit of the country to make gold a legal tender, any creditors holding public securities will object to receive payment in sterling money at a rate (to be decided upon fairly by government, and mentioned in the proclamation), and asking such creditors as object to the change to send in their protest within a reasonable time, say six or twelve months. I think that all public creditors will accept the proposition, if the rate offered be slightly favourable to them; for there will be a further consideration for them, that gold becoming a legal tender, will, at least for a long time, not be lowered in value, while silver, though its production is less than that of gold, will still not much rise in value, as its demand for the currency of India will be very much diminished. By adopting the plan of asking the creditors themselves to come to an arrangement, the whole difficulty, so long only looked at, but not grappled with, will be removed. If not, it will at least have the effect of showing government what portion of the public creditors would object. If it be a small portion, then there will be no great difficulty in paying this small portion in silver, perhaps at a little loss. But supposing, by adopting this plan of consulting the wishes of the creditors themselves, government positively ascertain that the public creditors will, in a body, object to being paid in silver, then we may see whether it is not possible, at some reasonable sacrifice, to meet the difficulty. There are about £30,000,000 of 4 per cent. in some eight or nine different loans, which are payable at three months' notice, and of which £4,000,000 form part of the £16,000,000 held in this country; and the Indian government has, at present, the credit of 4 per cent. in the English market for sterling loans. If, therefore, from time to time, government contract loans in sterling money in England, and as silver coin came in, in payment of revenue, government discharged the rupee loan, though the holders will be thus paid at par while the present quotation is about 93, still, as far as government is concerned, it will get the loan at the same rate, and will be no loser, except for the transport of the gold received here to India. This I suggest as an extreme

measure, if government thought, as they evidently appear to think, that the introduction of gold was a necessity. But even this payment by notice at par is not quite necessary, as government can, from time to time, according to its convenience, and as silver came in, buy up these loans from the market, at the market rate, supplying itself by new loans in gold. But I feel some confidence that such operations will not be necessary, and that the public creditors will come to some reasonable terms as long as they find that no immediate depreciation takes place in their property. Next, there is the loan of some £2,000,000 becoming due this year, and £16,000,000 in 1872, which government is allowing to be converted into new loans. Cannot government now put in the condition of the option of payment in gold or silver, according to the legal tender of the day, at a certain rate, now fairly fixed. Moreover, these two loans are five per cent. loans, and one would think the best plan for government would be to contract new loans in this country at four per cent., and pay off those of five per cent. with the silver coming in for revenue. The only loans which may appear to be rather difficult to deal with are those about £11,000,000, due in 1879, and something less than a million due in 1877 and 1882, but of this £11,000,000 about £4,000,000 are held in England, and only £7,000,000 held in India, which is likely to be demanded in silver. For these few years I do not suppose there will be much difficulty in keeping, as a part of the treasury balances, so much silver coin which can at any pressing emergency of war or any large expenditure be sold as bullion. Besides, as the gradual and careful introduction of gold currency will take five years or more before it can be made sole tender, with silver as tokens only, the difficulty about this one loan does not appear very insurmountable. There are also some service funds in the hands of government, but I suppose that the recipients are mostly in this country, and would not, I think, object to the payment in gold here. The plan, as far as I can see at present feasible, appears to be this. To ascertain by proclamation, instead of merely acting on surmises and fears, whether the public creditor will accept gold or not at a fair rate. The fair rate is a question which I shall speak about afterwards. When government sees its exact position in this matter, it will be able to adopt the necessary steps to bring about the change of currency with as little disturbance as possible. I think some alteration in the notification of 23rd November, 1864, No. 3,517, will be required. The last sentence of the notification runs thus:—"And that such sovereigns and half-sovereigns shall, whenever available at any government treasury, be paid at the same rates to any person willing to receive them in payment of claims against the government." I would propose before the word "claims" the word "existing" be inserted, and at the end to add the words, "and also to any persons in payment of future claims upon government, and that a sovereign shall henceforth be a legal tender for all private contracts at the rate of rupees for each sovereign." Mr. Massey, in his Memorandum of 2nd February, 1866, says, at the end:—"Two points, however, may be considered as determined. The one is, that nothing short of the recognition of the sovereign, or some other denomination of gold coin, as a legal tender will suffice; and secondly, that the result of this recognition must be, sooner or later, the establishment of the more precious metal as the ruling standard" (Return 148, of 1868); and I think so too. Whether government would adhere to 10 rupees for the sovereign may be considered by a competent committee, and settled. This rate, whatever is fixed, will be temporary, for after the notification government should cease to coin more silver, and to cease to return the silver coin into circulation paid into the treasuries, except for claims already existing, for which the claimant would refuse to accept gold sovereigns, and for small payments to officials and servants to a certain necessary extent, say up to 200 or 500 rupees. In time, a sufficient portion of the silver coin will return into the hands of government, and government, beginning to coin gold as necessary, can make gold the only tender, and make the rupee the only silver token, to be paid to the extent of, say 40 rupees. Gold thus, in time and gradually, will take the place of silver as the principal currency, without any disturbance of much consequence. If 10 rupees for a sovereign be not at first adopted, still, after the silver currency is reduced to tokens, there can be no difficulty in making the token rupee a decimal, or one-tenth of the sovereign, and, while the change is being made, the decimal system could be easily introduced in the smaller coins also. Mr. Hyde Clarke said the introduction of the decimal will be disturbing the habits of the natives, and he did not approve it. Now, as far as the most commercial natives of the Bombay presidency, and I may say of all India—I mean the Gujeratees—are concerned, they have always employed, and even now (though the rupee is 16 annas, and the anna is 12 pies) employ generally the "docra" or the "reas" in their calculations—100 docras being one rupee, and 100 reas being a quarter rupee. The small surpluses of their calculations they convert into the current coins of annas and pies. The rupee is originally both a decimal coin and a decimal weight, being in value 100 docras, and in weight 100 gunjas. Boys are taught mental arithmetic in docras in indigenous schools:—besides, in Bombay 40 seers = 1 maund; 20 maunds = 1 candy; 100 baskets of salt = 1 anna = $2\frac{1}{2}$ tons. In other parts of India, the decimal is not quite a novel quantity. In Bengal, they knew 1,000 fathoms, or 2,000 yards, to one kos; gold or silver weighed by 25 dhan = 1 anna, and 16 annas or 400 dhans = 1 tola. In Madras, there were copper pieces of 5 cash, of 10 cash = 1 doodee; and 20 cash = 1 pice. Fineness of gold is generally expressed in India by dividing it into 100 parts or touch. In Calicut, a maund = 100 pools; in Carwar, 1 maund = 1,000 pice; in Cochin, 20 fanams = 1 rupee; in Goa, a pardo = 300 reas, pagoda = 10 tangas; in Manglore, pagoda = 10 hunas; in Mysore, pagoda is imaginary, and fanam is one-tenth of a pagoda; In Pondicherry, 20 dudas = 1 fanam; in Surat, 1 candy = 10 pacca maunds. I give these few figures from Kelly's "Cambist" to show that a change to a uniform decimal coinage or weight will be no great difficulty. When the present rupee and pice coins were made universal, was there found any difficulty in the natives adapting themselves to the change? A little extra care and trouble on the part of government officials will soon make the natives understand; and it would be a great advantage to make the Indian system correspond with the decimal system that seems likely to be adopted in the West. With regard to the battle of ten rupees, and ten rupees and two or four annas, for a sovereign, I take the extreme case of ten rupees for a sovereign as being a handsome present to the public creditor, and a loss, say of $2\frac{1}{2}$ per cent., to the State. Now, if this became absolutely necessary to do, it will be only like making an investment such as is made in building roads in a town or country. The money sunk in the building of the road does not grow out of it, but the facility of transit occasioned thereby repays the investment tenfold. There is your Holborn-viaduct and all such other public works on that principle. If, therefore, admitting gold currency as necessary for the rapidly-increasing business of the country, the loss will be so much investment for pulling down the old silver but weak bridge, and putting up the golden bridge. No great change of importance can be made without paying a price for it, and if this change occasioned a reasonable loss to the State, there is sufficient justification. But, after all, except as to what is transferred to this country, much of the loss will be simply transfer from one hand to another, the aggregate wealth of the country being unaffected so far. It was said by Mr. Campbell that gold, on account of the discoveries, was falling in value, while silver had remained uniform for a long time, and he urged as a recommendation that silver was a better standard, and

ought not to be changed. If so, it would appear as if England, France, and the United States made a mistake in the adoption of the gold standard, and are persisting in that mistake, by not changing their currency to the metal of the "uniform value." I do not think Mr. Campbell himself will advise these three governments to change their currency from gold to silver, or would even say that they were persisting in a mistake in keeping to gold. But one important circumstance in the uniformity of the value of silver is not borne in mind. It was not simply because silver was produced in less abundance than gold, but an artificial increased demand was created for silver by the Act of the Indian government which prohibited gold as legal tender, and by the demand for China. I am not able to give at present earlier figures, but from the year 1848 to 1867 there has been an export from this country to India of above 75 millions worth of silver, and to China 41 millions. Had the Indian government not adopted the course of making silver the only tender in 1835, the currency would have very probably by this time settled itself, or been in the course of settling itself to gold, just as it did in England, France, and America. In these three countries the demand of silver for India and China accelerated the process. When double currency prevails, the debtors and creditors discount its effect by taking it into consideration. The real effect of the double currency is, that the dearer metal soon goes off to other countries where there may be greater demand for it, as silver left France and the United States because a demand arose for it in India. The whole amount of silver coin in India being said to be about 100 millions, two years is naturally suggested as a reasonable time for the disappearance of the existing coin, either by being all paid in for revenue, or, if the holders find it to their advantage, converting it into bullion for other useful purposes. Silver coinage will of course be necessary, as here, for small transactions, and, therefore, a certain amount will continue in circulation. If India made a gold currency, though the production of gold is larger, its consumption will also be very large, as every country advancing in commercial prosperity will find it necessary to adopt it for its currency, so the much-dreaded large fall in its value will have to be waited for, for a long time to come. On the contrary, it is possible that the supply may not keep pace with the increasing demand, unless more fields are discovered. It is said silver is enough for all purposes at present in India, and gold is not needed. We may just as well say that common roads would have been good enough for India; why go to the expense of hundreds of millions to build railroads? It is not enough that common roads are sufficient for present purposes, but we build railroads to produce more from the country, and so it is not enough that silver is sufficient for present purposes, but we want the more rapid medium of gold to meet the requirements of the expected greater production. You require common roads too, as well as railways, and you will require silver coins for small payments as well as gold. Commerce knows well how to take care of itself. The function of the legislature is to remove obstacles to its free development in its own way, and to help in supplying it with the best machinery of currency available.

(*To be continued.*)

NINTH ORDINARY MEETING.

Wednesday, February 2nd, 1870; Major-General JOHN T. BOILEAU, R.E., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Ashcroft, George, C.E., Cairo, Egypt.
Jones, G. W., 25, Essex-street, Strand, W.C.
Rogers, William, 13, Finsbury-pavement, E.C.
Soubeiran, Dr J. L., Société Imperiale d'Acclimatation, Paris.

The following candidates were balloted for, and duly elected members of the Society:—

Barber, Captain Harley, 20, Great George-street, S.W.
Brooks, William, 9, Stratford-green, Stratford, Essex.
Cornes, William W., Macclesfield.
Dixon, James Willis, jun., Cornish-place, Sheffield.
Gumpel, Charles Godfrey, 49, Leicester-square, W.C.
Hankey, Rodolph A., 9, Suffolk-place, Pall-mall, S.W.
Hudson, Robert, F.R.S., Clapham-common, S.W.
Jessen, Carl Ferdinand M., Whetley-grove, Manningham, Bradford.
Macnair, George, 44, Hamilton-terrace, N.W.
Mort, Laidley, 155, Fenchurch-street, E.C.
Nash, Samuel, 44, Renshaw-street, near Liverpool.
Saddler, John, 6, Southampton-street, Fitzroy-square, W.
Taylor, Arthur Edmund, 14, Basinghall-street, E.C.
Tufnell, Thomas Robert, Belmont, near Uxbridge.
Wayland, Alfred, 104, Campbell-road, Bow, E.

AND AS HONORARY CORRESPONDING MEMBER.

Locke, Richard Langford, Suddya, Upper Assam.

The Paper read was—

ON RECENT IMPROVEMENTS IN SMALL ARMS AND AMMUNITION.

By Captain O'Hea.

Nearly three years since, with experience derived from the great American civil war to guide me, impressed with the conviction that the termination of that protracted strife was in no small measure to be attributed to the inventive talent of Americans, which, when called forth by the necessities of the Northern States, evinced itself in the production of novel and improved weapons of war, thereby multiplying the power of the Federal armies—and with more limited experience acquired subsequently in this country, I had the honour to read, in this room, a paper on "Recent Inventions in Breech-loading Small Arms in Europe and America." Again, assisted with information obtained through the courtesy of British and foreign inventors, gathered from the Report of the Sub-Committee of Ordnance Select Committee in this country, and from the reports of the boards for the examination of military small arms, and of the Russian commission in the United States, and especially with experience derived from many trials with ammunition and arms, and much study on these subjects, I have the honour to-night, on the invitation of the Council of the Society of Arts, to present a paper on "Progress in the Invention and Improvement of Breech-loading Small Arms and Ammunition in Europe and America, during the past three and a-half years."

It is essential to the clear understanding of the subject of my paper, that it be divided into two branches, namely, the ammunition, and the arm; for though in actual practice connected, they are in theory and manufacture distinct and separate subjects.

The first, the ammunition, undoubtedly the premier division in importance, as gunpowder, the foundation of the cartridge, is in date of invention, contains the motive power, giving trajectory with accuracy, in a great measure vertically, and to some extent laterally. It also gives penetration, the latter depending partly on the propelling force, and partly on the consistency and figure of the projectile used.

The second division, the arm, is the engine (the word gun itself being derived from the French word *Engine*) in which the art of the machinist is made use of, to give effect to the power contained in the ammunition, facilitating the rapid and accurate use of the cartridge by means of breech mechanism, sighting, and correct and suitable rifling. To the cartridge, therefore, which contains the life of the arm, if I may use the expression, I shall give precedence.

No matter how accounted for—whether it be that

the available explosive material, the power of which capable of being to a certain extent measured and controlled, has been limited to gunpowder; or that alterations in the making-up of the ammunition to suit changes or improvements in the arm, have been more economically effected; or that the extreme limit to the application of this explosive material has not yet been reached—it is a palpable fact that, up to a very late date, alterations or improvements in the gunpowder cartridge have followed the production, or been made to meet the necessities of the arm for its use. I need not particularise instances in support of this statement.

Of late years, great ability and mechanical skill have been lavished on the production of breech-loading mechanism, and in a lesser extent on that of rifled barrels, 104 breech-loaders having, in answer to the War-office advertisement, "To gun-makers and others," of the 22nd October, 1866, been submitted for trial to the Special Sub-Committee of Ordnance Select Committee in this country; but, including arms re-submitted in a modified form, the number would be over 150. From the fact that, of 49 descriptions of cartridges—non-metallic as well as metallic—submitted for trial to the Committee, 48 of which were rejected from various causes, the greater number without any extended test; while in the United States the varieties of ammunition, entirely metallic cased, submitted to the boards on small-arms during the past three years, did not exceed twelve, the distinctive differences between them being, with one or two exceptions, very few indeed, it must be admitted that but comparatively slight attention has been given to the subject of ammunition, the propellent force and the projectile in particular.

The gunpowder cartridge for breech-loading small arms carrying its own ignition I shall class under three heads, viz., the paper, skin, or linen-wrapped cartridge; the metallic-cased cartridge and the bullet cartridge. On the first, known as non-metallic, a class of ammunition which is being rapidly superseded, I shall make but a few remarks, and these will refer chiefly to alterations which have taken place during the past three years. In the cartridge used with the well-known Prussian needle-gun, the peculiarity of igniting the charge of powder in front next the projectile, with a view to equalising elevation by backward combustion, no matter how extreme the charge of powder; the fine graining of the powder charge to facilitate the passing through it of the igniting needle; the ogive-shaped projectile, of much less diameter than the bore; and the sabot in which it is seated to centralise and give it steadiness and rotation in its passage up the barrel, but which materially interferes with accuracy in after-flight, are still retained. There has been no provision made in this cartridge against the deflection of the needle in passing through the powder, and consequent failure in reaching the fulminate, nor against gas escape through the breech works. There are, however, rumours of a change in either the Prussian ammunition or arm being contemplated.

In the cartridge for the French government arm, the Chassepot, the packing of the powder charge and consequent retarding of ignition, is retained. A waterproof linen powder case has been substituted for the old paper wrapping with doubtful benefit, both as regards security from moisture and lessening of fouling. Experience has proved that this description of casing is not always consumed with the powder, or carried away in the discharge. On examining this ammunition in connection with the Chassepot arm, it will be seen that it imposes on the latter the entire duty of stopping gas leakage through the breech; and it is evident that the vulcanised "caoutchouc obturator" interposed between the front face of the breech-bolt and a shoulder or flange on the needle-guide in the arm, is a faulty and perishable contrivance for effecting this object. It is, therefore, not surprising to hear that the French war administration are contemplating a change in the ammunition, information regarding which, according to the usual rule, is withheld.

Metallic-cased ammunition affords a wider field for remark. Its reproduction in the self-igniting form in the United States, during the late civil war, has caused an entire revolution in the arming of almost every civilised nation in the world. Nevertheless, if I except the fact of self-ignition, the description of metal of which the case is composed, and the process used in the manufacture, a metallic cartridge, or chamber for loading at the breech, is not novel, or even peculiar to nations accustomed to civilised warfare. I have here metallic chambers for loading jingals and other arms at the breech, proving that the Chinese, Japanese, and other Oriental nations, long prior to the beginning of the present century, used this description of ammunition in a primitive and imperfect form. And in our national museums we may see arms of far greater antiquity loading at the breech by metallic chamber. However, as this paper is intended to treat only of the ammunition and weapon of the present time, I would refer those who may be desirous of tracing the metallic cartridge of our time back to the metallic chamber of other days, to the interesting and instructive paper on ancient breech-loaders, &c., &c., read at the Royal United Service Institution by Mr. Latham, of the firm of Wilkinson and Co., Pall-mall, and published in vol. ix. of the *Journal*. It will be sufficient for me to observe that, prior to 1845, an attempt was made in France to introduce breech-loading in small-arms, with the ordinary paper cartridge, by means of a metallic ring or cup, which proved a failure, in consequence of the difficulty experienced in removing the ring or chamber from the breech after discharge.

Mr. Lang, of Cockspur-street, manufacturer of sporting arms, no doubt aware of, or prompted by this difficulty, brought forward, in 1851, a steel or iron, and, subsequently, gun-metal breech chamber, igniting by nipple and percussion cap, but only for the purpose of enabling sporting breech-loading arms to be loaded with loose ammunition at the muzzle. Subsequently, Mr. Reilly, of Oxford-street, gun manufacturer, also brought forward a chamber for breech-loading, having the powder chamber split or divided to facilitate extraction.

These efforts prove that for the past three centuries all the advantages of loading at the breech have been appreciated, and that a striving for the perfect accomplishment of this object has been from time to time renewed, yet such efforts, though not altogether failures, have proved more or less unsatisfactory, in consequence of the process of manufacture, and the use of metals not capable, even with the aid of improved machinery, of being worked into a sufficiently fine form to permit, after explosion, of easy and rapid extraction from the breech.

Passing without remark the Lefaucheux semi-metallic pin-fire cartridge case of 1836, for sporting arms, as well as the Chaudun metallic pin-fire cartridge case of 1849, for a like purpose, we arrive at the drawn rim-primed metallic cartridge case, brought into general use in the United States with military small arms during the late civil war, and which, although composed of soft metal (copper), an error in the right direction, served well the purpose for which it was brought forward. It has also led to the production, not alone of the numerous descriptions of breech-loading small arms at present known, but to a more perfect description of metallic ammunition, which, as well as this rim-fire parent of the modern metallic-cased cartridge, modified to centre fire, I shall presently bring to your notice.

My remarks will only bear upon the alterations and improvements which have taken place in well-known metallic ammunition, and on inventions brought forward within the past three years.

In British ammunition, two modified descriptions call for notice, viz., our government cartridge, known as the Boxer, and the Daw cartridge, which received the government prize of £400 in the cartridge competition.

The first, patented the 15th January and 13th October, 1866, by Colonel (now Major-General) Boxer, late superintendent of the Royal Laboratory, has, during the past year, undergone another material modification for the small-bore arm recommended by the Special Sub-Committee.

By patent of Mr. William Thomas Eley, of Gray's-inn-road, dated 18th January, 1869,—the paper which binds the metallic coil shell of the old government cartridge being in some instances discarded, whilst in others it is used inside the case—the long powder case for the large powder charge of the 45· bore has been considerably shortened. This is effected by what is known as "necking," that is, the part of the case which embraces the projectile is made of considerably less diameter, to suit the calibre of the bullet, than that part of the case which carries the powder charge.* The neck or smaller diameter of this cartridge case is formed by means of a die or dies so arranged as to form flutes, folds, or plaits in that part of the case, and so allow the reduction of diameter, the folds or plaits in the neck, and the condensed wad holding the coil at the base, serving to keep the coil together, and dispensing with the necessity of paper wrapping outside the case.

This case can be reloaded as ball ammunition; and I am informed upon good authority that, in this modification, the case gives better results on being reloaded than on the first discharge. This I ascribe to the fluted portions of the cartridge case being forced by the first explosion to take the exact form of the chamber of the arm. The weight of this case is 165 gr., length of cartridge complete, three inches. The weights of the government powder charge and projectile are well known.

The second modified English cartridge is the "Daw," the property of Mr. Daw, of Threadneedle-street. Mr. Daw has been manufacturing his cartridge case, necked or bottle shaped, for about a year and a-half. This he accomplishes in the process of manufacture, without in any way lessening the elasticity of the case or altering the smoothness of the outer surface. Mr. Daw exhibited to me, many months ago, a modified cartridge base, in which the cap-chamber and anvil are manufactured in one, thus lessening the number of pieces in the case, and simplifying the manufacture. This cartridge case is the lightest in weight that I have met with, weighing only from 100 to 105 grs. Its extraction from the arm is very easy, and I am informed by the patentee that the case can be reloaded repeatedly.

Of foreign modified ammunition, I have three specimens here, all American, namely, the "United States regulation centre-fire cartridge," the Martin's centre-fire cartridge, and "The Powers' centre-fire cartridge." The cases are drawn copper. These are simply modifications of the original rim-primed cartridge already referred to, as regards the location of the priming, the reinforcing of the head, and form of the case. The position of the fulminate in the rim of the old cartridge case was, from its location, found liable to displacement in storage, dangerous in transport, and weakening to the head of the shell, where the shell requires greatest strength, and, from the quantity of percussion composition used, a cause of uncertainty in the propelling force.

I may remark, as a reason for the adoption of a modified copper case in a country so fertile in invention as the United States, that in doing so the authorities have effected a considerable saving to the country by utilising the old material.

The United States regulation centre-fire metallic cartridge, pattern 1868, known as the "Frankford," from its being manufactured in the improved form at Frankford Arsenal, consists of the usual copper case, drawn slightly conical, a tin-plate reinforcing cup, firmly held in its place by crimping in the sides of the case over the edge of the cup, half a grain of percussion composition deposited in a small shallow recess on the outside of the cup, which, before crimping, is pressed snugly against the closed end of the cartridge case. At the extremities of the recess for the fulminate in this cup, two vents communicate the flame to the powder charge, which consists of 70 grains of United States musket powder, and there is, lastly, a lubricated lead bullet, weighing 450 grains; weight of shell complete, with primed cup, 150 grains; weight of one paper package, containing 20 cartridges, 2 lbs. 2 oz.; elevation for 100 yards, with United States regulation arm, 18′; for 500 yards, 1° 19′.

In the second modification, "Martin's centre fire" (the previous United States regulation cartridge, pattern 1867), the percussion composition is held in the cavity of a straight bar anvil of tinned iron, pressed closely against the head of the case, and likewise held there by crimping in the sides; but with a view to giving greater strength to the head of the case, this bar was replaced by the cup anvil above described. The weight of the case, with bar anvil, is 150 grains.

The third modified American cartridge is the "Powers," recommended in 1868, by the Board for Examination of Military Breech-loading Small Arms, in the State of New York, of which General Palmer, Comm.-General, was president, "for active service and general use, as combining the principles of internal and protected fulminate, and reinforcement of the head without use of an anvil."

This cartridge is associated with the Roberts' system of converting muzzle-loaders into breech-loaders. The Powers is the ordinary rim-fire cartridge, converted to central-fire by the insertion of a reinforcing cup, having the fulminate deposited in the head, as described in the Frankford, the only distinction being the metal of which the cup is formed, which, in the Powers, is copper. The weight of case reinforced is from 145 to 150 grains. Neither the Frankford, Martin's centre-fire, nor the Powers' transformed cartridge-cases, can be reloaded without removing the cup or bar anvil, and reforming the case.

Leaving modifications in ammunition, I now come to the Berdan external-primed, central-fire, metallic cartridge, the invention of General Berdan, the well-known organiser and commander of "Berdan's Sharp-shooters" during the American civil war. I would here ask attention to the family resemblance which this refined form of chamber for loading at the breech bears to the metallic chamber of 20 years past, used for enabling breech-loading arms to be loaded with loose ammunition at the muzzle, the substantial difference being in the weight and material, the improved manner of manufacture and shape of nipple or anvil. In the early part of 1867, the Berdan cartridge was submitted for trial to the Commission sent by the Russian Government to the United States, for the duty of selecting a cartridge and breech-loader for the use of the Russian army, and, after several months' examination, and many trials of different systems, this commission made choice of the cartridge which I now bring to your notice, and of a Berdan rifle, which, with other arms, I shall exhibit hereafter to-night.

The case is drawn brass, the cap-chamber and anvil being formed in the base in process of manufacture. The shell is reinforced at the base by a ring or perforated saucer swaged in, which guards against the possible escape of gas through cracks, or invisible defects of any kind in the flange—a not unfrequent annoyance with the ordinary drawn metallic cartridge. The case is necked, to suit the calibre of the projectile, which for the Russian arm using this cartridge is ·42 inch. The powder-chamber slightly increases in diameter from the slanting shoulder to the head of the case, enabling the large charge of powder for this small bore to be carried in a short case.

This cartridge-case is primed externally, by the insertion of a shallow saucer-shaped percussion cap, which, on being pressed into the cap chamber, rests on the

* In 1861, W. C. Dodge, author of the pamphlet, "Breech-Loaders *versus* Muzzle-Loaders," published in the United States, proposed a necked or bottle-shaped cartridge for Sharp's carbine.

metal, so as to ensure that the head of the cup containing the fulminate does not touch the anvil, thus carrying out in a perfect manner the idea of the safety shoulder anvil. When the cup is home in its place, the head being well inside the level of the base of cartridge, ensures safety from ignition, except by a blow from the striker, which indents the cap.

This case is punched from the sheet and drawn in six operations; headed, chambered, anvil drawn up, reinforced, pierced, and necked in five more.

The different drawings of the Russian cartridge have been confided to me, also the case in the different stages of heading and finishing. They are here. For the Russian arm the case carries a powder-charge of 80 grs., a projectile of 380 grs., and a lubricating wad of 5 grs.; total weight of cartridge, 610 to 615 grs., the variation in weight of shell being under 5 grs. Price of shells per thousand, £3 sterling gold; 130 exchange. I hold certificates stating that the Berdan case has been reloaded 50 times. I have one here which has been recharged 10 times, and, as can be seen, is in perfect condition, and capable of being used again. It is now two years since I mentioned this system of cartridge in a paper on "Ammunition," read at the Royal United Service Institution; and, if I may judge from the number of modifications which have lately come under my notice, the system is now finding favour with some of the leading manufacturers in this country.

By means of the simple reloader in my hand, you will perceive that any drawn external primed brass cartridge case on this system can be re-charged in less than one minute, without the aid of machinery. Thus—the exploded primer being removed, the shell receives the powder charge, a wad is placed in the neck, the case is inserted at the base of the reloader, the projectile is inserted at the other end, and with a setter fitted to the head and diameter of projectile and to the required length of cartridge, the bullet, with lubricating wad, is pressed home truly to its seat. The cartridge is then primed and complete. In fact, this reloader is nothing more than six or eight inches of barrel, finely chambered to receive the cartridge, the rifling of barrel at the other end being removed by boring up, to receive the projectile and the resetter.

One or two modifications of the brass drawn external primed cartridge case have been submitted to me, one of which, that of Messrs. Westley, Richards, and Co., adapted to their improved arm, I would mention as deserving particular attention.

With reference to the bullet cartridge, which, as no doubt you are aware, is a projectile carrying its own means of propulsion, I feel I cannot do better than refer to Captain Selwyn, R.N., who has been experimenting on the subject, and whose knowledge on all points connected with ammunition and arms renders his opinion most reliable.

Before leaving this, the primary subdivision of my paper, I would venture to offer a few observations on the subject of ammunition. My remarks will apply to the metallic-cased cartridge only, as it must be acknowledged that other descriptions of small-arms ammunition have been all but superseded by this.

In the metallic cartridge my observations will bear particularly on the chief component parts, viz., the *case*, the *powder-charge*, and the *projectile*.

With Reference to the Case.—It is palpable—all other considerations save the primary cost of manufacture being equal—that the cartridge case which can be reloaded the greatest number of times, in the simplest, readiest, and least expensive manner, must be the best, the primary or extra cost of case being decreased in proportion to the number of times it can be made available for extra service.

With such a system of case, and a suitable and simple means of reloading it, the manufacture, or rather the remaking up, of cartridges for breech-loading small arms by the troops—wherever cases, powder, ball, and primers can be supplied without necessitating the return of the empty cases to the store for the purpose—may with advantage again form part of the musketry instruction of the army, thereby obviating the necessity of large stores of made-up ammunition, subject to deterioration from climate or time, and effecting a large saving to the nation, as well as at the same time increasing the efficiency of the troops, by making them the means of supplying themselves. Loss or destruction of the cases, after discharge, by design or carelessness, may be provided against in the same manner as loss or damage to the arm, the clothing, or necessaries of the soldier.

By the volunteer who has, in order to approach the standard of efficiency requisite for a prize competition, to fire some hundred rounds of ammunition in a season, the advantage and economy of a cartridge case capable of being reloaded repeatedly by himself with facility, cannot but be appreciated. The only objection that could be advanced against such a system is, that the defeated competitor would not have even the consolation of throwing any part of the blame of his defeat on the ammunition which he himself had made up.

With regard to the powder charge.—The greater the strength of the powder charge which can be converted in a given length and diameter of bore to propel a projectile of defined weight, the greater the initial velocity of that projectile, and the lower the trajectory, up to certain ranges.

The lower or flatter the trajectory, the longer the "dangerous space," that is, "our catch and graze;" and the military arm giving the lowest or flattest trajectory to the longest range must be the most efficient, supposing all other points equal.

With the Snider ·577 bore, regulation charge, with elevation for 500 yards, the highest point of trajectory being 11ft. 10¾in., the safe distance for infantry, would be between 92 yards and 438 yards, viz., 346 yards. With the Martini-Henry, ·45 bore, elevation for 500 yards, with 85 grs. of powder, 480 grains projectile, the highest point of trajectory would be 8ft. 1¾in.. The safe distance for infantry would be between 135 yards and 396 yards, viz., 261 yards; dangerous space, 239 yards. Now, taking the height of the soldier at 6ft. (the utmost average), if the trajectory could be so flattened as to ensure, at a range of 500 yards, that the highest point of curve would not exceed the height of the soldier, it is evident that any error in judging distance in the hurry of file or rapid firing, would make but little difference in effect on a line, much less on a column.

To obtain the requisite initial velocity for this low trajectory, a heavy charge of powder, of increased rapidity of combustion, with a somewhat decreased weight of projectile is necessary; the heavy charge of powder compensating for the lessening of weight in projectile, even beyond medium ranges.

The people who have led Europe in making and adopting good muzzle-loading rifles—the Swiss—demonstrated this as far back as 1851, in their Federal or Wurstemberger rifle.

May it not therefore be worth consideration, or more than consideration, whether the lessening of the weight of the 480 grains projectile by some 60 grains or 80 grains, even with a ·45 bore; the increasing of the charge of powder by from 5 grs. to 10 grs, and if necessary the use of more rapid burning powder compressed, granulated, or both combined, would not obtain the required initial velocity and flatness of trajectory to catch infantry anywhere within 500 yards, or even within a greater distance, consequently rendering any close formation of troops within that limit difficult and dangerous. The slight increase of weight of metal in barrel would tend to keep the recoil at the prescribed limit, even should a 9-lb. arm not be of sufficient weight, the decrease of weight in ammunition more than compensating the soldier for the increased weight of arm.

A large rapid burning powder charge affects also the

material and calibre of projectile, and further the pitch of rifling in the barrel.

With reference to the projectile.—The material of which the projectile is composed should invariably be suited to the quality of rifling in the barrel, that is, to the depth and form of groove and form of land in bore. The shallower and finer the rifling, the harder should be the material of projectile. In the present stage of advancement in ammunition and arms, bullets should not be always made of lead.

To afford sufficient resistance, and to ensure that the large powder charge is consumed in the barrel, and the consequent application in the bore of the full force to the lightened projectile, the latter should be of a diameter close to the diameter of the bore measured along the grooves, or if ribbed rifling is used nearer to the diameter of the bore itself, thus ensuring not only the requisite resistance to the rapid combustion, but less upsetting, and the consequent retention of the form of projectile.

Regarding the best form of projectile, I can add nothing to the information which Major-General Boileau, R.E., did me the honour of putting forward in a paper prepared by me, on Cartridges, for the Royal United Service Institution, in March, 1868. I shall merely say, that cannelures on a projectile, though they might be of advantage in holding the projectile in some descriptions of powder case, must be detrimental in after-flight.

The increased charge of rapid powder for any given length of bore requires a proportionately slow pitch of rifling, to ensure that the projectile is not driven across the rifling. I need not observe that the decreased pitch, with a rapid burning powder charge, gives, as regards rotation, the same results as the sharper pitch with slower powder, the increased velocity of after-flight compensating for the decreased pitch of rifling; the lessened weight of projectile telling on accuracy in elevation only at the long ranges.

I now turn to inventions and improvements in breech-loading arms. Before, however, entering into this subdivision of my paper, I would mention that I shall not presume to touch on arms which have undergone trial, and been reported on by the Sub-committee of Ordnance Select Committee in this country, unless such as have been modified or altered since the publication of the final report of that committee.

The component parts of the arm are, the breech mechanism, the barrel and the mountings, each distinct and separate, the barrel on any system of rifling being available for use with any system of breech mechanism, as must, in these days of breech-loading, be generally known.

The breech mechanism for every description of arm may be classified under three heads, namely, the *block*, the *bolt*, and a combination of both, which I shall designate *compound block*, or *compound bolt*, as either system predominates.

There are several varieties of the block system, each taking or receiving a distinctive appellation, from the manner in which the block opens to permit of the cartridge being placed in the barrel. The extent of this paper will not permit of a detailed description of each particular system or arm which is here for your inspection. I am, therefore, reluctantly compelled to limit myself to a selection from the excellent specimens before you, which I shall divide into new and transformed arms. In making a choice of new arms, I shall take the two latest improved breech-loaders on the block system which have come under my observation, namely, the Soper and the Westley-Richards, which, I am proud to say, are both British.

Soper's lately-improved direct-action breech-loader, with side-hinged swinging block, has lately been submitted to me, and the inventor, Mr. Soper, of Reading, has lately given me an opportunity of testing the arm. It is extremely simple in manipulation, and for rapidity in firing, really astonishing.

By selecting for his improvements a system of block which opens the bore at the rear, so as to enable a cartridge of any length to be truly inserted and retracted, with axis in line with axis of bore, and by a peculiar arrangement of parts, whereby the opening of the breech, the cocking of the piece, and the extracting of the cartridge-shell are simultaneously effected by one movement of the hand, without changing the position of the arm, Mr. Soper has managed to combine the chief advantage of the bolt-system, with a description of block, which insures safety and extreme rapidity in firing, certainty of extraction, and the greatest length of rifle-bore. The large proportion of the cartridge-case, which is held by the sliding extractor, and the facility of examining and cleaning-out the bore, may be claimed as additional advantages in this arm. The lock, which consists of the usual pieces and springs in a modified form — the unity of sear and trigger lessening the number by one, being encased in a steel frame, which forms one with the trigger plate and guard, is securely enclosed in the stock, which is unbroken. The breech-block, extractor, &c., are worked through these pieces by a lever which takes the place of the ordinary cock. A peculiar construction and combination of the tumbler and hammer enable the latter, by means of the tumbler, to be drawn back to full or half-bent, allowing the tumbler to return with the breech-block, in closing the breech, without moving the hammer.

Connecting the breech-block and tumbler together by means of a rod and the pins and slots, which allow the block and tumbler to move freely in their respective places, while the rod works in a closely fitting guide, is ingenious. The accelerated extractor motion from beginning to end of throw is also noticeable. An examination of this arm will show that it is impossible that the hammer can explode the cartridge until the block is securely in its place. There are in the mechanism only two springs, neither of which is spiral.

I have seen certificates stating that the Soper breech-loader has been fired, for rapidity, over forty times in one minute. Certainly, from what I have seen of its performance, I can understand how this rapidity has been obtained. The weight of the arm here to-night is $8\frac{3}{4}$ lbs. The barrel is full length, and of more than usual thickness of metal.

I shall next call your attention to the new Westley-Richards breech-loader, with rear-pivoted dropping-block. In consequence of having received this arm only a few days since, I have not had an opportunity of practically testing it; but from the reputation of the patentee as a manufacturer, from the principle of the breech mechanism, and especially from the simplicity, strength, and ingenuity of the combination and construction of the parts, it needs no uncommon knowledge of arms to forsee that this breech-loader must take the leading position in future competitions.

The patentee claims the following advantages for this arm; a full-stocked arm, the absence of spiral springs, the use of a hammer of the ordinary kind, $\frac{3}{4}$lb. less weight in breech-closing arrangements than that of most other systems. The parts are simple, few, and very strong, being only twelve in number, and seven pins. As can be seen by the arrangement of the lever at the time of priming, the greater the force upon the block, the more firmly it is locked. The block is also supported at the extreme end, next the cartridge, by an arm of the lever, which is in a vertical position. The extractor is a powerful lever, capable of forcing out any cartridge case that might get jammed in the chamber; it also ejects the case clear of the rifle. The locking-bolt acts in place of a half-cock; it is a cam, very strong, and can easily be moved by the thumb when the arm is in the firing position. The rifle can be loaded and unloaded with the trigger secured. The cost of the arm is £3; in large quantities, it can be produced for less.

There is here another Westley-Richards rifle, similar to the arm just described in construction and principle, but having a horizontal striker and hammer combined, which is acted on directly by a main or V spring, which, in this case, is placed in the rear of the striker, thereby rendering the works more compact. By this means, two or three parts are dispensed with, and the process of manufacture is made cheaper and more simple. The weight of the Westley-Richards arm is $8\frac{3}{4}$ lbs. It can be fired, for rapidity, twenty-six times in one minute.

Of transformations, I shall introduce to your notice, first the Roberts' breech-loading rifle, the United States Springfield musket converted. In 1868, this system was recommended for adoption by the Board for Examination of Military Small Arms, in the State of New York, "as superior to all others examined for the conversion of the muzzle-loading arms owned by the State into breech-loaders, as combining the qualities of strength, durability, safety, efficiency, and economy."

The breech-loading parts, including the breech frame or receiver, which is imbedded in the stock in the place of the old breech-pin, and into which the rear of the barrel is screwed, are five in number, articulated together without pins or screws. The parts are, the rocking-block, the lever-plug, the lever-catch, and the lever-retractor. It is claimed for this arm that it is the only one strictly on the "lever" plan, having lever strength for its entire operation. The breech-plug is a lever, the extractor is a lever, and the "catch" that holds the breech-plug in place for firing is a lever. These are the principal parts that take the wear and tear in this class of fire-arms, and, as may be seen on inspection, they are all of great strength, and so mechanically combined as to receive the recoil shock of the charges without any cross-strain or disposition to displacement. By the arrangement of the pieces, repeated firing shocks have no tendency to destroy the fibrous structure or to weaken the parts.

The breech-block is inserted through the receiver, and supported against the rear end on a semi-circular shoulder forming the back of it, the centre round which this semi-circle is described being in prolongation of the axis of the barrel. The rear of the breech-block is turned to fit with exactness this semi-circle, and is played around it as a fulcrum. The cheeks of the receiver support the block laterally. When the block is in place in the receiver, it forms a curved lever, the handle projecting backwards, and it then is moved about the solid abutment of the receiver instead of being pivoted by any system of points or pins, thus affording great solidity and strength.

The block ie divided—a peculiarity in this system. The forward end of the rear and larger division has a semi-circular groove cut transversely through it, for the purpose of receiving a corresponding tenon formed on a block of steel, which latter is termed tho recoil plate. The front face of this block is flat, and, when in position, fits squarely against the vertical face of the chamber and head of the cartridge case. A small space is left between the tenon on the rear of this block and tho front surface of tho breech-block above the transverse groove, to admit of a slight rocking motion of tho recoil-plate, so that it will descend perpendicularly when tho lever is raised, until tho top of the plate passes below the axis of the barrel, after which it swings with tho arc of tho circle on the rear end of the receiver. When the rear of tho lovor is raised, the recoil-plato ascends to its position by the exact reverse motion, up to the axis of tho barrel on a circular motion, and then, to close the chamber, ascending vertically, and closing squarely against the head of tho cartridgo-case and the vertical faco of the chamber. Tho extractor, or retractor, is actod on only when tho top of this plato reaches tho bottom of tho chamber.

There aro throe springs in the broech mechanism, ono only of which is spiral, viz., the lever-catch spring, the spring for throwing up tho breech-plug after the cartridge is inserted, and the spiral spring, to draw back the firing-pin when the lever is operated.

The price per gun for conversion on this system is about 21s. This arm has never been submitted for trial to our Special Sub-committee.

The next block transformation is the Peabody system, for conversion of muzzle-loaders to breech-loaders; also American, as the name implies. This is a modification of the Peabody falling-block arm, which I exhibited in this room nearly three years since. I am sure you will admit, on examining this transformation, that, for simplicity and strength, the mechanism is of the highest order. It consists only of a breech frame—a solid breech-block—having a spring attached to its lower side, and carrying an igniting bar, a lever extractor, and a pivot or pin. This arm is also on the "lever" principle, the hinged-falling breech-block (which is pivoted by a strong pin passing through it) and the sides of the frame being one with the lever tailpiece, and operated on from above by pulling upwards.

The extractor is also an elbow lever, operated on by the block when it falls. On the underside of the breech-block is a spring, the rear end resting upon notches, which serves to hold the breech-block in different positions for loading and firing. On the block there is a projection in rear of the fulcrum-pin, so made that the hammer—which, with side-lock, is retained with this arm—in striking the firing-bar, must hook over and on to the projection, and thus completely lock and secure the breech-blook at the time of discharge, and make the discharge impossible unless the breech-block is fully up to the position of firing, for otherwise the nose of the hammer, catching upon this projection, will not reach the firing-pin. On the rear end of this firing-pin is a projection forming a shoulder, which has a bearing on a portion of the breech-frame, raised at that point to correspond with the angle of the shoulder, and forming a stop for the hammer. In the operation of loading, the firing-pin is drawn backwards, in consequence of the shoulder of the projection coming in contact with the raised part of the breech-frame, thus preventing the point of the firing-pin from piercing or even touching the cartridge until driven forward by the hammer.

The points of merit in this arm are, the small amount of metal required for the breech mechanism; the small number of parts; the easy manner of taking out the breech-block; the retaining a stock unbroken, the ordinary permanent guard, and the regulation lock.

The third American modification is the regulation-arm for the United States army, model 1868. This is the Springfield rifle-musket, model 1863, converted to a breech-loader on the Allin principle. To the barrel is screwed a receiver, or breech-frame, in which the block swings upwards and forwards, as in the model of 1866. The opening in the breech-block in this frame is $3\frac{1}{4}$ inches in length. The breech mechanism consists of three spiral springs, and six pieces, or pins, viz., the receiver; the breech-screw, or pin, with circular recess; the hinge-pin, around which the breech-block turns; the cam-latch, which locks the breech-block in place; the cam-latch spring, to press the cam-latch into the recess; the firing-pin, through which the cartridge is ignited; the firing-pin spring, to retract the firing-pin when the hammer is raised; the cartridge-case extractor; and the ejector-spring. In order to prevent the possibility of the hammer falling upon the firing-pin when the breech-block is not down and lockod, a projection is arranged on the end of the thumb-piece, serving the same purposo as that already referred to in the Peabody system.

I now refor to the socond system of breech mechanism, the bolt. Although having strong belief in its safety, convinced that placing the cartridge in tho chamber with axis in line with axis of bore, and that retraction by the same lino must always tend to the general efficiency and security of the ammunition, I confess I approach tho subject with diffidence from the

fact that lately the system has been condemned by very high authority; and I should not put forward my weak voice in favour of the breech-loading mechanism, had I not here to-night the means of proving that arms can be produced on the bolt system, giving as great security from premature ignition as those on any other. With this view, I have made choice of one or two recently improved bolt arms for your inspection.

It is almost unnecessary to inform this assembly that the chief difference between the block and the bolt system is that, in the one, in securing the cartridge in its chamber, the block comes across, or obliquely, and gradually approaches that part of it containing the fulminate, the cartridge being already inserted, or partly inserted, in the chamber by hand. In the other, the bolt comes directly up to the base of the cartridge, whether placed in the chamber by hand or pushed into the chamber with face of bolt flush with the primed base of cartridge, any sudden contact with the percussion-cap, which is not always inside the level of the cartridge base, being dangerous. The manner of placing the cartridge in the chamber, and of approach in shutting it up, is the secret. Mr. Kerr, of King William-street, no doubt fully alive to this, and also desirous of establishing the safety of the bolt system, has produced his screw-bolt breech mechanism, thus improving an arm which had already been favourably mentioned in the report of the Special Sub-Committee.

Mr. Kerr's screw-bolt is a simple, strong, and safe means of breech-loading. The side-lock is retained, and is altogether separated from the bolt. By a screw motion which is given to the bolt, it is mechanically impossible that the face of the bolt can strike the base of the cartridge, or close on it with any force. Neither can the firing-pin reach the percussion cap so as to cause explosion until the system is locked and in position for firing. In this system, it is not necessary to place the cartridge home in the chamber before closing the bolt; if within half an inch of its position, it must be moved gradually home by the screw motion of the bolt, no matter with what rapidity or force the latter is moved forward. Seven pieces compose the breech-mechanism; and as there are no openings in the shoe communicating with the lock, the barrel can be washed out by pouring water through it—a matter of some importance in a military arm.

Another safe and efficient arm on the bolt system is a modification of the well-known Green bolt-gun, using a metallic cartridge, the invention of Messrs. Green. In this arm, the cartridge can either be placed in the chamber by hand or by the bolt, without danger of exploding the cartridge, even should the cap be flush with the base. A spiral spring is used in the bolt, but only for the purpose of retracting the striker, which is driven by a hammer worked by an ordinary main-spring, and the head of the striker is effectually secured against percussion until the bolt is locked, even should the hammer fall, rendering it secure from premature explosion. I can speak from experience of this arm, as Mr. Green has afforded me ample opportunity of testing the safety and efficiency of it.

Another description of bolt-arm has been entrusted to me, which, I regret to say, I have not been able to test practically, in consequence of receiving it only very lately, and being pressed for time in completing this paper. But from what I have seen of the arm, it strikes me as being a simple and valuable breech system for sporting arms, and will well pay an inspection, I allude to the Bacon patent bolt-arm. The projection of the striker in pushing the bolt home is entirely obviated in this arm.

Of compound breech-loaders, I have here one specimen, the Berdan Russian, which is a "bolt," working through a hinged "block."

I shall now ask your attention and inspection of a novel and very ingenious cavalry small-arm, the Le Mat repeating and single-loading carbine, the invention of Col. François Alexander le Mat, of New Orleans, which is a nine-chambered revolver, having a slug barrel for single loading with a metallic cartridge. The weight of this astonishing little arm is but 5¼lbs.

I shall close the subject of breech-loaders with a few remarks on the spiral spring, when employed as a main or driving spring. To those who use an arm having the main-spring a spiral one, it is well known that the force given to the striker is materially affected by the manner in which the trigger is pulled—I mean to say, the way in which the spring is released—a sharp jerky pull of the trigger igniting a cartridge when the slow, steady pressure, which our musketry instructions teach the soldier to use, fails. This can only be attributed to the fact that the spiral or coil spring acts obliquely as regards the spring, although directly as regards the striker, and that, when released gently, the spring expands coil by coil, imparting only a pushing motion to the striker—hence mis-fires; but when the spring is released suddenly, a greater number of coils are brought into action at once, imparting to the striker a more sudden movement, which consequently effects ignition. In fact, in one case the contact on the cap is by a push, in the other it is, if I may use so unmechanical a term, by a shove. From this it is clear that a spiral spring ought never to be used as a main or driving spring.

With regard to the barrel, I can only say that the thicker the metal round the bore, the more efficient the arm, always considering the weight of arm a soldier can carry with efficiency. The most perfect rifle barrel is one having the thickness of metal equal to the diameter of bore; but as this amount of metal cannot be given to or carried by a soldier, the barrel having the least reduction must be the best. So long as in rifling the cylinder the present system of cutters is pursued, every cut diminishing the truth of the original bore, we can never arrive at a perfect rifle, but the most perfect is the barrel with the finest grooving. I would suggest also that the rifling for a military arm which is fired from the right shoulder be from right to left, instead of left to right, according to the present system. My reason for this suggestion is, that the soldier fires from the right shoulder, the pull of the trigger is to the right, and the pitch of rifling being to the right, and the recoil on the right, the result of all firing is to the right, as proved by the records of practice.

Before closing my paper, I should wish to mention that I am indebted to the Royal United Service Institution for many of the arms which are here to-night for reference and exhibition. I should also wish to acknowledge my obligations to my correspondents in the United States, particularly to W. Read and Sons, of Boston, Massachussetts, the well-known and extensive ordnance and small-arms manufacturers; and to the treasurer of the Union Metallic Cartridge Company, Bridgeport, Connecticut, who have been most liberal and generous with information and specimens of arms and ammunition.

DISCUSSION.

Capt. Selwyn, R.N., said he appreciated so highly the labours of Captain O'Hea, that he felt it incumbent on him to say a few words on the subject, and, in so doing, to economise time, he would take seriatim the points in the paper which seemed to call for remark. One of the first was that in which Captain O'Hea referred to the comparatively slight attention which had been paid to ammunition for breech-loading rifles. For many years he had been trying, in concert with Captain O'Hea, to press upon public attention the fact that the ammunition was the life and soul of the breech-loading system. If they began with the arms, they began at the wrong end, and that was now beginning to be understood. They ought to begin with the projectile; then consider the force employed to drive it; the kind and quantity of powder; thirdly, the cartridge in which it was con-

tained; and fourthly and lastly, the breech-loading arm. He need not say that this order had been exactly inverted, for the Henry-Martini rifle having been chosen, the committee were now trying, and he hoped not in vain, to get a suitable cartridge for it. With regard to the Chassepot rifle, he could so far corroborate what Captain O'Hea had said of it, that very recently he had been in conversation with a French gentleman, who mentioned that, on a recent visit to Paris, he had seen the surgeon of the *Chasseurs de Vincennes*, who told him that he had performed no less than twenty operations of the thumb, every one occasioned by an injury exactly similar, from the premature explosion of the cartridge in a Chassepot rifle, from the insertion of the needle when not intended. Such experience might teach them how dangerous was the premature explosion of the cartridge in a breech-loading arm, and also that any system by which the bolt was pushed up by the thumb presented a difficulty which did not occur in other cases. With regard to Mr. Daw's cartridge cases, that gentleman had been the most persistent worker in England, at any rate on this question of cartridges, and had produced one which, to say the least, stood at the head of all made in this country, and, as he thought, equal to any, particularly in lightness, which was a matter of very great importance, since the least diminution in the weight enabled the soldier to carry more; and inventors were now pressing forward with arms capable of firing more shots in three minutes than a man could carry. The modified copper case, which enabled them to reload was also of great value, for although such a thing would be impossible in ordinary field operations, it would be of immense value when troops were shut up in a fortress, without the opportunities of adverting to a Boxer-Eley-Daw-Mitford machine for making cartridges. The price of the cartridge was also as important an element to the nation as anything he could conceive, for, with the ordinary breech-loading rifle, the price of a thousand cartridges was equal to that of the gun, and it was no use having an arm which cost only £2 if you fired away the value of it in a thousand rounds. He quite agreed that it was well worth considering whether the weight of the bullet could not be reduced, both on account of the lower trajectory which such a bullet would attain when propelled with a heavy charge of powder—whether slow powder in a long rifle, or quick in a short one, for the length of the barrel ought to determine the nature of the charge; and in either case no doubt the projectile would be propelled further, and with a lower trajectory; but there was also this important point, that it would lessen the weight of the individual cartridge, and thus enable the soldier to carry more. Still more was this the case when the lightening of the bullet was obtained by an admixture of tin, as had long ago been illustrated by the chairman, who showed that such a bullet was harder than one made entirely of lead, while, at the same time, its specific gravity was not too much diminished, as would be always the case when plugs of clay behind, or plugs of wood in front, were employed. Such lightening of the specific gravity always had the effect of raising instead of lowering the trajectory. With reference to the bullet cartridges he need not point out to persons conversant with military arms, that if the metallic cartridge was an admirable invention in its present form, it would become still more valuable if they were able to enclose the charge of powder in the bullet, and thereby do away with all necessity for extractors and complicated gas closure. This had been done to a certain extent, but there had hitherto occurred some difficulty in the practical application. Two systems had been adopted: one, in which the powder was enclosed in the hollow case of the bullet, which was made longer in consequence, although of the same weight; and the other, in which two hollow bullets were employed. In this plan the bullets were all filled, like cartridges, when intended for use, one was taken from the pouch, opened, the powder shaken out, and the bullet placed in the rifle; the second cartridge was then taken and pushed up behind the other, provided with a proper amount of fulminate. When the gun was fired the first bullet was projected forwards, whilst the other remained behind in the barrel ready to serve as a projectile in its turn. This method was very ingenious, and would no doubt have been entirely successful, but for the fact that in all these cases there was a certain degree of difficulty attendant upon mis-fires, when it became a somewhat tedious operation to take the non-exploded cartridge out of the barrel. That the material of which the projectile was composed should be suited to the grooving of the rifle was a principle of the utmost importance—indeed, he might call it an axiom, both with regard to cannon and small arms, although hitherto it had received but little attention. All sorts of rifles were produced, with every variety of form and twist of spiral, and with all kinds of fancy grooves, but no great attention had been paid to the proportion which the groove ought to bear to the projectile which was employed. In conclusion, he would say that all who had listened to this paper, as well as the former one by the same author, would agree that Captain O'Hea had performed the most difficult task of steering clear of all that was old, and giving them not only what was new, but a great deal of that which was valuable.

Mr. Mackie said there was one particular in Captain O'Hea's paper which required correction; it was with regard to the dates of Colonel Boxer's patent and Mr. Daw's. The former was stated to be the first, the patent being dated in January and October, 1866, while the second modified English cartridge was said to be Mr. Daw's, without giving any date at all. Now, if any reference were made to dates in such a paper, extreme care should be taken that they were accurate. The first central-fire cartridge was that shown by Mr. Daw, in 1861; and Colonel Boxer did not patent his cartridge until he was called upon by the government to produce a cartridge, for the Snider rifle, and his patent was dated in 1866. Reference was also made to a bottle-shaped cartridge as produced by Mr. Dodge, in America, in 1861; no doubt "necked" cartridges were produced in drawn metal at an early period, but the real value of a necked cartridge involved a question of far greater importance than the date of a patent. Allusion was made in the same place to a cartridge drawn-in or puckered-up with folds or plaits, but no reference was made to a very admirable cartridge, of bottle-shaped construction, made long previously by Mr. Daw. He did not think the bottle-shaped cartridge of that gentleman had ever been equalled. He had fired six rounds from a Daw cartridge after refilling, and had also fired some with perfect success after immersion for 12 hours in a bucket of water, then being put by without any care or precaution for two years. Passing these, no doubt, accidental errors, he might refer to one or two other topics which seemed worthy of notice. Specimens of drawn cartridges had been handed round, and he should like to say a word on the subject of drawn metal cartridges *per se*, independently of who were the makers; because he believed that on the mechanical principle upon which a cartridge was constructed, its efficiency in a great degree depended. He did not think it possible for a drawn metal cartridge to compete with one made of coiled metal, for several reasons. In the first place the metal must be soft, in order to be drawn, and if soft, it was liable to be set up into the chamber by the explosion; and if it got set up it was difficult of extraction. Again, a drawn cartridge must have a certain mass of metal in it to ensure it from accident by fissures, holes, or defects, and therefore it never could be drawn so fine, thin, and light, as metal foil could be, which was rolled up into a case. Moreover, metal foil could be examined before it was used, and if not perfect could be thrown aside. He believed that if anyone would take these drawn car-

tridges, well made as they were, and weigh them in the scale, and compare them with the coiled cases made by Mr. Daw, or anyone else, out of thin metal foil, they would find them much heavier; and a practical soldier like Captain O'Hea, was aware that the weight was a very important consideration. Again, in a drawn case there was only a certain distensibility, limited by the extension of the metal itself, and if that were over-strained by a cartridge being put into a bore of larger diameter, there might be a rupture and escape of gas; whereas in a soldered cartridge, the distension took place by sliding over the solder, which permitted a considerable extent without any rupture in the tube. These were matters which he thought called for the serious attention of everyone interested in the question. Another point had been mooted by Captain O'Hea, in which he could not agree with him, viz., in his desire to diminish the weight of the bullet, and increase the charge of powder. In increasing the charge, either in quantity or violence, they must not forget that they had to deal with a human machine—the soldier; an increased charge meant an increased recoil, and then it became a question of how much a man could bear if he had to continue firing for any length of time. Besides, by diminishing the weight of the bullet you at the same time diminished the amount of force in it when propelled to any given distance. If Captain O'Hea could persuade him that the force or momentum of a bullet was not, roughly speaking, as the square of the weight multiplied by the velocity, he should be very glad indeed to agree with him that a light bullet might hit as hard at 1,500 yards as a heavier one travelling with the same velocity. The practice made by Mr. Whitworth last year at Shoeburyness with his 9-inch gun, showed very clearly that he could throw a 300 lb. ball to the same distance, within 200 yards, as a 250 lb. shot, with the same charge of powder, and pretty nearly the same velocity; the relative proportion between the ball and the powder must be fixed, or there would be loss of force on the one side or on the other. He thought it was far better to gain actual hitting power at a distance, by increasing the weight of the ball and also the quantity of the powder, which is done by the diminishment of thickness and weight in the coiled case. So far as flatness of trajectory was concerned, most admirable shooting had been got out of the Henry barrel at Woolwich, and he believed the practical minimum of trajectory was pretty nearly acquired. In order to get a flatter trajectory they must charge with heavier bullets, and more powder. They must have weight in the metal flying through the air, in order to keep it down from the incline of air against which it travelled, and they must also have rapidity of motion from point to point. If a ball were fired from a point 16 feet above the plane of the earth, they knew it would fall that 16 feet in exactly a second of time; if it were propelled 1,200 yards in a second, it would fall at the distance of 1,200 yards; if 1,500, at the distance of 1,500 yards; so that the distance which it travelled in a given time was the exact measure of the flatness of the curve which it described in going through the air. In conclusion, he said the questions brought before them in the paper were of such importance that he trusted they would be well considered and discussed, not only there, but elsewhere, so that the real history, present condition, and actual requirements of cartridges might become well known to the public.

Mr. Latham said he had listened with great attention to the paper, and also the remarks made by Mr. Mackay, with the majority of which he agreed, particularly with regard to the advisability of altering the weight of the bullet. He could not help thinking that, in going down to these small bores of ·45, which appeared to be accepted now, although they had gained a great deal in accuracy at long ranges they lost in force. Reference was made by Captain O'Hea to the ignition of the powder in front of the cartridge, and he might mention that at the Exhibition of 1862, the value of this method was shown by Mr. Vallance, who made many interesting experiments with guns and gunpowder. He showed that a bullet of 530 grains weight could be projected with a thin drawn piece of tube, if the powder were ignited in front; whereas if it were ignited behind, the tube burst, and there was no accuracy of shooting. If they could devise any means for igniting the powder in front, they would gain considerably both in accuracy and in the weight of the rifle.

Captain Selwyn said he had forgotten to mention one point on which Captain O'Hea would forgive him for differing from him, viz., with regard to cleaning arms. He had had a good deal of experience in this matter, for he never allowed any one else to clean his own guns, and he did not at all agree as to the use of water. He considered one great advantage possessed by the breech-loader, which both sportsmen and soldier would recognise, was, that it could be cleaned in two minutes, simply by drawing a piece of flannel through the barrel, much more perfectly than a muzzle-loader could be cleaned by any means whatever.

Mr. Botley said every one must agree that they were much indebted to Capt. O'Hea for the able and instructive paper which he had brought before them, and for the collection of arms with which he had illustrated it, and he had no doubt that a most cordial vote of thanks would be accorded to him.

Capt. O'Hea, in replying to the observations which had been made, said he fully agreed with many of the observations of Capt. Selwyn, and would only add that that gentleman's great experience was quite sufficient to set the highest value upon his opinion on this subject. With regard to Mr. Daw's cartridge, which had been referred to by Mr. Mackay, he was sorry that specimens were not in the room. Mr. Daw had spoken plainly of the priority of invention of the Daw cartridge over the Boxer cartridge on a former occasion of his (Capt. O'Hea's) reading a paper at the Royal United Service Institution; the present paper was, however, confined to improvements made within the last three years, Mr. Daw's real improvement within that period being that of attaching a solid basis to his first cartridges. With regard to the weight of the bullet, he must still adhere to what he had said. The larger the powder-charge that could be fired out of any given arm the flatter the trajectory; that was all he could say, but it had been proved, over and over again, in the case of the Russian arm, which gave a flatter trajectory than the Martini-Henry. He had always said that the weight of the arm should be made to suit the capacity of the soldier and the size of the ball, but the heavier the arm a man could carry the greater would be the efficiency.

The Chairman, in summing up the discussion, said the paper which had been read treated of matters which deeply affected their national honour and independence. A great nation like England could ill afford to be behind other countries in the development of those mechanisms which now formed the chief excellence of infantry small arms; for in proportion as they maintained their place, either on an equality with, or of superiority to other nations in this matter, so would they receive respect from them; and in proportion as they were able to use these mechanisms which the talent of their gunsmiths produced, so far would they be able to maintain their independence. The extreme precision, great length of range, the rapidity of fire, the simplicity of mechanism, the excellence of the ammunition, and the penetration of the bullet—all these points combined had made modern weapons of war terrible to an extent never before anticipated. It had, to a great extent, placed the man of courage and the man without on the same level, and had, to a great extent, done away with that which had always been the pride of the British soldier, his "pluck," so that government were now beginning to recoil at the great advances which had been made in weapons of destruction, and to turn their attention not so much to

improving what seemed already near to perfection, as to how they could best protect their own soldiers from the weapons of the enemy. In the early days of the game of war, "clubs" won; but since arms of precision had been introduced, and it became necessary to provide be a screen from the bullets of the enemy, he might permitted to say that "spades" were trumps; for it was now actually decided that each soldier should carry not only his rifle and ammunition, but also a spade. But, whatever might be the progress of invention in these matters, there was not yet the slightest doubt that the British soldier would always be found equal to the occasion; and he had no hesitation in expressing his conviction that whatever might be the mechanical skill of the nations of Europe and America, the English would, as they had hitherto, stand far in advance of all the rest in the excellence of their arms, as they had always done in the valour of their troops, and in all other attributes required in a soldier. With regard to the question of ammunition, they were much indebted to the gentlemen who had taken part in the discussion, because one of the principal objects of such papers as they had just listened to was to elicit discussion in societies which, being totally independent of government influence, afforded free scope for the expression of all opinions, which could not fail, if well founded, to guide, to a certain extent, those to whom the selection of the small-arm of the future would be entrusted. They were, therefore, much indebted to both Captain Selwyn and Mr. Mackay for the freedom, and, at the same time, courtesy with which they had expressed their different views. With regard to the hardening of the bullet, he agreed generally with what had been said by Captain O'Hea. A very soft bullet had objections to it of various kinds, which must be apparent to all who had any acquaintance with rifle-shooting, but with regard to lightening the weight, there was one point which seemed to have escaped notice. When a bullet was very light the resistence of the air acted greatly upon it, and brought it to a slow velocity much sooner than when it was heavy, and therefore the sustaining power of a heavy bullet gave it, to a certain extent, a low trajectory. A bullet might be conceived so light as scarcely to range any distance at all. He believed experience had proved 480 grains to be about the best weight with reference to the weight of the arm and the powder charge. Since Captain O'Hea was good enough to refer to his bullet at the Royal United Service Institution he had made one slight alteration chiefly with the view of obtaining length and sustaining power, which consisted of the insertion of a small wooden peg or plug in front of the base cavity, which added to the length, but did not in any way detract from the penetrating power; three-fourths nearly of the fore part being solid, as it should be. The bullet contained about 5 per cent. of tin, and was sufficiently hard to penetrate at the extreme range to which a rifle would throw a ball. There was one point which had not been noticed, though he considered it of very great importance in all cartridges, whether for muzzle or breech-loaders, viz., that the bullet should be wrapped in paper, either greased or not. It was absolutely necessary to interpose some substance between the metal of the bullet and barrel, or else the latter rapidly became foul, and after a few rounds all precision of firing was impossible. With regard to breech mechanism, there were three rifles exhibited that evening which were pre-eminently good, the first of these was the Soper rifle, one great advantage of which was the simplicity of action, which being confined to the wrist, did not tire the soldier so much as where the arm had to be moved. Nothing could be simpler than the up and down wrist movement in this rifle. Next came the Wesley-Richards rifle, which was a great improvement on the Martini-Henry; though the general principle was the same, the mechanism being much simpler. When this rifle was considered, as he had no doubt it would be by the Select Committee, he thought it would replace the Martini-Henry, which he believed was only the *embryo* rifle, and not the one which would be definitely adopted if a better one were brought forward; and he had no doubt that before the expiration of the two years appointed for testing it, many excellent arms would be brought out. The last rifle he wished specially to notice was that of his friend Mr. Green, with which he fell in love at first sight; and if he were permitted to take into action the rifle which he most approved of, he should certainly select this arm. It could not be fired until the block came perfectly into its place, so that premature explosion could never occur. He had fired a good many rounds with the first pattern, which was adapted for paper cases, and since had been improved by the substitution of metalic cases, he believed it was decidedly the best breech-loader out. The ejection of the cartridge case was very perfect. In conclusion, the Chairman put to the meeting the vote of thanks to Captain O'Hea, which was carried unanimously.

EDUCATIONAL NOTES.

There have been several meetings held under the auspices of the League during the last few days. At Newcastle, arrangements have been made for a series of meetings in the district, for explaining and advocating the principles of the League, and one has been held at South Shields. At a large meeting at Devonport, called by the Mayor, Mr. Jesse Collings, the Honorary Secretary of the League, asked for further delay in legislation, fearing that though Mr. Forster may carry a measure, it will be framed "on a denominational basis," and will not settle the question, but will only lead to a new agitation for an "absolutely secular system." This meeting appears to have been a very stormy one.

At Dudley, Mr. Dixon, M.P., President of the League, delivered an address to a large audience, and the general feeling was evidently in favour of the principles laid down by him. He also spoke at Derby, where the Mayor presided; and at Stroud, where Mr. F. S. Marling, M.P., was in the chair, and where the League views seem to meet with strong support. At Hinckley a branch of the League has been formed.

A meeting has been held in the Town Hall, Oxford, at which the Mayor (Alderman Hughes) presided, and amongst those present were the Hon. Auberon Herbert, the Hon. G. C. Brodrick, Professor J. E. T. Rogers, Rev. W. C. Sedgwick, of Merton College, and the Rev. G. W. Kitchin, of Christ Church. The views advocated were those of the League, and they were supported by, amongst others, a Baptist minister and a Congregational minister.

Last Monday evening, a meeting was held at St. George's-hall, Langham-place, for the purpose of establishing a branch in connection with the League. Mr. Joseph Guedalla was in the chair, and though the meeting was rather noisy, owing to the reception given to a speech from a Roman Catholic clergyman, who raised the religious question, a resolution in favour of the League proposals was unanimously passed.

The London Central Association in connection with the League, is actively engaged in organising local committees within a radius of a few miles of the metropolis, and already nine such committees have been established.

The representatives of the Union have also been active. A meeting has been held at Leicester, presided over by the Duke of Rutland, and among those present were the Bishop of Peterborough, Lord John Manners, Archdeacon Fearon, and Colonel Akroyd, M.P. The speakers appear to have been unanimous in condemning the views advocated by the League. A numerous gathering of the

clergy and laity of the diocese of Rochester has been held in the chapter-room of the cathedral, under the presidency of the Bishop, who expressed hopes that the measure to be introduced by the government would take a middle course between the extreme views advocated by the League, and the more moderate demands of the Union. On this occasion the Rev. H. B. Stevens, M.A., incumbent of Chatham, is stated to have actually gone so far as to insist on the education of the masses being left in the hands of the Church. The Hon. A. F. Egerton, M.P., presided at a Union meeting at Stroud, supported by Lord Howard of Glossop, Archdeacon Durnford, &c., when the views of the Union appear to have received some support from Dissenters, a resolution proposed by Archdeacon Durnford having been seconded by the Rev. E. Bishop, a Primitive Methodist.

An important meeting has been held at Cambridge the Vice-Chancellor, the Rev. Dr. Atkinson, presiding, and there being present, the Masters of Trinity, St. John's, Christ's, Magdalen, and St. Peter's Colleges, with other university dignitaries, and a number of the clergy and laity. The respective merits of the Union and the League were discussed, and resolutions in favour of the former, without giving any pledge " to all its exact details," were passed.

At a meeting held at Dundee, it was resolved not to join the League, but to take steps to procure an Education Bill for Scotland, with a compulsory clause, and rates providing for those whose parents were unable to pay. A feeling in favour of the Bible as a class-book was expressed.

A National Education League for Ireland has been started in Belfast. Its objects are to maintain non-sectarian education, to promote the further application and development of the principle, to oppose any change in the existing national system, and to remove any anomalies which may have crept into its operation. It will also aim at raising the status of the teachers, and improving the quality of the education in the National Schools.

Mr. Roebuck, late member for Sheffield, on the occasion of the distribution of the prizes of the Oxford Local Examination at Nottingham, in the course of his address, said he thought the State should insist on compulsory education with a firm hand, and that there was no tax that would be laid on the English people which would be so beneficent as a tax for this object. He was grieved to see a body of men at Manchester arrayed against another body at Birmingham—divided by the spirit of suspicion. He thought a Minister of Education should be appointed, and that that official should have a council to assist him.

Mr. Samuel Morley, M.P., speaking at Nottingham, in the course of his address, said that he had clung many years to the conviction that the less the government had to do with the people regarding education the better. He thought the work might have been more efficaciously done by the people themselves.

The Solicitor-General, Sir J. Coleridge, speaking at Exeter, said, with regard to the religious question, that no education was complete in an intellectual sense, without instruction as to the relations of man to God and to his fellows; but if they could not get all they wished, they should accept what they could get, if it was not radically wrong. He hoped the Liberals would unite to support the government measure.

Special attention may be drawn to the conference summoned by the Council of the Society of Arts, for the 7th inst., when proposals will be submitted, which not only attempt to combine the best features of the League, the Union, and the Manchester Committee, but also very considerably supplement their proposals. The meeting cannot fail to aid in elucidating the subject, if not in promoting an agreement on some of the points of difference.

EDUCATION AND DISCONTENT.

One of the subjects referred to in the last number of the *Journal* has attracted attention in more than one quarter. The *Pall Mall Gazette* maintains that extended education must necessarily be likely to produce discontent, but it faces the difficulty boldly by saying that—"Discontent is so far from being an unmitigated evil, that it is the necessary condition of all reform; if we could only teach the working classes to be heartily discontented with the ordinary national school, they would speedily have something better; if they are to repose unlimited confidence in their spiritual and temporal rulers, they will remain ignorant, stupid, and wretched till doomsday. The impulse to an effectual reform may come from above, but unless it is encouraged by a widely-spread discontent among the persons most affected, it will be speedily and conclusively checked by the profound complacency of the comfortable classes. The discontent is necessary to supply the proper leverage for reformers; or rather it is a force with which we cannot dispense, though it may be directed with equal ease in an injurious or a beneficial direction. It may work simple mischief, or it may lead to a permanent removal of the causes by which it has been produced. The test of good statesmanship is the power of using it for one or the other purpose."

Discontent is certainly a dangerous weapon, which has been often used by reformers in all ages, and sometimes has precipitated changes which they neither anticipated nor desired; and we must evidently now be prepared for what has been called the "discontent of enlightenment," which is probably less to be dreaded than the discontent of ignorance. It is, therefore, on every ground, important, in dealing with this question, to avoid hasty and patchy legislation; to take care that we are not carried away too strongly by our educational enthusiasm, and that any measure that may be passed this session is really founded on sound and durable principles.

CORRESPONDENCE.

A NEW HOUSE FOR THE SOCIETY OF ARTS.

Sir,—For about a quarter of a century I have been a member of the Society of Arts, becoming so by an accident. During that period I have been a careful, quiet watcher, so far as an occupied life permitted, of the various phases of humanity, and the constant progress of the great majority to a condition of greater comfort, enlarged intelligence, and higher views. The Society began, like most societies, with a knot of men who had more leisure and better perceptions than their neighbours. They understood that by arts, manufactures became possible, and with manufactures commerce increased, albeit the term manufacture indicated that they had not contemplated the processes whereby the powers of nature, chemical and mechanical, were destined to supersede the mere muscular exertion. Possibly some of them were crotchety men, and some of them vain, but we should not look at the quality of vanity too critically, for nature has bestowed this quality in the human race for some useful purpose. We, doubtless, prefer a Faraday, finding his satisfaction for work done in a sense of duty, but for one Faraday we find a thousand others—useful men too—who prefer public approbation, and have no notion of doing good by stealth without the reward of fame, and we could not well spare this army of workers.

Neither do we admire the popular idea of a miser; albeit accumulation and aggregation of property, represented by money, is a process without which civilisation could not exist. The bee-faculty is an instinct implanted in man as well as in animals, and may be a mere

selfishness, but it is a selfishness very useful to the masses. Time was that men, beginning by rubbing farthings together and ending by the accumulation of millions, found no pleasure in anything but the magnitude of their last will and testament, whether to endow a spendthrift eldest son or an almshouse. Their only ambition was to hand their name down to posterity, for they knew of no other fame. They were not men, but money-bags; and Thelluson, who strove to lock up and accumulate his capital for four generations after his death, was only an exaggeration of this class.

Gradually a prescription grew up that it was a very barren satisfaction to accumulators to make a sensation only after death, and that it was better to do so during their lives, and so obtain a result in the appreciation of their neighbours. Some, of course, did it for the gratification of vanity, but very many with a higher object—the love of doing good according to their faculties and perceptions. One of the earliest millionaires to set this example was Miss Burdett Coutts, who, through a life of long and large sympathies, has bestowed the hoarded wealth of a bank upon works of something far higher than eleemosynary charity, striving after permanent utility, helping people to help themselves. Self-help does not belong to the masses, but to individuals, who accumulate by means of the masses. If all were equally endowed with intelligent and accumulative qualities, the result would be simple communism; a thing scarcely possible, for though "God has made of one blood all the nations of the earth," assuredly some individuals are created and signed by nature as pastors and masters, and the great masses to be disciples and servants, and probably the latter may have the easiest life of it. It requires a large amount of beneficent intelligence and hard work to be a true master in the highest sense of the word. A Latin, Greek, or mathematical master has much harder work than his scholars, albeit technical; and a true educator who moulds the minds of his pupils or strives to do it, is the hardest tasked of all.

Wisdom, to govern the world, must be beneficent and not selfish. The meaning of the word is, the domination or command over knowledge. Love of power is legitimate, if the individual be beneficent. If mere power be his aim and end, it denotes a limited sphere of knowledge; and the latter end of that man shall be worse than the beginning. It is probable that the percentage of wise men throughout the world is the same at the present day that it was in the days of Mr. Green, and as well-skilled and intelligent men; but the world in those days took more note of them, in the smaller aggregate of mankind.

There is a prevalent notion in these days that education can do anything for civilisation. The fallacy lies in assuming that education can be something more than the word means—that it can put faculties into human beings, instead of drawing out into light and use the faculties that exist. Statisticians have yet a very useful work to do for mankind—to take nation by nation and give us a census of their faculties. What per-centage is there of poets on the higher issue of the mind, wise men, philosophers, astronomers, musicians, sculptors, painters, architects, chemists, agriculturists, mechanicians, mechanical labourers with mental aptitude, labourers without, accumulators or saveals, soldiers, sailors, physicians, and others, not forgetting lawgivers, men of jurisprudence as well as of technicalities.

The men who have made money by their own unaided faculties, applied chiefly to one object, have surely known how to use it in the best mode for the welfare of their fellows. Mr. Peabody, conscious of this, left the direction to others, contenting himself with the gift. Mr. Whitworth has done the same. He is hardly likely to choose the masters for his foundations. Sydney Waterlow is not a self-made man; his father lived before him, and reared the plant, but his model dwellings are the result of his own thought. Josiah Mason set an architect to work to build a great almshouse, and if I mistake not, the Swiney Prize, awarded by the Society of Arts from time to time, is due to a bequest made to the Society long since; and more recently, the system of lectures instituted, and bearing Dr. Cantor's name, is due to a bequest by that gentleman; and I see that it is now announced in the daily papers that Mr. Alfred Davis, a late member of the Society, has just bequeathed to it a legacy of £2,000.

But these kinds of gifts during life are getting into a still better phase. Men are proud, like Mr. Nettlefold, of Birmingham—no screw, though a wholesale worker of screws—to give a thousand pounds, in company with others doing the same thing, for educational purposes, and the high munificence belonging to the Di Medici and such men of the middle ages, is now becoming the common practice of ordinary citizens. And why not? These can only really use their food, clothing, lodging, and fuel in a limited quantity for their own persons, and, if they study their children's welfare, they will rather give them an education by which they can always earn money, than a mere fortune, which they may lose or waste. Timon's thought of making friends by his gifts was not unsound in itself, but only in being an abuse of intellect wherewith to understand and choose his friends.

There can be no doubt that we are, year by year, growing richer and richer in our national stock of wealth; neither is there any doubt that abundant misery is to be found hanging on to the fringe of society. We think this something extraordinary, but the truth is, that such has always been the case, only we are more conscious of it because our invaluable public press sets it always in a strong public light. Facts are no longer hidden; and the large heart of humanity is waging constant war against misery as fast as it crops out. And though it is quite true that "the poor shall never cease out of the land," those poor will be a very small per centage when they are confined, as they might be, and will be, to those physically and mentally helpless. Physical misery, arising from the want of the necessaries and comforts of physical life, is in a fair way to be abolished, as people begin to understand the new circumstances of life, with all the drudgery now performed by machines, setting large numbers of men free for newer and higher occupations. We are going through a phase of history analogous to that which induced the Luddite riots. The old is changing for the new, and those who are without work—which means without food—must be fed, or they will live, like ravenous wild beasts, on plunder—not a desirable condition.

And teaching must accompany the feeding. I do not believe in competitive examinations, with a view of saving employers trouble, getting by certificate what they should take the trouble to find out for themselves; but I do believe in setting before the community the means of acquiring that for which they have physical or mental aptitude and capacity for absorbing. "Cram" is of no use, and the result of crams is commonly to give a testimonial, and there an end. The crammer gains a repute as such, and the crammed drops from his artificial vitality into his normal condition of lassitude.

In the process of putting before the public mental food for those who might choose to absorb it, the Society of Arts has been conspicuous, though, no doubt, very irregular. As Lord Granville once said, "They poked their noses into everything." Time was that they were as dull a body as London could produce—a body without a soul. But in the year 1849 they struck a light and looked about them, and one result was the Great Exhibition, an offshoot from the small annual exhibitions that had dragged their slow length along till their vitality had expired. The Great Exhibition was a great success, and, without doubt, it was like a fairy tale taken out of an Arabian romance, and it was also a great feeder for every special aptitude, whose owner possessed eyes and ears; in other words, the faculty of absorption. It was also a great money success, but the money, some

portion of which, at least, should have formed an accumulative fund for the Society of Arts, went elsewhere, and only the reputation remains; but it had founded a colony at South Kensington, and it had put forth a weekly journal. Dull enough sometimes is this journal, dull enough for the time when "George the Third was king," but, withal that, it contains from time to time valuable original matter not elsewhere to be procured, contributed by the hard-working minds of men who are not mere grinders of words from the dictionary, but men of absolute knowledge of the subjects and processes they talk about. This journal keeps up the connection between outlying members and those who meet to listen in what we would fain call the Great Room, but for respect for truth. This journal alone is worth the annual members' subscription for those who want to know not mere abstract science but accurate material progress.

But the Society of Arts has not kept pace with the age. It is living in "lodgings;" the cramped, narrow, converted dwelling-house kind of apartments, more adapted to a dilettante body than a public one. It has outgrown its habitat, which is better fitted for a Christie's auction room than for a continually growing institute; and if it does not cast its shell, the Society bids fair for its shell to kill it. It is more like a general shop for all sorts of goods, "washing tubs, wafers, and wigs," than a hall of science and art, or an institution of manufactures. It is almost farcical to behold the way in which things are mixed up together: the scientific apparatus of Mr. Norman Lockyer, the models of Channel steamers, and the magnificent art collection of Mr. Davenport, elbowing each other as though brought for sale into a broker's shop. It is more than farcical to see crowds turned away on meeting nights unable to find seats.

The Society has always been a self-supporting body, aiding government in many ways, but never aided by it. It has no grants, like South Kensington, and it has always expended its annual subscriptions for useful purposes; and the benefactions of private individuals are but annual incomes devoted to lecturing purposes. But it has outgrown its site; the premises are probably more valuable for private than for public purposes, and, if the Society is to keep pace with its capacity, it must enlarge its domicile, as has been admirably done by the Institution of Civil Engineers, with a much smaller number of annual subscribers. With the education question, the food question, and a multitude of other questions constantly growing, with a need for a library where the books may be rendered accessible to readers, and a museum, not of curiosities, but of the actual and continually progressing materials of daily art, another and efficient building is imperatively demanded.

How is it to obtained? Only by the creation of a building fund, which may be quickly or slowly accomplished. There are rich men enough, nearly or remotely connected with the Society, who might inscribe their names in a non-perishable roll for a work of utility second to none in public value. The London University was thus established, in days when there was less of public spirit, and a far less amount of public wealth; and the London University began its career without a century and a quarter of accomplished reputation as a goodwill. Yet it is now one of our most flourishing institutions. One hundred of our trade magnates setting down their names for £1,000 each, with about the same facility that their ancestors of the last century took their pen to write £50, would accomplish the object; they would be the Greshams of a New Exchange, where art and science would incessantly supplement and extend an ever-growing commerce, and as incessantly lessen the sphere of human want. It is no joint-stock speculation, with a net of loss. It is a long-established business, that has to be extended for no individual gain. It is a "casting of bread on the waters," that will infallibly return after many days. Who will write his name first on the list as captain and leader of this new house of future commercial progress. —I am, &c., COSMOS.

MR. P. L. SIMMONDS' PAPER ON PEARL FISHERIES.

SIR,—I read with much interest Mr. P. L. Simmonds' paper on pearl fisheries, and also the letter of Mr. F. Hendriks, touching the value of the "Gresham pearl." I allude to the paper read, and the letter of Mr. Hendriks, simply to place before you a fact in reference to a "pearl necklace," which formed one of the presents to the Infanta of Spain, when an alliance was contemplated between England and Spain. On the match being broken off, the presents sent were returned. The jewels were valued at £100,000 (from the "Epistolæ Ho-Flianæ, or Familiar Letters," by James Howell, Esq.). From one letter, dated 10th of December, 1624, we gather, among articles of value, "there was a great table diamond for Olivaris, of 18-carats weight; but the richest of all was to the Infanta herself, which was a chain of great Orient pearls, to the number of 276, weighing nine ounces." These pearls must have been of great beauty and value, for, we are told by Howell, that "the Spaniards, notwithstanding they are the masters of the staple of jewels, stood astonished at the beauty of these, and confessed themselves to be put down."

The value of pearls increase in a ratio as they increase in size. Will any of your readers "up" in the value of pearls, give us an idea of the probable value of the said "chain," taking into consideration the increase of the value of money also? I am, &c.,

W. C. AITKEN.

FORTHCOMING PUBLICATIONS.

The Photographic Art Journal (half-a-crown) is announced to appear on the 1st of March, and to be continued monthly. It will be illustrated with photographs printed in permanent pigments, and will be edited by Mr. Thomas Sutton. Each journal will contain two or more choice prints, which will be copies of fine modern paintings and works of art, views, portraits of eminent persons, &c.

GENERAL NOTES.

Netherlands Agricultural Congress.—An international exhibition of agricultural mechanics will be held at Arnheim in June, July, and August.

Russian Imports.—The increase during the past year, according to a report just published at St. Petersburg, has been considerable. The increase in the importation of tea, over that of 1868, was 80,000 lbs., of coffee 180,000 lbs., and tobacco and wine in proportion.

Sanitary Reform in Turkey.—A measure of great importance to every town in the Turkish empire has just been decreed. A Hygienic Council, attached to the Ministry of the Interior, has been created, with the function of improving the drainage, enforcing proper street scavenging, and generally applying measures for the advancement of public cleanliness, both in the capital and throughout the provinces. Its further duty will be to improve existing civilian hospitals, and establish new ones where needed.

Scotch Fisheries. — The take this winter of herrings, and small fish of the same species, has been unprecedented in the Moray Firth. About 600 barrels, weighing nearly fifty tons, have been despatched from Inverness alone, since the beginning of the year, to the principal markets of the south. The price in Inverness has been only about 1s. per cwt.

Preserving Iron and Steel with Sulphur.—A mode of protecting iron from atmospheric influences has been proposed by Messrs. Macmillan and Macgregor, of Dumbarton and Glasgow. They bring melted sulphur into contact with the cold metallic surface to be coated. The sulphur chills and sets into a hard, thin protecting covering.

The Cultivation of Beet-root.—A note drawn up by Mr. G. M. Kemmis, civil engineer, and issued by the Board of Trade, contains the particulars of a new method of cultivating beet-root, and of increasing the productiveness of the soil. The peculiarity of the system consists in restoring to the soil all that has been taken away by its culture—its elements, carbon, hydrogen, and oxygen, being constantly carried off into the inexhaustible receptable of the atmosphere. Lands which for six successive years have produced beet-root have increased twofold in value. An outlay for working material of £4,000 sterling would permit the advantageous application of this system to a surface of 700 or 800 English acres.

The Metric System of Weights and Measures.—Professor Leoni Levi has made the following inquiry of the Standards Department of the Board of Trade:—"Whether it is allowable to use metric weights and measures for manufacturing purposes; whether a manufacturer can use such in the sale of his manufactured goods; and whether he could obtain such metric weights and measures duly stamped." Mr. Chisholm, the Warden of the Standards, replies:—"I beg to inform you that the opinion of the law officers of the Crown has been given to the following effect:—1. That any person using metric weights and measures for the purpose of buying and selling in shops and other places, subject to the visits of inspectors of weights and measures, or having them in his possession, is liable to have them seized, and to conviction and forfeiture. 2. That a manufacturer or artisan, chemist or scientific person, being in possession of or using metric weights and measures, not for the purpose of weighing or measuring goods for sale or purchase, conveyance or carriage, is not liable to a penalty. 3. That the Board of Trade is not restrained by any existing statute from authorising and directing the comparison and verification of metric weights and measures which are to be used for scientific researches and otherwise, not for the purpose of buying and selling goods, or weighing them for conveyance or carriage, with copies of French standards. I have only to add that the necessary steps have been taken for procuring accurately verified copies of the French standards from Paris, for the use of this department. Their construction and verification necessarily take a considerable time, but due diligence is being used in having them completed at the earliest period; and public notice will be given when metric weights and measures can be thus verified here, and of the regulations determined upon. The authority for issuing such regulations for 'comparison, verifications, and other operations with reference to standards of length, weight or capacity, in aid of scientific researches or otherwise, as the Board of Trade from time to time authorise or direct,' in the Standards Department, is contained in Sec. 11 of the Standards Act of 1866. But it is probable that, before such regulations are determined upon and issued, a statutory power will be required, empowering the Board of Trade to charge a fee for such verifications. It will be a question whether in all such cases the instruments verified should be stamped, or otherwise authenticated, as having been officially verified."

Meat Supply.—It is stated that extensive arrangements are now being made in Prussia for the slaughter and preparation of meat, to be supplied *via* Hamburgh to the London market. English slaughterers have been sent over to dress the meat, and the hind-quarters only are to be imported into England.

The Treatment of Sewage.—The Richmond Special Drainage Committee recently visited the Leamington sewage works, and brought away with them two samples of sewage water, one being of sewage after it had passed the charcoal filter, and the other of sewage before going through that process, although submitted to chemical influences. These samples were submitted to Dr. Letheby for analysis, and he reports:—"The results show that the sewage has been deprived of all the suspended matter, and of a great part of the soluble, and that, although certain mineral substances, as alumina and magnesia, have been added to the water, yet is not likely to cause offence by being discharged into a large volume of running water." He further says, that whilst there are 15·08 grains of organic matter (in solution) in ordinary London sewage, he found only 8·40 grains in one of the samples submitted to him, and 9·40 in the other; and that, whilst ordinary London sewage contains 22·04 grains of mineral and 16·11 organic matters in suspension, he found the two samples perfectly free from either. At the present time, when nearly all the towns of the Thames Valley are under imperative orders from the Thames Conservators to discontinue draining into the river at a given time, the above analysis is of great importance.

MEETINGS FOR THE ENSUING WEEK.

Mon......Farmers' Club, 5½. Mr. Cadle, "On Grass Land; when to be profitably broken up, and when more profitably kept in Pasture."
Victoria Inst., 8. Rev. Dr. Thornton, "On the Numerical System of the Old Testament."
R. United Service Inst., 8½. Mr. Peter Jensen, "Steenstrups' Conical Screw and Breech-loading Cannon."
Society of Engineers, 7½. President's Address.
Royal Inst., 2. General Monthly Meeting.
Entomological, 7.
Medical, 8.
London Inst., 4.

Tues ...Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."
Civil Engineers, 8. Discussion upon Mr. Harrison's paper, "On Railway Statistics and Expenditure."
Photographic, 8. Annual Meeting.
Ethnological, 8. 1. Mr. W. Boyd Dawkins, "On the Discovery of Flint Flakes under a Submerged Forest in West Somerset." 2. Rev. R. J. Mapleton, "On Remains of Pre-historic Man, in the neighbourhood of the Crinan Canal, Argyllshire."
East India Assoc., 3. Lord William Hay, "On India and the Houses of Parliament."

Wed ...Society of Arts, 8. Mr. J. W. Wood, "On Loss of Life at Sea."
Geological, 8. 1. Prof. P. Martin Duncan, "On the Fossil Corals of the South Australian Tertiaries." 2. Mr. J. W. Hulke, "Note on a very large undescribed Wealden Vertebra" 3. Mr. J. W. Judd, "Additional Observations on the Neocomian Strata of Yorkshire and Lincolnshire, with Notes on their Relations to the Beds of the same Age throughout Northern Europe."
Graphic, 8.
Microscopical, 8. Annual Meeting.
R. Literary Fund, 3.
Archæological Assoc., 8.

Thur ...London Inst., 7½
Royal Inst., 3. Prof. Odling, "Chemistry."
Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Royal Society Club, 6.
Mathematical, 8.
Society of Fine Arts, 8. Lecture by Mr. Hyde Clarke, "On the Culture of the Fine Arts, in its Influence on Industrial Pursuits"

Fri ......Astronomical, 3. Annual Meeting.
Royal Inst., 8. Dr. Carpenter, "Temperature and Life in the Deep Sea."
Quekett Club, 8.

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Mr. Scott, "Meteorology."

Journal of the Society of Arts.

FRIDAY, FEBRUARY 11, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

February 16.—"On Emigration." By Thomas Plummer, Esq., late of British North America. On this evening Sir George Grey, K.C.B., will preside.

February 23.—"On the Utilization of Town Sewage." By William Hope, Esq., V.C.

March 2.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

March 9.—"On Tramways in Streets." By W. Bridges Adams, Esq. On this evening Chas. Hutton Gregory, Esq., will preside.

March 16.—"On Surface Decoration." By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

March 30.—"On the Causes and Consequences of High Charges for Passengers by Railway, and the Advantages to be expected from an adoption of Low Fares." By G. W. Jones, Esq.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

INDIA COMMITTEE.

The adjourned Conference on the subject of a Gold Currency for India was held on Friday, January 21st, W. S. Fitzwilliam, Esq., late member of the Supreme Legislative Council of India, in the chair.

(*Continued from page* 217.)

Mr. Frederick Hendriks said that the objections raised at the last meeting, of the 10th December, upon the suggestions he then submitted for the discussion of this conference, as to a plan for the introduction of a gold currency for India, in connection with a system of international coinage that has lately attracted so much public attention in this country and abroad, appeared to him to have been put forward with much fairness. At the same time, he could not admit the general or even the partial force of these objections. The proposition was, that upon a single gold standard being introduced by degrees into India, and in the manner and subject to the conditions he had explained, 10 rupees of Indian gold coinage, or the Indian sovereign, might with advantage be made identical in weight of pure gold and in fineness of standard with 25 francs, or five dollars (or half an eagle) of internationalised American coinage, or with one sovereign of English or Australian coinage, reduced to international standard in the way contemplated by the Chancellor of the Exchequer, and submitted to the notice of Parliament during the last session. Such a scheme, as regards Indian currency, would, in point of fact, bring it into conformity with the principles of the Monetary Convention of December, 1865, under which several nations have already made their coins of circulation agree precisely in weight and fineness. This scheme for India would make every two rupees of gold coinage* exactly identical in value with the *modulus* of the system of that convention, which is the five-franc piece weighing $\frac{1}{620}$th of a kilogramme of gold, nine-tenths fine, or any multiple of that piece. The two-rupee piece, if such were coined in gold, would thus be equivalent to five francs, or one dollar, or four shillings' worth of international gold coinage. The objections ranged themselves distinctly into two categories, viz., (1) upon the ground of the impolicy of disturbing an alleged duodecimal system, supposed to actually exist in India, and asserted to be superior to a decimal or metrical system; and (2) upon the ground of the plan being unadvisable on reasons of political and social economy, and particularly as inconsistent with other estimates of the relative values of gold and silver in India. Now, it might be supposed, from the tenor of these objections to decimalisation, that a very positive proof could be adduced of a widely spread and ancient custom in India of reckoning in denominations of coin that were multiples of 12. Nothing of the kind is to be found in the Sanscrit arithmetic of Bhascara. The table of money by tale, at the beginning of the "Lilawati" (see Colebrooke's and Taylor's translations) runs thus—"Twice-ten cowry shells (varatakas) are a cacini; four of these are a pana; 16 of which must be here considered as a dramma; and, in like manner, a nischca as consisting of 16 of these." These denominations were probably only those in use by the particular part of the country where Bhascara wrote in the 12th century, so that it is very desirable to refer to a much enlarged area of circulation of coinage and of system of account, at a later and more flourishing period. Fortunately, the pages of the "Ayeen Akbery," or institutes of the Emperor Akber, who reigned from A.D. 1556 to 1605, are very full of information on this head. The Vizier Abulfazel, in this remarkable financial work, gives the weights and values of no less than 24 gold coins current throughout the Mogul Empire. Eight of these are multiples of the mohur, in denominations of 2, 20, 25, 50, and 100. Then come a series which are halves, fourths, and fifths of the mohur, with coins of one-eighth, one-sixth, and one-thirty-second part of the mohur, and of 12 and nine rupees. And when we come to silver coins, we get the rupee, alleged by Abulfazel to have been first introduced in the time of Sheer Khan. To this follow eight silver sub-divisions of the rupee, corresponding with $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{16}$, and $\frac{1}{20}$th of a rupeeah, or round form of the coin, and the jilaleh or square form. Some engravings of the round and square coins may be seen in the well-known travels of Tavernier. For copper coins, we find the dam, or fortieth part of a rupee, as the general coin of circulation and account; and its sub-divisions, the adheleh, or half-dam, or $\frac{1}{80}$th of a rupee; the powlah, or quarter-dam, or $\frac{1}{160}$th of a rupee; and the dumree, or eighth of a dam, or the $\frac{1}{320}$th of a rupee. In addition to the above somewhat complicated list, the existence is noted of the dinar as a gold coin, and of the dirhem as a silver coin. Both of these coins are also mentioned in the Sanscrit mathematical work above referred to, and the dinar is supposed by some archæologists to have an analogy with the Roman decimal coin the denarius. But through all this complexity of coins of circulation, and

* Not 2½ rupees' worth as accidentally uncorrected in the Report in *Journal*, page 105, but corrected, in a note from Mr. Hendriks, at page 150.

which are as much arranged on a system of division by 2, 5, and 10, as by 2, 4, and 8, we find no such difficulty existing when Abulfazel, in the course of his celebrated work, had on numberless occasions to give prices and accounts. In the vast quantity of quotations of revenues of provinces or sircars, and of prices of all kinds of commodities, labour, and pay, he reckoned in dams in preference to rupees. And, what is more curious, it positively appears that accountants in India, in their manipulation of these coins in their calculations, used what amounts to a decimal sub-division. For Abulfazel states (1) that, although the market price of the rupee is sometimes more or less than 40 dams, yet this value is always set upon it in comparative calculations. And again (*sub voce* dam, *vide* Gladwin's translation, p. 30) the vizier observes:—"In value the dam is the fortieth part of a rupee. Formerly, this coin was called pysah, and also behlooly; now it is issued under this name. On one side is stamped the place where it was struck, and on the reverse the month and year. Accountants suppose the dam to be divided into 25 parts, each of which they call a cheetel, and use them in calculations." The cheetel was, therefore, $\frac{1}{25}$th of $\frac{1}{40}$th, *i.e.* one-thousandth part of a rupee. We thus have it, on the unimpeachable evidence of Abulfazel, that accountants reckoned in cheetels or $\frac{1}{1000}$th parts of a rupee. And the vizier himself uses them in all his mint calculations in the "Ayeen Akbery." Nor need we be surprised at this decimalisation. The Hindoos were precursors of the Arabians, and it is believed also of the Chinese, in the discovery and use of the decimal system of notation. All writers of authority on the early history of mathematical science concur in remarking that the Arabians, who introduced that system into Europe, borrowed it from the Hindoos. In the Arabian arithmetical works of more than a thousand years ago the decimal system is called the Indian method of computation, the Hindasi, or Indian arithmetic. In talking upon Indian subjects there is, moreover, far too great a tendency to refer everything to the latitude of Bengal. But some reference should also be made to the history of the currency of other provinces of the Indian Empire. For instance, in Madras, from very ancient times down to a recent period, the coins of account were 10 cash = 1 doodie; 80 cash = 1 fanam; 45 fanams = 1 star pagoda. The "Madras People's Almanac" states:—"The value of the Arcot rupee was 12 fanams, 60 cash, at which rate 44-6 fanams = 3½ rupees. The usual rate of conversion, when great nicety is not required, is 1 fanam = 1 anna 3 pie. The correct value of one rupee is 12 fanams 68-70 cash. There were formerly a great variety of coins current in South India, as every petty prince issued his own. The Hindoo dynasties nearly all had, as the basis of their currency, a gold coin worth about four rupees, and a smaller gold or silver coin (pana) of one-tenth of its value, with copper coins representing a greater or less proportion of the latter. It seems that formerly this gold coin was stamped with the effigy of a boar (varaha in Sanscrit). This, with its corresponding name in the vernacular, continued to be given to this coin, though the device was changed. The coin in use at Madras had a representation of a pagoda, and hence the English there adopted the name pagoda. The rupee and anna sub-division seems to have been introduced by the Poghul dynasty. Nearly all the multifarious native Indian coins are rapidly disappearing, and accounts are kept throughout our territories in British Indian currency. This is a great public convenience. In Mysore, however, the revenue accounts are still kept in the Cantaroy currency, the varaha being fixed at Rs. 2-14-8. The Canara revenue accounts are still kept in Bahadary currency; but as the varaha is taken as four rupees, its conversion is perfectly simple, the fanam being just four annas." In the Bombay Presidency, similar variations in the native currency were prevalent, and it appears that accounts are still often kept there in rupees, quarters, and racs, 25 racs making one anna. This is all more decimal than duodecimal; and it should also be observed that, side by side with the system of metallic currency in India, there still exists a system of shell currency, of the cowry, or *Cypræa moneta*, that has been in use from the earliest historic ages. The methods of reckoning these cowry shells, as used by the natives, vary in different parts, but they do not include any duodecimal arrangement. In the North-west Provinces it appears to be of a binary kind. In Bengal, it is in this way—4 cowries = 1 gunda; 20 gundies = 1 pun; 5 puns = 1 anna. All the evidence just adduced is opposed to the conclusions advanced by Mr. Hyde Clarke, at the last meeting of this conference, that a decimal system is incompatible with the wants and usages of India. A country that reckons in lakhs, 100,000; and in crores, 1,000,000; can surely not be at a loss with the use of tens, hundreds, and thousands in the money concerns of its daily life. Observe the contrast in the neighbouring country, China, and the command it gives the meanest of its people in the science of calculation, by means of its adoption of a decimal system of cash account. Even if it were a disturbance in India, which it is not, of a time-honoured custom of antiquity, there is ample precedent amongst other nations of interference with a duodecimal system, in the cause of education, of progress, and of commercial concord with other countries. One would imagine, from the singularly overdrawn laudation sometimes heard of the existing British mixed vigesimo-duodecimal-quaternary system of money notation, that we English were the sole nation that possessed from remote antiquity such a system of financial accountantship. But it was anything but an exclusively English notion. One of the most distinguished prelates who have filled the see of London, Cuthbert Tonstall, published, in 1522, an excellent arithmetic, wherein he remarked that most nations at that time divided their coins of account into pounds of twenty shillings, and into shillings of twelve pence. But now that three centuries and a half have passed since this bishop wrote, we find that almost all nations, except the English, have given up this system in favour of the decimal or partly decimal division of their currencies. This fact is more eloquent than abstract argument, and the advocates for a decimal system of weights, coins, and measures, supported as they are by practical proofs of its advantages, may be excused for showing some vigour in the renewal of their agitation for its introduction. They now have before them, not only the enlarging chances of a scheme of really national education being speedily introduced, and the necessity that it imposes of the most saving and perfect machinery of elementary calculation, such as the decimal system, being taught, but they have also the turn of the tide of Royal Commissions in their favour, as will be found by those who will take the trouble of studying the admirable reports on the subject, issued and being issued by the Standards Commission. A little banter about "craving after decimals," to use the expression certainly made in no adverse spirit by Mr. Hyde Clarke at the last meeting of this conference, may well be excused by those of us who know how to distinguish between the raising up a fetishism of the metrical system, and the recommendation of it *modo et ratione*. The Society of Arts, as a combination of practical and scientific men, should be the very body to recognise the advantages of the metrical system as an international one. The daily increasing success and spreading of that system can best be understood by remarking that it is now in obligatory use by about 150 millions of people, in partly obligatory use by about 100 millions more, and that the Supreme Government of India, in agreement with the Secretary of State for India in Council, stand pledged to introduce the metric system of weights and measures amongst the 150 millions of inhabitants of British India. Now, the matter of coinage is a necessary complement of the metric system. Introduce the latter, and it is purely a question of time as to how soon a decimal coinage shall follow. The public press in

India has given every encouragement to the change, and has been almost unanimous in admitting that India presents especial facilities for the incorporation into its administration of every reform in these matters that has been found of proved value in the experience of other countries. The tonnage of ships trading between the British East Indies and Hamburg, Denmark, Holland, Belgium, France, Bremen, and the United States exceeds 200,000 tons. These figures are sufficient to indicate that the commerce of India has to adapt itself to other markets besides those of England, and that she is directly interested in the introduction of the units of weight and of measure now being in course of speedy adoption by all the leading commercial nations. Having taken the responsibility of stating that the present is a favourable opportunity for considering the policy of the introduction of a decimal and metrical system of coinage into India, at the same time that the reform of weights and measures is carried out there, some further explanation may be desirable. The chief reason is, that in international conferences, and in the senates and legislative bodies of almost all the great countries of Europe and America, plans of international coinage are under discussion. With the probability of the leading manufacturing countries of gold coinage—the United States almost certainly, and England at no distant date—altering their weights of current coins so as to bring them into conformity with those of the countries parties to the principles of the Monetary Convention of December, 1865, already adopted by upwards of 100 millions of people in Europe, having a collective annual foreign trade of over 500 millions sterling, or one-fourth more than the aggregate British exports and imports, it would be undesirable to make two changes in India. Better to deal with the coinage as India is prepared to do with weights and measures, *i.e.* make the reform there, even before it is carried out in England, seeing that England will certainly, at no very distant date, find herself, by many considerations, constrained to adopt the metric system, and then, if not at some previous time, to decimalise her coin, and bring it into harmony with the international scheme. If this great advantage cannot be attained, and England should unwisely refuse to take cognisance of that scheme, and leave it to France, Italy, Austria, Switzerland, the United States, Canada, and probably Germany, to arrange between themselves, she herself—Shylock like—refusing to pare down the surplus grain of gold, although the *summum jus* is preserved in the bond through the compensating process of the imposition of a seignorage, then, of course, we must resolve to keep out in the cold. But, even under those conditions, it might be well to consider whether the partial good of making 10 rupees of gold coinage equal to 1 sovereign might not be worth accomplishing. It would be a means of consolidating, to some extent, the funded debt of India, and very probably of reducing the interest on future loans. At present the funded debt has to come into competition with a guaranteed railway debt. The interest on the latter is paid in sterling, half-yearly in London, whilst, although a power is given to the holders of Indian registered debt to have it enfaced for registration at the Bank of England, in London, the practical result is, that when the holder goes to receive the interest, it is not in sterling, but in the shape of a bill on the Treasury in India for so many silver rupees. This has to be sold to a bank or dealer in bills, at the fluctuating exchange of the day. The element of uncertainty is thus introduced. The recipient of interest has to face the inconvenience of the exchange market, the details and secrets of which he is quite unacquainted with, and wherein his loss is the buyer of the bill's gain on the transaction. Under these circumstances, it is not surprising that, out of the total of 628¼ millions of rupees of registered Indian debt, on 31st December, 1868, only 157½ millions of rupees were held in England. A much larger amount would be thus held, to the eventual advantage of the finances of India, if gold were made the standard in India, and 10 rupees made equal to one sovereign, either of its present weight, or of the weight of 25 francs, or 5 dollars of international coinage. On such a footing, interest might easily be arranged to be paid in sterling, or in rupees, ten to the pound, half-yearly in London or in India, just as the interest on many loans to the colonies is made payable there or in London. The result would be an increased holding of Indian registered debt in London, and the loss arising from the fluctuating, and, on the average, losing price of the interest bills, and from the liability to have the capital of the loan repaid in silver rupees, which, to the holder here, are bullion only, and not money, would be avoided. Mr. Hyde Clarke made another objection to the scheme, that he was sure that if we had an international system, the bullion markets of the world would be subjected to far greater vicissitudes than those they suffered from at the present time. He (Mr. Hendriks) believed that this is a completely unfounded notion, although it has been brought forward in many forms, in the newspapers, and in pamphlets, and before the Royal Commissioners on International Coinage, but always in an abstract manner, and with no substantial proof whatever. He would, in turn, ask whether the bullion market of London has been subjected to greater vicissitudes than before, because the gold coinage of Australia, about 20½ millions to 1865, was, in the year 1865, made international as between England and the colony, although before that year it was nothing more than bullion in England? Then, again, according to the assumptions of the theory, the internationalisation of the gold coin of the foreign nations who became parties to the Convention of December, 1865, should have been the mutual cause of greater vicissitudes in their currency, when the floodgates were opened to above £200,000,000 sterling worth of new Napoleon currency. *E pur si muove!* All went on in its accustomed course, rather freer from chances of perturbation than before. The vicissitudes of bullion markets ought, upon the real merits of the plausible hypothesis, to be much greater when coin has to be melted, and recoined, and melted again and again, in non-international conditions, at sundry demands for exportation. When an international plan prevails, the zones of circulation are enlarged, and the supply of coined metallic currency is much more automatic and self-regulating. After all, the quantity of coin in circulation, for the ordinary wants of a population, are not largely or directly influenced by fluctuations in the rate of discount or of exchange; but, in exceptional times, when they are affected by such circumstances, international coin would be preferable to mere bullion, such as coin is in relation to foreign trade when the coin is not international. For, according to the theory of fluctuating scarcity or abundance of coined gold comparatively with demand, international coined gold would form an instrument possessing higher powers of adjustment than bullion or non-international coined gold, as between nations recognising the international agreement of their gold currency, and who would thus, in this regard, form one nation. They could thus, in times of commercial or banking panic and vicissitudes, reciprocally help each other far more effectually with loans of international coin, than with sales or loans of non-international coin or bullion, such as were made upon certain occasions, known in commercial history, of bullion transactions, between the Bank of England and the Bank of France. According to the observations made by Mr. Hamilton at our last meeting, 10 rupees and 8 annas, *i.e.* 10½ rupees, would be "the nearest simple fraction at which the sovereign could be introduced into India with a fair chance of its remaining in the country; that is, silver at a little over 5s. per ounce British standard, and sovereigns 10 rupees 8 annas, will be found to be very nearly equivalent." But it is obvious that Mr. Hamilton narrows the question to too small an issue. The wants of India in the matter of metallic

currency ought no longer to be confined to the restricted groove in which its legislation on this has run, in attempts, more or less serious, to ascertain the trade value of the gold mohur or English sovereign as estimated in silver rupees. The real question is the larger one of an imperial standard that shall answer the changed requirements of the people of India, in face of its progress in industrial enterprises and resources, and in regard to the altered conditions arising out of the new supplies of gold from Australia and California, which are modifying and affecting the standards of the chief commercial countries. He (Mr. Hendriks) believed that the same views as he had just expressed would be found to be held by his friend Colonel Smith, who also addressed the meeting on the 10th December, and he understood the colonel's remarks then made, as addressed rather in criticism of Mr. Hamilton's methods of assessment of the sovereign at 10½ rupees, than as implying dissent from the general outlines, although Colonel Smith might differ from the details, of the plan for a gold currency which he (Mr. Hendriks) had submitted for the consideration of this conference. It will be recollected that Colonel Smith spoke of the equation in commercial valuation, not in mint or legislative valuation, as he (Mr. Hendriks) had done. And Colonel Smith's estimate of the commercial value of the sovereign was very different from Mr. Hamilton's, for Colonel Smith made it as nearly as possible 10 rupees, ascertaining it upon the basis of any one of three methods, viz., either (1) "taking the price of silver and gold in the London market, and calculating all the expenses of landing them in India;" or (2) calculating the value of gold in rupees from its power of purchasing bills in London, according to the rate of exchange." Or else (3), "basing the value upon the average price of gold as sold for rupees in the Indian markets." The government of India has been frequently urged by commissions on the currency to make its estimates of the value of the sovereign in rupees in some of these ways; but they appear to be a very imperfect solution of the requirements of the case. The very fact, that in applying methods of getting at the open-market relations between gold and silver, Mr. Hamilton and Colonel Smith (who have both written able treatises on such results) arrive at results varying by no less than five per cent. from each other, Mr. Hamilton making his equation 10½ rupees, and Colonel Smith his 10 rupees per sovereign, shows the uncertain and shifting nature of all calculations made upon such variable data, all of them being liable to perpetual oscillations and disturbing causes such as no country should take cognisance of in fixing its standard. Mr. Hamilton is guided in his views by Bombay average prices; Colonel Smith assumes his averages from Calcutta prices; a third writer may take his from the Madras standpoint; a fourth may suggest whether it be at all possible to predicate from the past experience of a fluctuating proportion between gold and silver, what will be the future experience. Indeed, we may say that this has always been found impracticable, from the time when the English government of the last century, with the advice of Sir Isaac Newton, and of subsequent Mint-masters, tried the experiment, and finally abandoned it in 1817, much to the public advantage, down to the time when, in the present century, the French government of 1803 made the same experiment, to be attended, in our own days, with the like results. The functions of a State, so far as concerns its metallic currency or standard, are distinctly confined to affixing its mark, certificate, or stamp, by the act of coinage, to disks having a defined and unvarying weight and fineness of the particular metal constituting its standard; and although, for convenience sake, the State may also affix its mark to disks of other metals, and give them either legal tender circulation by a nominal double standard being set up, or else a simple permissive currency only, without attempting to render them obligatory legal tender, any attempts it may make to regulate the rate of exchange between the metals is practically barren of results, and even theoretically unsound. Two standards of weight or measure may co-exist; they are unchangeable in their ratio to each other. Not so the values of two quantities of metal, or of any commodity, relatively to each other; these must always be liable to variation. There is but one remedy for a State to adopt, if it does not wish to see its standard of value ever uncertain and fluctuating; it must choose either gold or silver as its single standard. If it select gold as its single standard, it has the advantage of being able to coin, in a token form, its subsidiary coins of silver; that is to say, in a form of fineness and weight reduced in value, so as to prevent the risk of their being melted and exported from the country wherever a profit can be derived from such an operation. If it select silver as its single standard, it cannot retain this advantage, because silver being, in its inherent primary value in the general estimation of the world, subsidiary to gold, we cannot, in practice, and having regard to the necessities of foreign commerce, apply the same process of token valuation to the superior as we can to the inferior metal. If India should continue to act upon official tariffs of adjustment between gold and silver coins, as England did between 1717 and 1816, *i.e.*, for 100 years with various modifications, or as France has done under the legislation introduced in 1803, by the law of the 7th Germinal, year XI, its attempts will be found as futile to regulate and keep in order the exchangeable value of the coins according to such tariffs. And most assuredly such tariffs will be found insufficient to introduce a gold currency, which, it is admitted by all competent authorities, is a desideratum for India. The examples of England and France, and their experience in the matter, ought to be sufficient guides for India to follow. In England, during all the adjustments of value that were tried between silver and gold coins, by artificial legislation and mint regulations before 1817, the coins were always oscillating in value relatively to each other. Almost all the full-weighted new coins, of the metal dearer and more in demand at the time, minted at a vast expense to the country, went to the melting pot, or were exported as soon as they were issued from the mint. The whole metallic currency was kept in a degraded state. At one time the over-estimation of mint price of one metal, as compared with the open market price of the other metal, acted upon the silver coinage, and made it disappear, with the exception of light pieces under legal tender weight. At another time, the same results were obtained in regard to the gold coinage. The only cure for this annoyance was found to be the establishment of a single standard, in 1817, the coinage of silver in a token form by the establishment of a seignorage through the coinage of each pound troy of silver into 66 instead of 62 shillings, as before, so that silver of the mint standard is coined into 5s. 6d. out of each ounce of bullion, although the ounce can be bought in London for between 5s. and 5s. 1d. The example of France is even more important as a precedent, for there we have the example of a great country successfully demonetizing her silver coin, the very problem required to be solved in India. The experience of France is all the more to the point, as it has occurred under the observation of the present generation, and since the new gold discoveries. The following details of what has taken place there may be of use for consideration before we remark upon the applicability of them to our information as to what is desirable in the case of India:—The legal condition of the French metallic currency has rested upon the double standard, established by the law of the 7th Germinal, year XI. (28th March, 1803), which decreed that the unit should be a silver franc, weighing 5 grammes, nine-tenths fine, but that, at the same time, gold pieces should be coined of 20 and 40 francs, and of the respective weights of 155 and 77½ to the kilogramme, nine-tenths fine. Thus, whilst it appeared, theoretically, that silver was the leading standard, gold was practically decreed to be a collateral and equally binding standard, at the fixed pro-

portion of $15\frac{1}{2}$ to 1. In consequence, however, of the supplies of gold from California and Australia, its market value, as measured by the market value of silver, has approximated more nearly to 15 to 1 than $15\frac{1}{2}$ to 1. Hence the premium on silver, which has disarranged the metallic currency of all countries in which silver was either the single standard, or else the alternative leading metal of coinage, with gold as a second standard, France, with its vast metallic currency, naturally experienced inconveniences of a serious character in the process of rapid demonetization of its silver currency, and the substitution of a gold one. In the eight years, 1852-59, the exports of silver from France amounted to nearly 2,506 million francs, whilst the imports of silver during the same time were under 1,127 million francs. The balance or excess of silver exports was, therefore, 1,379 million francs, or about £55,000,000. Carrying these totals five years further (1860-64), although the ratio of the adverse balance was, from the more and more diminished means of supply, a decreasing one, it had nevertheless swollen the total by a further 313 million francs, making the gross aggregate excess of silver exports over imports 1,692 million francs (£67,680,000), or a drain of nearly £5,200,000 per annum as the average for the 13 years (1852-64). Gold has become the fundamental coin—the basis of all important transactions of sale and purchase—in France; and in point of fact, the French gold pieces of 20, 10, and 5 francs form, relatively to the national circulation, as compact an aggregate as the English circulation of sovereigns and half-sovereigns, and there has been a coinage of about 205 million pounds sterling worth of French gold since 1851. France has established, like England, a token money for all the subdivisional silver coins less in value than the smallest gold coin, the 5-franc piece. The silver 5-franc pieces were at length entirely eliminated from the French circulation, and until the English system of silver token money was adopted in France, by coining all denominations under five francs at ·835, instead of ·900, fine, there was a drain, of almost as inconvenient a character, of the 2-franc pieces and silver coins of lower denominations. The interruptions to trade were most serious until a remedy was applied. The agio or premium on silver was reported to the Minister of Finance, in 1857, as having caused a pressing scarcity of silver change in no less than thirty of the departments. A majority of the Commission of Inquiry were even in favour of a temporary and exceptional restoration of the anti-economical policy of an export duty on silver, a measure which would clearly have failed to produce any but a momentary effect. We cannot, however, be surprised that some panic should have been felt, when the agio on silver was at one time, in 1859, as high as 7 per cent. at Marseilles. The ordinary current premium of 25 or 30 per mille gave the holders of silver a very handsome profit in parting with their franc-pieces to refiners and exporters. Debtors had to the fullest extent the power of discharging their obligations in gold. Article 1,190 of the Code Napoleon, viewed in connection with the article that precedes it, gave them a clear option: "Le choix appartient au débiteur (d'une obligation alternative, *i.e.*, to pay in silver or gold), s'il n'a pas été expressement accordé au créancier." No French creditors have ever thought of stipulating from their debtors that the payment should be in a particular metal, and even in the past year, 1869, some debtors have chosen to pay in inconvenient heavy silver pieces. But creditors have naturally become anxious at their prospects, in presence of the law of the 7th Germinal, year XI., which leaves all the chances of future profit in the power of debtors, so that the payers of perpetual rents or interest (including the government), will, under that law, have the power of making payments in silver, whenever that metal, as compared with gold, becomes the cheaper one of the two, for the discharge of their obligation. And to show how difficult it is to prevent disturbing elements in a country like France, where there is (*de jure*) a double standard, it may be observed that, since the year 1866, nearly 200 millions of francs in five-franc pieces, of nine-tenths fine, have been issued at the French mint, at the demand of holders of bullion, and thus have introduced a great element of disturbance, so that the Government Commissioners and the Senate are disposed to give up the double standard altogether. These are the reasons that fortify the position of the advocates in France of a cancelment of the double standard, and of resort, like Russia, Portugal, and the Brazils, to the system of a single gold standard, the unit of which would be the gold franc, the weight of which is fixed at 0·3226 grammes, 0·29035 pure gold, and the remaining tenth, or 0·03226 alloy. "Il faut donc suivre l'exemple donné par l'Angleterre, c'est à dire par le peuple qui entend le mieux et les principes de l'économie politique et les grandes loix du commerce," was the flattering language adopted by the French Commission of 1857. And the Commission now sitting in 1870 quite holds to the same language. Writing in 1866, he (Mr. Hendriks) had mentioned that we also in England ought to admit that we have much to learn from France in matters of currency, and to be ready to appreciate the consistent and zealous endeavours of many of her public men to disseminate sound principles in the question of international coinage, suited, as they really are, to promote the harmony and good-will of neighbouring nations; and he can only repeat that what France has done in that respect, and the way in which she has been able, without serious inconvenience, to demonetise her silver currency, and substitute a gold coinage, is a lesson of the first importance for the government of India to study and to shape its own course by. There is a tolerably close analogy between what India has been doing since 1835 down to the present time, and what France did between 1803 and 1851, when the gold discoveries led to her practically demonetising her silver coinage. For just in the same way as France, during the period 1803-51, side by side with the leading and working standard of silver, introduced a gold circulation, in the proportion in weight of 1 gold to $15\frac{1}{2}$ silver, so did India, side by side with her leading and working standard of silver, try to introduce a gold mohur circulation, in the proportion in weight of 1 gold to 15 silver; authority to coin at these rates being given by clause 7 of Act xvii. of 1835. It has already been shown in his (Mr. Hendriks's) statement at the last meeting, that when the present rates of seignorage of 2 per cent. on silver bullion and 1 per cent. on gold bullion at the mints of India are taken into account, the more correct rate defined in the legislative action of India is really 1 gold to 15·15306 silver. But in India gold was not made legal tender at the debtor's option quite in the sense of the French legislation. A tolerated and modified tender value only was given to gold in India. Indeed, clause 19 of the Act of 1835 declared that they should not be legal tender. At the same time, the Act of 1835 gave authoritative government approbation to the coinage of gold at the alleged proportion of 1 gold to 15 silver. This showed that in Indian contracts something like that proportion might and ought to be taken in agreements (if such were entered upon) to pay in gold instead of silver. And the best proof that something like that proportion was maintained in the ideas of the Indian public, appears from the statement of the Commission presided over by General Sir William Mansfield, in Calcutta, in 1864. This Commission then averred that the gold mohur or government piece of 15 rupees, "as fixed by Act xvii. of 1835, is, as nearly as possible, the average market rate of the price of coined gold of the present day." This observation of the Commission can, however, only have been based on the average price of the open market, and was apparently arrived at on Bengal prices, rather than that of Madras and Bombay combined with them, so as to get a general

average for the whole of India. And, in 1864, the time when the Commission sat, the coinage of gold in India was positively in a state of suspense. For although the government, between 1841 and 1852, had, as far as they were able, promoted the introduction of Indian gold coin into common usage at the assessment of 15 rupees per gold mohur, at which rate the public treasuries were authorised to receive it, the amount of gold mohurs coined from 1841 down to 1864 but little exceeded 15 million rupees worth. Down to the latest published returns, *i.e.* to 1867, it amounted to 16,420,707 rupees, so small an aggregate compared with the silver coinage and the wants of 150 millions of inhabitants, that these gold pieces can scarcely be said to have circulated at their normal value, but rather at a value affected by the agio of appreciation, arising from a considerable demand upon a small supply, just as, in old days of silver coinage, in France the Napoleon always bore a premium. But, for the 12 years immediately preceding the date of this commission, the treasuries had positively ceased to receive the mohur. The Indian government appear to have been amongst the first to feel uneasiness at the probable revolution to be apprehended in the comparative value of silver and gold, as affected by the Californian and Australian diggings; and a proclamation had been issued by Lord Dalhousie's government, in 1852, rescinding the authority to receive gold coins at the public treasuries. Sir Charles Wood, writing in September, 1864, to the then Governor-General, Sir John Lawrence, observed that, "before the recent discoveries of gold, an ounce of gold was worth, in the markets of Europe, nearly $15\frac{3}{4}$ ounces of silver. It was, therefore, according to the relative legal rating of gold and silver, more advantageous to pay in silver than in gold. Silver coin, therefore, for many years formed the currency of France, the gold coin bearing a premium. Since the recent gold discoveries, the value of gold relatively to silver has fallen to about 1 to $15\frac{1}{2}$. This difference has rendered it more advantageous to pay in gold. Gold has displaced silver, and now forms the currency and standard in France. It is obvious, therefore, that whether the sovereign, rated at 10 rupees, can circulate to any extent in India concurrently with the silver rupees, depends upon the question whether it will be cheaper to meet an obligation of the amount of 10 rupees by a gold sovereign or by 10 silver rupees." Sir Charles Wood then went on to explain the method of working out his view, that to enact that a sovereign should be legal tender at 10 rupees in India would be inoperative, although he observed, at paragraph 26 of his letter, that at the present time there could hardly be a question of the readiness of the people of India to receive sovereigns for 10 rupees, and he wound up his communication by recommending, as a tentative measure, that English and Australian sovereigns should be received at that value in all the treasuries of India. The government put this recommendation into force by their notification, dated Fort William, November 23, 1864. But again, in 1868, the Indian government rescinded Lord Dalhousie's minute of 1852, and restored the provisions of Act xxii. of 1835, as to the gold mohur coinage, and altered the assessment of the sovereign at the treasuries from 10 rupees to $10\frac{1}{4}$ rupees. The following are the exact terms of the notification:—"Financial Department, Simla, 28th October.—In modification of the notification by the government of India, No. 3,517, of the 23rd November, 1864, the Governor-general of India in Council is pleased to direct that, from and after the publication of this notification, sovereigns and half-sovereigns coined at any authorised Royal mint in England or Australia, of current weight, shall be received in all treasuries of British India and its dependencies, in payment of sums due to the government, as the equivalent of ten rupees and four annas, five rupees and two annas, respectively; and that such sovereigns shall, whenever available at any government treasury, be paid at the same rates to any person willing to receive them in payment of claims against the government. The gold pieces stated in section 13 of Act xvii., of 1835, will also henceforth be received as above, according to the values stated in that Act." Sir Richard Temple, in the Legislative Council for India, adverted to this measure as having met with some success, for already, on the 6th March, 1869, he observed, upwards of 100,000 sovereigns had been received at the Indian treasuries and taken out again by the public. But all this is fairly open to criticism, as being but a petty result. What are 100,000 sovereigns introduced permissively, and not as legal tender of an obligatory kind, amongst 150 million people? Or what is a coinage of $1\frac{1}{2}$ million pieces of gold mohurs in the thirty years, 1841-69? Mere drops in the ocean of the currency. It is playing with the question to say that this amounts to anything like a sustained attempt to introduce a gold currency into India. It may serve as a useless attempt again to solve a problem that has over and over again been tried in Europe and found to fail, namely, the unsolvable problem of a permanent double standard; and the attempts to accomplish this, however well-intended, as measures to accustom the people of modern India to understand the superiority of a gold over a silver standard, ought now to give place to a larger and more decided scheme. And he (Mr. Hendriks) would, with some confidence, venture to assert that a scheme of the kind contemplated in the sketch he had submitted to this conference at their former meeting would be found an easy, practicable, and really safe way of introducing a gold coinage, whether the Indian government (in concert with the home government) adopted the international coinage system or not. If they did not adopt that system, then the plan would be as follows:—India to establish a temporary transitional double standard of gold and silver, for the discharge of debts, according to the debtor's option, in either of the metals, to cease absolutely at the end of five years. India to stop all further coinage of 1 rupee pieces in silver for the next five years. India to coin, during the next five years, all denominations of silver under the value of 1 rupee of the same standard and weight as the English silver token money, namely, at the rate of 66 half-rupees to each pound troy of silver of English standard fineness.* India to resolve, by legislative enactment, that, at the end of five years, gold alone shall be the standard, and silver coin legal tender to the value of 100 rupees only. India to call in, at the end of five years, the silver coins, both rupees and lesser denominations, minted before the commencement of the period of five years, and to deal with them as was done with the sicca rupees in 1835-38, when it was ordered that, from the 1st January, 1838, they should cease to be a legal tender, though received by the collectors of land revenue and at all public treasuries by weight, and subject to a charge of 1 per cent. for recoinage. To these would be added the conditions necessary if India decimalised her coinage and made it international. India to join the Monetary Convention of December, 1865, so far as regards the weights and standards of its gold coins, on the basis of 2 rupees of its gold coinage being made equal, in weight and pureness, to 5 francs of French gold coinage, or 1 dollar of American coinage. India to coin all fresh issues of rupees or lesser coins of silver at the end of the five years, at the rate of 33 rupees to one pound troy of silver of standard English fineness, *i.e.*, to make them of the exact weight and fineness of the English florin, two-shilling, or 100 mil pieces.† India to decimalise its coinage at the end of five years, by converting the rupees into 200 new pics, or half-mils English, instead of the 192 pics of which it now consists. There only remain to be answered two other objections arising in the course of these discussions. (1) What is to become of the demonetised silver in India? and (2) How is the revenue that has hitherto accrued from

* The weight was given at 62 half-rupees at p. 105 of *Journal*, a clerical error, which was accidentally uncorrected at the time.

† This was similarly given at 31 rupees instead of 33, at p. 105.

seignorage on coin in India to be kept up, seeing that the seignorage has hitherto been 2 per cent. on silver bullion and 1 per cent. on gold bullion? To the first objection he would answer, that India is pre-eminently a country of small transactions amongst the mass of the population, the rate of wages and the prices of the necessaries of life being alike low in comparison with European countries. This would necessitate a large amount of small change, in metallic currency, being kept up to meet the wants of at least 150 millions of inhabitants, affected as it would be by the proposed extension of the legal tender of silver coin, from the limit of 40 shillings, as in England, to the limit of 100 rupees (equal to 200 shillings in intrinsic value) in India, would save at least one-half of the silver bullion contents of the present rupee circulation of India from demonetisation when the change suggested might come to be carried out. The present circulation would have to be recoined into new rupees of the reduced value, to be presently explained; but the very circumstance of legal tender being given to the reduced new silver rupee, as a subsidiary coinage to the new gold coins, in the same way that florins, shillings, and sixpenny pieces are subsidiary to pounds sterling in the English coinage, would require a much larger supply of subsidiary coin in India than in England, in consequence not only of the legal tender of such coin being fixed, as proposed, at five times the amount at which its legal tender is restricted in England, but also from the circumstance that the population of India using such change of the superior coin, is five times as large as the population of England. On these grounds, it may not be an erroneous estimate to anticipate that something like 500 million silver rupees, out of the 1,000 million now assumed to be in circulation, would be recoined into new rupees. The existing silver rupees of $\frac{11}{12}$ths, or ·9167 fine, would have to be remelted and recoined, under the proposed plan, at the increased English standard fineness of $\frac{37}{40}$ ths, or ·925, and at a weight reduced from 180 grains troy, as at present, to 174·5454 grains troy, being the weight of the English florin, of which 33 at present are coined to the pound troy. The rupee and the English florin, of one-tenth of a pound in value, would then be identical. The question then is, how will the revenue be affected through the seignorage? This, as already explained, is no novelty in India, where it has always existed as a means of defraying the expenses of, and having a profit upon, mintage of bullion into coin. The rate is now 2 per cent. on silver bullion, or 1 per cent. on recoinage of coin. The gain upon a recoinage of 500 millions of rupees is not the mere difference in weight of 5·4546 grains of silver per rupee (or the difference between 180 grains, the weight of the rupee, and 174·5454 grains the weight of the English florin), but is to be determined by the pure silver contents of each. These are 165 grains of pure silver for the rupee, and 161·45454 grains of pure silver in the florin, a difference of about 3·54546 grains per rupee. The holders of the present rupees, on bringing them to the mint to be recoined into new rupees, would, upon full weight coins, apparently gain a gross profit of 2·14873 per cent., from which must be deducted the 1 per cent. charged to them on recoinage. This would leave a net profit to them of 1·14873 per cent., but as the rupees would not be taken by tale, but only by weight, they would be found nearly 1·14873, or rather beyond $1\frac{1}{7}$ per cent. below full original weight, so that the public, bringing the present rupees for recoinage, would neither be gainers nor losers by the operation. The mint, on the other hand, would get its 1 per cent. on all rupees brought for recoinage; and, on all silver bullion brought for coinage, it would gain the same amount as the English mint now obtains, where the pound troy of silver, worth from 60s. to 61s., according to present market price, is coined into 66s., thus giving a gross seignorage varying from 10 to $8\frac{1}{5}$ per cent. This would more than recoup the Indian mints for the expense of carrying out the recoinage. In fact, it would probably, on the whole operation, leave a fair profit, and would enable the country to surmount with ease all the minute fractional differences which, as explained at our former meeting, would still exist in rendering the gold circulation conformable, either with the present sovereign at 10 rupees, or with the reduced international sovereign equivalent to 25 francs of gold coinage. Every nation entering upon a revision of its monetary standard must, perforce, round the angles and corners of its fractional differences to some extent, to make its coins become, to a convenient degree, commensurable with those of other countries. That conformity, under the terms of the Convention of December, 1865, can very well be attained by dealing with conformity of one standard, and that of the superior metal, gold. It is not, therefore, necessary to deal with the subsidiary or token-coinage of each country. That is, for many reasons, better left to have a localised, national value only. On these grounds, the nations in the convention do not attach importance to the subsidiary coins of silver being reduced to the continental fineness of ·835. All that is wanted is the gold fineness uniformly at $\frac{9}{10}$ or ·900, and the coinage of gold in pieces of the value of 5, or 10, or 20, or 25 francs, or of any multiple of 5 francs exactly, and at the rate of 3,100 francs to the kilogramme of gold, nine-tenths fine. The monetary systems of India, England, Australia, the United States, France, Italy, Austria, and other commercial countries are now in sufficiently near unison to admit of being brought into absolute accordance, in the manner suggested. All that is wanted is, for each nation to make some slight mutual concessions. The advocates of an international coinage in England have done their best to show how this can best be attained with, as near as possible, a retention of the highest equity to all concerned. That is too large a question to enter into the details of on the present occasion. All that remains to be added is, that the matter of gold currency introduction into India presents neither the real difficulties nor the complexities which the opponents of any change would have us believe. If the will be not wanting, the way will be found, by approaching the subject in a manner approximating with sufficient exactness to an equitable consideration of all the interests concerned. But, to arrive at absolute equity, to the very hair's-breadth of the minutest fraction, is impossible. On that we may, with advantage, take the sound advice given by M. de Parieu, the Minister-President of the French Council of State, the most distinguished advocate of the international coinage plan, and who, after expressing himself in terms of commendation upon the manner in which the discussion for and against that scheme has been conducted in England (*vide Journal des Economistes* for December, 1869, p. 388), remarked that he knows from experience, and ventures to tell us, his neighbours, across the Channel, that with the absolute *summum jus* as a condition, hardly any monetary improvement is possible with us or with anybody else. And in giving such an opinion, he appropriately observes, that the mission of statesmen is not merely to confirm ideas that have already become almost unanimous; it consists, rather, in guiding their country, and, as remarked by M. Magne, late Finance Minister of France, "in not waiting until noon-day to know that the sun is up." Such ought to be the policy of English and Indian statesmen as regards the introduction of a gold standard into India. The question has incubated quite long enough, and it is generally acknowledged that the country would derive an advantage from the disuse of its silver standard. It is time, then, for the over-cautious experiments, and tentative expedients upon a small scale, of the thirty-five years now past, to give way to larger and more comprehensive measures that need only to be just and rigorous to ensure their complete suceess. It may here again be objected—all this is very well to urge on theoretical grounds, but, in practice, the difficulties are insuperable. But we may

well question whether any real difficulty exists at all. The objection (1) as to what is to become of the demonetised silver rupees and (2) how is the gold to be forthcoming in a reasonable period of time, to enable such a stock of gold coin to be in readiness in India when gold shall become the sole standard, and the only legal tender for sums above 100 rupees, are of but small importance when the figures of the supply of precious metals in India are maturely considered. An analysis of official returns of imports and exports of silver and gold bullion, from 1845 to 1869, *i.e.*, for the last twenty-five years, shows that a gross value of, as nearly as possible, 200 million pound sterling worth, has remained in India, as the balance of imports over exports of the two kinds of bullion. Of this, about two-thirds or £133,000,000 sterling worth have been in excess of silver bullion imports over exports, and the remaining one-third, or 67 million pounds sterling worth, has been excess of gold bullion imports over exports. The Indian coinage, during the same period of the quarter of a century last past, has amounted, for silver, to about 150 million pounds sterling worth of rupees. No doubt a vast portion of the silver bullion imports of 1845–69 has been absorbed in this coinage, but how much of the coinage of the period has been recoinage of light-weight rupees, minted either before 1845, or reminted two or more times between 1845–69, it is not possible to ascertain. And, as before stated, considering all the circumstances of the quantity of rupees turned into bangles and personal ornaments, and in other ways converted into bullion, and allowing for the coinage of twenty-five years, including much recoinage, there are reasons to believe that the active circulation of rupees in British India does not exceed 1,000 millions, or say, 100 million pounds sterling worth. The late Right Hon. James Wilson estimated the actual circulation, in 1860, at 1,000 million rupees; but Mr. W. R. Cassels, of Bombay, in his communication to Sir Bartle Frere, dated 1st January, 1864, observed that he could not understand by what process Mr. Wilson arrived at this high estimate, but that he believed that if Mr. Wilson had reduced it by one-half, he would have been much nearer the mark. But, considering the great increase of wealth in India, particularly through the development of the growth of cotton, during the 10 years that have elapsed since the date of Mr. Wilson's estimate, 100 million pounds sterling worth of active silver circulation is a fair and liberal amount to assume as the grand total of metallic currency to be immediately affected by the changes in the standard. We may reckon that at least one-half of this active circulation, or say 500 million rupees, will be required for recoinage in a token form, that is, reduced to the lesser weight, but increased to the greater fineness, of our English two-shilling or one-florin pieces. These 500 millions of rupees will be wanted for the purposes of small change, and of legal tender to the extent of 100 rupees (according to the plan proposed) amongst 150 millions of the people of India, whose daily life is specially mixed up with smaller payments than those that concern the populations of European countries. Then as to the balance of 500 millions demonetised. That will find an outlet as bullion for export to China and elsewhere, and some portion of it will go to swell the ever-augmenting hoarded wealth of India in ingots, personal ornaments, and objects of artistic or useful value. There only remains the alleged difficulty about providing the gold coinage to take the place of the supplanted 500 million rupees? Where is the gold to come from out of which they are to be coined, and what will be the state of things, it is objected, if the course of the exchanges prevents considerable fresh supplies of gold coinage into India? The answer to this is that, admitting, for the sake of the hypothesis, highly improbable though it be, that a check to their import might perhaps occur, there is still an ample stock of gold bullion already existing in India, and ready at hand to be turned into gold coin, irrespective of the fresh supplies that will, on the average, continue to flow in. It must be recollected that quite 670 million rupees' worth of gold bullion, after deducting exports, has remained as the balance of imports in the twenty-five years, 1845-69. We know that partly out of this, and partly out of previously existing stocks of gold, less than twenty million rupees' worth of gold mohurs have been coined at the Indian mint during these twenty-five years. Well, deducting this from the balance of 670 million rupees' worth of excess of gold bullion imports, we have, in 1870, a fund of 650 million rupees' worth of gold, in addition to the stock existing in 1845, to provide for a gold coinage. And five years' work at the three mints of India would easily turn out 500 million rupees worth of gold pieces. In 1866, these mints turned out 145 million rupees worth, in one year's working, of silver coin, a much more laborious manufacture than the out-turn of the smaller number of pieces comprised in a gold coinage. Thus, India could easily be supplied with the material for the resort to an obligatory gold standard at the end of five years from legislative notification. It has frequently been observed that the word "difficulty" should be expunged from the vocabulary of an engineer working on sound and tried principles. And, with such principles, and with the long-tried experience of such countries as England and France to guide Indian legislators in this matter of the standard, they similarly ought not to allege "difficulty" as deterring them from abandoning the old and worn-out machinery of a silver coinage, and from adopting in its stead one of gold, as essentially suited to the modern life of nations, and to the wants of a country such as India, whose industrial resources are being opened up in a way of which its former rulers had not the remotest conception.

(*To be continued.*)

CONFERENCE ON EDUCATION.

On Monday, 7th February, a Conference on National Education was held, for the purpose of harmonising into a measure practicable at the present time the best features of the Manchester Education Union, the Manchester Education Bill, and the Birmingham Education League proposals. Lord Henry G. Lennox, M.P., Chairman of the Council, presided, and among those who attended were the following:—The Earl of Lichfield, the Earl of Longford, Right Hon. Lord Robert Montague, Right Hon. Sir John Pakington, Bart., M.P., Sir Thomas Bazley, Bart., M.P., Admiral Ommanney, Sir Walter Stirling, Sir Tilson Marsh, the Very Rev. the Dean of Canterbury, the Rev. Canon Melville, the Rev. Canon Cromwell, Principal of St. Mark's Training College, Messrs. Geo. Anderson, M.P., Charles Buxton, M.P., Joseph Alfred Hardcastle, M.P., Henry Edwards, M.P., Frederick Snowden Corrance, M.P., Edgar A. Bowring, C.B., M.P., George Moffat, M.P., Donald Dalrymple, M.P., Right Hon. C. Pelham Villiers, M.P., C. Wren Hoskyns, M.P., Samuel Morley, M.P., Thomas Hughes, M.P., Dr. Lyon Playfair, C.B., M.P., Henry Cole, C.B., Edwin Chadwick, C.B., Major-General Eardley Wilmot, R.A., the Rev. Dr. Barry, Principal of King's College, London, the Rev. Dr. Butler, Head Master of Harrow, the Rev. J. H. Rigg, D.D.,

the Rev. Derwent Coleridge, Rev. J. Oakley, M.A., Rev. W. Rogers, M.A., Rev. W. A. Duckworth, Rev. Arthur Rigg, Rev. R. G. Macmullen, Rev. Jonathan Bates, Rev. J. G. Wrench, Rev. T. M. Beaumont, Rev. W. Dorling, Rev. W. Unwin, LL.D., Principal of Homerton College, Rev. A. J. D. D'Orsey, B.D., Professor Owen, F.R.S., the Mayor of Portsmouth, G. F. Wilson, F.R.S., Hyde Clarke, D.C.L., George Godwin, F.R.S., Seymour Teulon, Samuel Redgrave, Dr. Stallard, J. T. Ware, Alexander Redgrave, J. F. Wright, Thomas Twining, T. R. Tufnell, T. H. Bastard, Robert Smiles, W. Botley, James Henderson, Ernest Noel, Lockhart Gordon, T. W. Ramsay, M.D., Edwin Pears, Dr. Bennett, George Campbell, William Hughes, F.R.G.S., J. Vaughan, Rupert Kettle, J. Heywood, F.R.S, and Dr. Nichols, &c.

The following was the programme for discussion:—

Programme for Discussion at the Society of Arts Conference on National Education, on Monday, February 7th, 1870.

In which it is attempted to combine and supplement, in a scheme practicable at the present time, the best features of the National Education Union, the Manchester Education Bill, and the National Education League proposals:—

1. That, in order to secure the education of every child in England and Wales, on which all parties are agreed, it is necessary that a Department of Government, responsible to Parliament, be constituted for the purpose.

2. That such Department have ample and discretionary powers to take all necessary measures to cause proper elementary and secondary education to be placed within the reach of the whole people: also to make economical combinations of existing schools: also to have direction of all grants and public funds devoted to National Education: also to have charge of all national museums, galleries, &c., so that the same may be properly administered in aid of National Education throughout the United Kingdom, and to appoint Inspectors of Education instead of merely Inspectors of particular schools, as at present.

3. That the means of instruction in reading, writing, arithmetic, with moral training, and, where practicable, in drawing, singing, and drill, be provided for all, and encouragement given by government to the higher branches of general culture, science (especially that bearing on health), and art. Infant, primary, and secondary schools, colleges, and universities receiving government aid, to be helped to act in union, as far as possible, as parts of a system.

4. No child to be hired for labour who is under a given age, and not receiving satisfactory instruction. Compulsory attendance at school to be obtained by fining employers (according to the principle of the Factory Acts) if they employ such children.

5. Industrial schools, Union schools, Reformatory schools, and the like, to be brought under one direction, and compulsory powers given to take and educate children of the vagrant or destitute class.

6. Existing efficient denominational schools to continue to receive parliamentary grants, with government inspection for reading, writing, arithmetic, drawing, singing, and drill.

7. Each denomination to provide for its own religious teaching.

8. Where additional schools or increased school accommodation appear to be wanted, an official inspector to inquire what improved arrangements can be effected: in populous places, by organisation and combination of existing schools, or by the adoption of a half-time or any other system. The locality to be invited to establish schools, giving it the option to do so by voluntary subscription under the existing system, or by rates administered by a local board according to rules; but if the locality neglect to do so, then government to establish the necessary schools, charging the cost of buildings, and a proportion of the annual expense, on the rates of the locality. Existing schools to be free to adopt this system.

9. School fees to be maintained, and be applicable to the augmentation of the incomes of the teachers, who will thereby be stimulated, and the schools kept efficient. Fees of destitute and pauper children to be paid out of the rates.

10. Existing training schools for teachers to be consolidated as early as practicable, and, if need be, enlarged.

11. Parliament to give provisionally large and general powers to the Education Department, whose work, until a national system has been matured and is in action, must be tentative.

Lord Henry Lennox said, as Chairman of the Council of the Society of Arts, it was his duty to take the chair upon that occasion, and he asked the indulgence of the gentlemen present whilst he stated generally the views of the Society of Arts upon the subject of education. He was well aware that in that room and elsewhere there were many persons whose presence in the chair would have added much more to the dignity of the subject than one who held so humble a position in the House of Commons as he did; and it was his official position as Chairman of the Council which had induced him to accede to the wishes of his colleagues. There was, however, no Society in the country having so good a claim to be heard on the subject of national education as the Society of Arts. For many years past it had made itself very busy in obtaining valuable information, and publishing that information to the world. It was the parent of Industrial Exhibitions, which opened the eyes of artisans to the lamentable want of technical education which existed. Subsequently, the Society established a system of Local examinations, which had done so much for the cause of education; and which had since been followed up even by the Universities themselves. With the two bodies which had recently been propounding their views before the country—the League and the Union—and with the object they had in view, the Council of the Society of Arts had the most perfect sympathy, and having sympathy with that object, and going beyond it, they had felt it their duty to subscribe to the funds of both. It was not his intention to enter into any criticism of the details of their plans, or to ask the present or subsequent meeting to do so. The object of the League and the Union was to place within the reach of every child in the kingdom a sound primary education. The Council went beyond that, and said that in certain cases, with regard to teaching-powers, it was possible that certain classes might enjoy, or might have placed within their reach, an advanced system of secondary education. He would call the attention of the meeting to a paper, the result of the first of a series of inquiries, which had been carried on under the Society of Arts' direction, as to the state of ignorance and vice existing in one of the suburban districts of London. The idea emanated from Mr. Chadwick, and, like everything else which came from him on the subject of education, it showed the zeal and anxiety which he had to promote the welfare of the community. The first inquiry took place into the state of the parishes of Ealing and Brentford; and an inquiry was now going on with regard to Richmond, Mortlake, and other parishes. But what had already been done showed

what an immense field there was for an initiative, and not a passive, government department of education. It was not his intention to dwell at length on the various subjects which the paper contained. But there was one which threw light on the extreme darkness which reigned within a stone's throw of the wealthiest districts of the metropolis, and he could not forbear calling attention to the figures, in order to stimulate the desire they all had to improve the present system of education. In Ealing and Old Brentford, there were 96 licensed and unlicensed drinking houses. At the present time, the average of drinking houses was one for every hundred of the population. The total receipts was £300 per annum for each, which, he believed, was a moderate and under-statement. The total value of the yearly consumption of beer and spirits in the two parishes was £28,800; and in Brentford alone the value was £21,200. They had compared this cost of drink with the cost for education in those two parishes, and the following were the startling results:—In Ealing, £8,500 was annually spent in drink, while the sum of £750 was spent in education. The average per person was 30s. for drink and 3d. for education. In Old Brentford, nearly £20,000 was spent annually in drink, and £1,000 only for education, the average being £3 per head for drink and 3s. for education. He thought, if it were necessary to give any stimulant to the desire for an improved system of education, it would be to learn what was the state of two of the suburban parishes, presenting no unusual or marked features on the whole, of the education and the prevalence of drunkenness and its sister, crime. The Society of Arts thought that the best way was by going, as he said before, with the League and the Union as to the object which they had in view. The Society thought the object could best be obtained by supplementing the present system of education, where it was or could be made to be efficient. They thought that for many reasons; not because it was the cheapest, the most easy, and most practical mode of education, but because they thought that the system had, for the last thirty years, however defective it might be in itself, brought about such great results that they would be unwilling hastily to tamper with or destroy that which had been so beneficial to the country. The question as to the way in which it should be carried out was the keystone to the whole subject, and would form the subject of the first resolution—that the education of the country could not be put upon a proper basis unless we had an initiative, and not a passive, department of education, which should have large powers to deal with the existing great and crying necessity. The arguments against such a plan were held by a few, and were very weak ones. The very weakness of the argument proved to the Council of the Society more than ever the absolute necessity and advisability of the establishment of an educational department. It was said that if the whole power were placed in a government department, it would lead to one stereotyped system. But the same thing might have been said of the system which now existed, of government examinations and payment by results, and the result of that, they all knew, had proved the very reverse of that which was prophecied. Far be it from him, or from those of whom he was the spokesman that day, to say that they had any wish to hamper the government, or to interfere with the government, or to dictate to the government. All they wanted to do was to strengthen the hands of the government as to any bill which they might think it right to introduce; and if in that room there could be evoked a discussion such as he thought they would have, he felt sure the government would be the first to come forward and avow the obligations they were under to the Society for having taken that course. The duties of the proposed new department, according to the Society of Arts' view, would be very large. It should have ample discretionary power to take all necessary steps to place elementary and secondary education within the reach of the people. It should also have direction of all grants in aid of public education, and the management and direction of all national collections, museums, and galleries. He could not touch upon this subject without calling attention to the fact that it was one which he had pressed upon the government of the country, in Parliament and out of Parliament, for the last seven years. The management of the institutions to which he had referred was not what it might be made; and, under proper and judicious control, these institutions might be rendered much more valuable than they were now, not only to the enjoyment and recreation of the people, but to the furtherance of the adult education in the country. With regard to providing new or additional schools, the power of the new department should also be very great. Where additional schools or school accommodation appeared to be wanted, an official inspector should inquire what improved arrangements could be effected. Localities should be invited to establish schools, and they should have the option of doing so by voluntary subscriptions or local rates. If they neglected to do this, then the government should establish the necessary schools, charging the necessary cost of building and a proportion of the annual expense upon the rates of the locality. The new department should have the power to organise or combine existing schools, and propose to those schools the half-time or any other system that might be found beneficial. His colleagues had been very busy in personally visiting and inquiring into the system which was now carried on in some of their large schools and educational institutions in the country, and the consequence had been to show them the extraordinary results which flowed from a large system of training and teaching art, which by the aggregation of large numbers, had been brought into practice in London and elsewhere. Some time ago, when the half-time system was first introduced, it was met with incredulity, because it was thought not possible that by the half-time system the same amount of instruction could be given. Nevertheless, the result of the inquiries of his colleagues, and what he had seen himself in some instances, showed that a still further advance could be made in the teaching-power, even when coupled with the half-time system. It would appear, from the inquiries which they had been able to make, that they must have an improved half-time system of hours, and not only a half-time system of hours, but a saving in the wear of the teaching-power, and in the annual cost of the schooling of the young. Those great results were to be met with in some institutions in London. In Bell-lane Free Schools there were 3,000 children rescued from the gutters and dens of filth with which Houndsditch abounded, and a teaching-power of 30 operating upon this raw material drawn from the gutters; and as under the old system they only had an opportunity of teaching very little, and that little very imperfectly, those young persons were found to possess a degree of solid instruction which fitted them for some of the most productive works in the country. He had visited these schools with his friend, Mr. Chadwick; the boys were put through examinations, and it was perfectly astonishing to find that, in so short a period as four or five years, they should have been brought to such a perfection as they were, at one-third of the cost under the old system of teaching-power, and one-half of the total cost. At the admirable Middle-Class Schools under the direction of Mr. Rogers, in the City was shown what could be done by a careful organisation of teaching power. There they had some 900 boys, and a teaching-power of 17, and the results were most remarkable. And he must say they made him, who belonged many years ago to a public school class, envy the amount of instruction, and the varied nature of the instruction, which these boys had obtained at a trifling cost. Some of his colleagues had been to another of these institutions—the Faversham School Union. There the pupils were the sons of farmers and the sons of farm labourers, and they illustrated how all denominations of religion could work harmoniously together

if they had a mind to. By 11 years of age the pupils were fully taught reading, writing, and arithmetic. After 11 years, the class of labourers' children were obliged to be taken away, but those of the farmers and the lower middle-class remained till 13 or 14 years of age, by which time they gained a sound and advanced secondary education. When they considered the amount of instruction which a boy of 11 years old obtained, and a boy of 13 or 14 years obtained, he thought the Council of the Society of Arts did right to call the attention of the country to these subjects, believing as they did that they must form a very important part in the administration and legislation on the subject when the question came before Parliament. Upon the subject of secondary education the Society of Arts were in advance of the League and the Union. These only discussed the question of primary, whilst the Society of Arts went in not only for advanced secondary education but physical training. There were a few other points on which he desired to say a word, with regard to the Society of Arts' scheme for national education. One was, what should be the amount of compulsion. There could be no more difficult question than that, he supposed. The Society thought that compulsion, in the sense of compelling all parents to send their children to school, would, at the present time, be unadvisable and almost impracticable. It would, in rural districts, entail much hardship upon parents who might possibly not be able to send their children to school four or five miles off in the winter months, trudging through mud and snow. It was hoped, therefore, that the government might be able, by making a radius in which schools should be placed in various localities, enable a certain amount of compulsion to be applied. It was also wished to extend the action of the Factory Acts which were already in existence. The only class of children to which the Society of Arts were prepared, at the present time, to recommend that absolute compulsion should be exercised, were those forming so large an element in Bell-lane Schools, namely, the homeless, houseless, nameless Arabs who inhabited the bye lanes and streets of the metropolis. No doubt compulsion, even in their case, would form a large item in the Chancellor of the Exchequer's Budget. But he could not help thinking that he was a sufficiently keen and sensible man to know that the expenditure would be a repaying one to the country, and at the same time humane to the class to whom it was proposed to apply it. It would be observed that amongst the resolutions to be proposed, there was one touching the point which had been most warmly and keenly discussed, namely, how far the denominational element should enter into the government schools. He had great faith, and hope, and belief that that which appeared at one time an almost insurmountable difficulty was gradually fading away, and becoming less difficult and less insuperable. He remembered that when, as a member of the House of Commons, he declared himself in favour of an efficient conscience clause, he found himself in a small minority of persons denounced by those who had most excellent intentions on the subject of education. But now the very foremost amongst those who were opposed came forward to say that no system of national education could be just or complete without a very effectual conscience clause, which, only a few years ago, they thought could not be carried out. The very change of opinion with regard to the conscience clause made him hope that still further changes might take place, and that, when they were all anxious to carry out one great system of national education for the people, they would not allow differences of religion to interfere and subvert the Bill which he hoped government had in store for them. He could not suppose that all persons would agree with him upon the subject, and he had only lightly touched upon it. He had great hope in the weakening of the religious difficulty with regard to education; and he hoped still further that that difficulty would altogether vanish in the course of the ensuing session. There was one other point to which he would draw attention shortly, at the same time apologising for the length at which he had trespassed upon the attention of the meeting. The point was, whether the national schools should be free, that was to say, whether there should be no fees. The Society of Arts disapproved altogether of the abolition of fees to those schools. They thought that a great deal of the success which had attended the education of the country in universities, public schools, and parochial schools was due to the fees payable by those who enjoyed their advantages. It was thought that when the master depended solely upon a fixed salary, and had no chance of increasing that salary by extra exertions, it led the master to go to sleep, and the scholars to follow his example. The Society wished that the master should have a fixed salary, but, in addition, a payment which would stimulate the ambition of the master, and make him stir up the energy and industry of his pupils. He hoped and believed it would be thought that the present session was a very good and proper time when some government bill upon the question should be proposed. There seemed to be on all hands an opinion that such a time had come. When he found persons of eminence belonging to the Liberal party in the House of Commons and those belonging to the Conservative party agreeing in general principles, and merely differing upon slight details, he confessed it made him hope and believe that they were near to the end of the race at last. He occupied a very humble position as a legislator, but his right hon. friend Sir John Pakington occupied a very different position, and upon the Scotch principle that "many a mickle makes a muckle," he would be happy to follow his friend Sir John Pakington, provided he would give his cordial support to her Majesty's government in carrying out such a system of education as that which he had ventured to sketch an outline of. There was another saying, which no doubt all had heard, with reference to a great man among them, namely, that he gave up to party that which was due to mankind. He could assure them that he (the chairman) would not give up to party that which was due to mankind, but would preserve for the benefit of mankind and the education of the young whatever energies he had, in the coming session of Parliament. All nations held governments responsible for the administration of justice and the suppression of crime. He hoped the time had come, and would be brought about in the present session, when they would recognise the principle that they held the government of the country responsible, by a drastic system of education, for the suppression of ignorance. With these few remarks he would ask the meeting to enter into the consideration of the topics which he had ventured to suggest, and would call upon the right hon. Sir John Pakington, M.P., to propose the first resolution.

Sir John Pakington, Bart., M.P., moved the first resolution, as follows:—

"That, in order to secure the education of every child in England and Wales, on which all parties are agreed, in existing or additional schools, it is necessary that a Department of Government, responsible to Parliament, be constituted for the purpose, and that Parliament should be asked to give large and general powers to that Department."

He was willing to move the resolution, because the substance of it was a subject which he had repeatedly urged upon the consideration of the country, both without and within the walls of Parliament. His belief had long been, and now there were reasons why tho belier should, he thought, be stronger than ever, that we ought to have in this country a well-organised education department, with a responsible minister of high rank at its head. He would be glad to be allowed to state a few reasons why, in his opinion, the subject was now of more pressing importance than ever. He hoped and believed they were now upon the eve of tho settlement of the great national question upon a broad and liberal basis. He was

not a member of, and had in no way joined, either the National League or the National Union which had been referred to, but, in passing, he would express his gratitude to both those associations, because he believed that by their action and the great part which they had taken, they had given a great stimulus to the progress of the question, and had added greatly to the hope which they previously entertained of seeing the question finally settled in the approaching session of Parliament. But he had attended the meeting because he thought it well that a great Society of this kind, which pervaded the whole country, should now meet, and he hoped it was the object for which they were assembled, not to pretend to draw the exact outlines of an Act of Parliament, not, above all, to act in any spirit of dictation towards the government, but, irrespective of this association or that association, to approach the great subject of education in a spirit of moderation, and in that spirit to express their willingness to assist the government in the difficult task they had undertaken, stating, in a spirit as conciliatory as they possibly could, the views which they as individual men entertained of those principles upon which they had a belief the government could now safely proceed. He hoped they would carry on the discussion of the day in no spirit of party, either political or religious. He trusted they would avoid anything like exaggeration. Men were apt to express themselves warmly upon subjects in which their feelings were deeply engaged; and the advocates of education—he was not sure that he had not come under the imputation sometimes himself—had been charged with presenting to the public exaggerated pictures. The League, at this time, were charged with having stated exaggerated opinions as to the amount of ignorance and destitution in the country. He hoped that in their discussion, which, in his opinion, if conducted in a proper spirit, would be most valuable, they would limit themselves to calm statements of those requirements which, in their judgment, as experienced men, they thought the government ought to introduce in any measure which they proposed to bring forward. He was not one of those who had ever been an enthusiastic approver or a supporter of the existing denominational system in this country. Looking at it as a national system, he had always regarded it as a clumsy contrivance. He had always thought, and thought still, that if the statesmen of England had at any period devoted their minds to establish a system of national education, they certainly never would have devised such a system as the denominational. But, on the other hand, that system had been carried on so long, it had done so much good, it was now so rooted in the country, that he was free to say he did not think any prudent man could seriously propose now to do away with it. It had, no doubt, effected great good. It was at this moment effecting great good in almost every part of the country. What, then, should be the object of those who had at heart a really effective national system, and who wished to supply the defects and deficiencies which existed? He thought the answer to that question was obvious, and that the duty of gentlemen who entertained those views was to consider in what manner it was in the power of the government, and the Parliament, at their suggestion, to supplement and improve the existing system, so that, without impairing that in it which was good, they should so alter it as to make it effect that which it had never yet effected, namely, to reach every portion of the population. In his humble judgment, there were three requirements which were essential to make the present system what it ought to be. The first of those requirements was, that they must have additional schools. He believed the number of additional schools required was not nearly so large as was generally supposed. But there were localities, and and they were for the most part either in large towns or in crowded populations, where new schools were pressingly required. He would add that these were exactly the localities in which they could not rely upon voluntary effort and benevolence to supply the want which existed. They, therefore, at once pointed to two considerations, upon which he would say, in passing, the National Union were entirely silent, namely, the question of local organisation and the question of supplying the schools from some public fund. That was the first point which seemed to him to require serious consideration, and he was prepared to support the necessity of providing those schools from some public fund. Coming to the second of the three requirements which he thought essential, and which was more important, in his judgment, than the first, it was that they should have better schools than they had. Let them not for a moment suppose that he did not recognise distinctly and entirely that, under the present system, they had all over the land valuable schools. But, speaking generally and widely, the question in his mind of improving the schools was more important than that of providing the schools which they had not. The third point upon which he thought it was essential that government should know the views of such a meeting as that, was that the attendance of the children at the schools should be longer. It was in vain to send a child to the best school if that child was to cease all education at the age of ten or eleven years, because it was almost certain that, before he arrived at the age of manhood, the teaching given him in the best school would have been forgotten. It would at once be seen that, in connection with the third point, they came to a question which had been touched on in the able address of the Chairman, namely, the question of compulsion. That was comparatively a new portion of the subject, and one which he thought required to be very cautiously considered and cautiously dealt with. But he hoped that the government would not shrink from resorting at least to indirect compulsion upon the principle of the Factory Acts, and that the legislation of the government would be so shaped that, speaking generally of the education of the humbler classes of England, they should not be allowed to cease their training in the schools until they arrived at least at the age of fourteen years. Those were the points upon which it seemed to him it was desirable that the views of such an assembly should be known, and, having stated those three requirements as they struck his mind, he did not think they could make up their minds upon the manner in which they thought those three requirements ought to be dealt with without touching upon that important though difficult branch of the subject, namely, the question of religious teaching. He was sorry to observe that, in the resolutions proposed for adoption by the meeting, the subject of religion was altogether passed over, though the question was not omitted from the programme. He admitted the difficulty of drawing a resolution which was likely to meet all views. But there was a broad question, upon the insertion of which in a resolution he thought there could be no difficulty, and it was the broad preliminary question whether in the schools of England there ought to be religious teaching—aye or no. For very many past years he had taken an active part, as was well known to many, in urging upon the legislature and upon the country a system of popular education upon a broad and liberal basis; but he had never advocated the idea, which he was sorry to see was now pressed in different parts of the country, that religious teaching should be banished from their schools. He was willing to give credit to all parties for good intentions; and, although there was a party which now seemed to think that the best plan might be to ignore religion altogether in their schools, he did not believe that this was the sentiment of the people of England; and he should be glad if the meeting would permit him to read some very short extracts proceeding lately from two men whose opinions were certainly entitled to attention. They all knew the maxim, "*Fas est ab hoste doceri.*" The first extract he would read was from Mr. Miall, who, having been unable to attend the meeting of the National

League, at Birmingham, wrote them a letter, in which the following passage occurred :—" I feel convinced that if by unsectarian schools the interpretation should be the rigid exclusion of all religion from the schools, the nation will lose the very best teachers; for, *cæteris paribus*, they are the best teachers who bring a religious spirit and motive to their work. I am sure the working classes, as a body, would not care to shut out Christianity altogether from the school to which they send their children." He would now read one sentence from a late speech, which no doubt every one in the room had read—a speech of Mr. Bright to his constituents at Birmingham. Speaking of religion, Mr. Bright said:—" What I think may be taught of it in every school to every child is this, love of truth, love of virtue, the love of God, and fear of offending him; and I think that every right-minded and every rightly-appointed teacher in every school in England will undertake, as far as it is in his power, to teach that to all the children under his care." Neither of the two gentlemen to whom he had referred were Tories, they were neither of them Churchmen, but they were both of them Christians, and he thought those two extracts breathed the spirit of Christianity in a manner honourable to both of them. He agreed with those gentlemen most cordially, and the only question which the extracts suggested to his mind—and possibly ere long he should call upon them for explanation upon the point—how those principles, which were excellent, were to be carried out. They would not be carried out if the secular school system was to be adopted as the system of this country. On the other hand, he had contended again and again, and was prepared to contend as long as he took a part upon the subject, that the religious teaching of the schools of England must be conducted not only upon a liberal basis, but with the most implicit respect to the rights of conscience and of religious opinion. Were the two things irreconcileable? He broadly contended that they were not. He had alluded to two classes of schools. In the first instance, to the denominational schools now existing, which, whatever he might have thought of their origin, had long continued, and he hoped would long continue, to contribute a useful and valuable education to the poor of the country. He thought the denominational schools, with regard to religious teaching, must be left as they were. He hoped this was the plan which the government would adopt and carry out, and from which they would not shrink—namely, that wherever aid was given from the funds of the State, there an effective conscience clause ought to be an indispensable condition. As to those schools which no doubt would be established under the action of an Act of Parliament, looking to the localities where they would exist, and to the nature of the establishments, no doubt there would be greater difficulty with respect to them than there was with regard to denominational schools. But he said of that difficulty as he said of all the difficulties connected with the subject, that if they had a strong government, determined to carry out a moderate and good measure, all difficulties would vanish. There was a mode in which, in his humble judgment, religious teaching in the schools might be established, and he should have been disposed to enter more into that branch of the subject, were it not that he saw in that room a reverend and very able friend of his, who, in the neighbourhood in which they both lived had offered suggestions upon this subject which he thought were well worthy the consideration of her Majesty's government. He held, in the first place, that there ought to be, for the benefit of these little children, all over the land, as Mr. Bright had said, a mode of teaching them the love of truth and the love of God. On the other hand, he for one was not prepared to contend for any undue sectarian principle, but he believed, with his reverend friend, that if the government said every child should be taught the Apostles' Creed, the Lord's Prayer, and the Ten Commandments, by some such arrangement as that the religious teaching in every class of school might be arranged upon principles which would deserve and would receive the general consent of the nation. He hoped he had not unduly trespassed upon the time of the meeting, but he could not avoid giving an outline of principles upon which he hoped the government would be disposed to act, and on which he believed they would be glad to receive any suggestions which came to them bearing the weight of so important a meeting. If any such plan were to be carried out by government, it ought to be done by a strong administration, and by a properly organised government department. He appealed to any man of common sense whether the constitution of the present educational department was such as anyone would suggest if they had to arrange it *de novo*. In the first place, had they an education minister? If they had, he must confess that he did not know his name. The only answer he could give was, that they had a nominal education minister who consisted of two parts, and these two parts could not always be relied upon to run in the same direction. Lord De Grey was President of the Council, and some perhaps would say that he was the education minister, but they never heard a word from him on the subject. They did not even know what were that nobleman's views on the question of education. Then, was Mr. Forster the educational minister? Certainly not. No doubt he was a most competent man on the subject of education—perhaps few men were more so, and he would probably propound to Parliament any measure upon which the government might determine, but he was only a subordinate, who had no power to originate measures, or to come down to the cabinet with the authority a minister of education ought to have, and say, " Such and such are my views, and they must be carried out." He simply came forward to represent the views of others, and in no way therefore could he be considered as a responsible minister. And what was the Council of Education? If the arrangement of Lord President and Vice-President was open to criticism, much more so was that of the Council itself; he could hardly conceive of anything more open to ridicule. They were only called in to act now and then, whenever it so pleased the Lord President, and when they were summoned it was to advise upon some avowedly difficult point. And who were the gentlemen who were thus asked for advice? Statesmen deeply immersed in arduous duties of some other office; they were sent for from the Board of Trade, the War Office, the Home Office, or wherever else they might be engaged, and suddenly asked to give an opinion upon a subject which they had never considered, and by which they might overrule the judgment of those, nominally at the head of the department, who had been studying the question for a long period. It must be obvious to every one that such a system was objectionable, and certainly it would never be able to stand the strain of efficiently performing the enlarged duties which they hoped and believed would be imposed upon them by the legislation of the coming session. He could not but hope even now that the government would commence their legislation on this important public question by creating an educational department worthy of the country, and fully competent to carry out the great measures which public opinion now imperatively demanded. He would only add that, as a member of the House of Commons, he earnestly hoped they would not be disappointed, but should find that her Majesty's government was prepared to legislate on this matter. He believed the present moment was, under all the circumstances, very favourable for such a purpose. He, for one, should enter into the consideration of this subject knowing no party but one, and that party the millions of poor children who were spread over the country, whose future in this world and the next would mainly depend on the instruction provided for them, and upon whose conduct, whilst they remained in

this world, the prosperity, welfare, and happiness of this great empire must mainly depend.

The Rev. Canon Melville said he would not go at any length into the requirements for a government department of education, nor would the meeting expect it of him, but if any argument were wanted to enforce the necessity for such an organisation, it was to be found abundantly in the programme which had been put before them for the day's discussion, which embraced a great number of subjects, ranging from the top to the bottom of the whole work of education. He did not see how practically these matters could be administered except by an efficient government department. Sir John Pakington had noted three main requirements which had pressed themselves upon his notice as characterising this great question of the day, and he would beg to call attention for a moment to three answers, not exactly in form, to these requirements, but which, from the generality with which they were at present being expressed throughout the country, were not without grave significance. He quite agreed with Sir John that, however much they might differ from both the League and the Union, but more especially as regards their attitude to each other, they must all admit that they had done this great service—they had thoroughly awakened public attention—they had got up the steam, and as he had recently had occasion to remark, he believed this question was in the hands of an engine-driver in the House of Commons, who would turn that steam to a very direct purpose. The answers which they had received from the country were these:—First, the country distinctly declared, in response to the appeal which had been made to them, that they would have education; and they had gone on to say farther—and this was very significant, considering the order of society from which the declaration came—that in some degree, more or less, somehow or other, that education must be compulsory; and, further still, that in some way or other—perhaps in a less degree intelligible to themselves, but just as decided—that education must be unsectarian. He must crave the indulgence of the meeting for a short time, while he expressed his own very strong convictions on one point, which it had perhaps been desired to keep out of the discussion, but he believed he should not ask in vain for a patient hearing, even if his views were in any degree unpalatable, because he spoke not as giving expression to his own opinions alone, but as, he believed, representing the convictions of that very order of society for which they were now proposing to legislate. In fact, he did not think it was possible to avoid a discussion of this topic; even the noble Chairman felt that it must be alluded to, and everybody else felt the same. He, therefore, put it to them as reasonable men, would it be wise for such an assembly to pass by such a question altogether? Would it not detract in some way from the value of whatever conclusions they might come to? He was not there as the representative of any section, not even of the Church, which was the great national teacher. His desire was that that Church should be equal to the national demands, and he was convinced that it could never be so by any mere sectarian action. His desire was that that Church should not shrink into the narrow proportions of a denomination, and he feared that the attitude taken up by some of its leaders would tend in that direction. Having put himself right on this matter, he would come to the point on which he wished to say a few words. If they were going to initiate new schools, not on the denominational system, they must be supported by the public funds; of course, therefore, they must be administered by public bodies, and the moment they came to manage any particular school the religious element came in. If public funds were granted for the establishment of an educational establishment, it followed that the money must not be wasted, and immediately the principles of compulsion came into play. Then, if, as Mr. Dixon had declared, there were millions of neglected children to be swept into these schools from the gutters, gratuitous education must be more or less conceded, to what extent might be a matter of detail. Then, if these free schools were to be under the management of public bodies, the religious question at once presented itself, and it must be met. Of course, the admiral who put the glass to his blind eye, and then drove through the enemy's fleet saying he could not see them, and Mr. Brunel, when he turned on extra steam to drive through an obstacle in his path, knew what they were doing; they measured the force which was opposed to them, and calculated that they were able to overcome it, but that was a very different thing from shirking a question which came prominently before them. He would, therefore, ask the meeting for a moment to consider how the religious element could be supplied to these schools. If they decided that it could not be supplied, that was one condition; but, at all events, the subject must be considered. The Council of the Society of Arts had not entirely lost sight of the matter, for in the programme which had been put forward, they included a proposition that each denomination should provide for its own religious teaching, and he expected, of course, that there would have been a formal resolution embodying that opinion, but such was not the case. That was one of the answers which might be given, that each denomination should look after its own children; as Mr. Dixon said the other day:—"The homes and the churches must be looked to for the religious element." That was a very intelligible process, and one which, no doubt, ought to be fairly considered; but he would ask them shortly to consider what it would really come to. If each religious teacher were to take the children belonging to his own denomination away somewhere, on such days as might be arranged, in order to give them religious teaching, you would immediately have the most direct polemical sectarianism, and aggravate the objections to the conscience clause, that it did to a certain extent aggravate sectarianism, and that would be, to his mind, a fatal objection to such a scheme as this outside the school denominational system. Mr. Dixon had referred to it as the sorting of sheep; but anyone who had ever seen the process would not be of opinion that it was a very inviting one, and it must have the effect of setting one flock against another in a most marked manner, thus intensifying the very evils which it was their object to overcome. But, in addition, he believed it would be an impracticable system, and that practically it would come to secular education pure and simple. Take the case of a parish with several thousand inhabitants; it was impossible that a clergyman in sole charge of such a district could undertake the religious teaching of the children, and many clergymen had not the ability for teaching the young; it was a natural gift which many did not possess who had the will, whilst many others had neither the will nor the power. He would, therefore, put aside the denominational system as impracticable, and also on the ground that the religious teaching of the young ought to be intra and not extra scholastic. Then, if it were given inside the school, it must be a part of the daily school system. Sir John Pakington had expressed his opinion that the mass of the people were instinctively religious, and in this he cordially agreed, and he spoke, therefore, on this point in the full assurance that he was but the representative of the people at large. They had, however, been misled by the very glaring lights which had been held before them during the last few months, called unsectarian education, and their attention had thus been called off from the matter. Only the other day, he was present at a large meeting held under the auspices of the League, and having often failed to get an answer to the question what positive lay hid under the negative that there should be no sectarian teaching, he put it to the meeting whether they were prepared to have no positive at all. He simply appealed to the religious instincts of the audience, and he had their universal concurrence with every word he said; and the leaders of the meeting, who were of course averse to his in-

terfering with the principles of the League, were ready to endorse a rider to the effect that they must have incorporated with the League system a positive basis for religious teaching connected with the daily school system. He knew that many gentlemen would shrug their shoulders at this, and say that it was bringing in sectarianism and so on. But by religious teaching he did not mean ecclesiastical teaching. He believed there existed now in the best schools a religious teaching which was not dogmatic, and that in it the nonconformists of the present day of almost all denominations acquiesced, because it provided everything which they desired to be taught, and nothing which they objected to. He took his stand for that teaching on the sentence which Sir John Pakington had read from the speech of the President of the Board of Trade, where he spoke of morality based on theology, for that was what it came to—a love of purity, truth, and virtue, based on the love and fear of God. That was the position he ventured to take up; they must have in every school the teachiug of morality based upon a certain amount of divine truth—they must have certain tenets of religion as the basis on which to lay a moral superstructure. He would go no farther than that, for he considered dogmatic teaching a mistake. In addition to the two authorities which Sir John Pakington had quoted, he might mention a third, a gentleman who had had great experience in this educational question, and who was a great authority on the foreign branch of it, Mr. Mundella. He wrote to him saying that he was not in favour of unsectarian education, if that meant irreligious, for he himself was too much indebted for all the religious teaching he ever had to a national school in England; but, he added, that for certain his stomach was turned against all divine truth because of the unintelligible formulæ which were crammed down his throat. That was exactly where he (the Rev. Canon) drew the line. He believed it was positively against the directions of the Prayer-book that they should teach the sacramental system to little children. Of course this was not a topic to bo enlarged upon at such a meeting, but they should not neglect any glimmering of light which might assist them; and at the end of the baptismal service they were only directed to teach the Creed, the Lord's Prayer, and the Ten Commandments to children; but there was a further injunction, that when they were preparing for confirmation they should also be instructed in the church catechism. That was where he believed they should draw the line; they should teach that prayer in which the great Fatherbood of mankind was contained, the evidence on which the broad principles of morality rested, and then just the outline of that faith which could give a substantive being both to that prayer and to those commandments. He went no further, and he hoped government would go no further, and there would still be plenty left for the different churches to do—plenty of extra-scholastic work for the denominations in enforcing their own distinctive characteristics. All he maintained was, that the people of England desired instinctively that their children should be taught that religion in school which it was a mockery to expect them to supply in their homes, and that that should be taught in the daily system of school, not made a species of top-dressing after the ordinary schooling was over. He did not believe in the system of top-dressings; they were something like the floss silk which a lady added to her wool-work; it was very pretty, but added nothing to the real value of the article. He felt sure that if the master were to maintain his authority, the backbone of that authority must be an appeal to a religious foundation. He again repeated, however, that he distinguished between religion and dogmatism, and with that definition he maintained that religion was one of the things without which any system of national education would be defective.

Mr. Charles Buxton, M.P., had great pleasure in supporting the resolution. There was no doubt that there ought to be a responsible minister at the head of the educational department, if it were to be conducted in such a manner as to make it as perfect as possible. As long as no one knew who was at the head, and no one was responsible for its work, there was necessarily a waste of power and amount of friction which ought to be got rid of. He had no doubt that, considering the deep interest which the country now felt in this question, the government would feel that the time had come when they could no longer put up with a half-constructed machinery. With regard to the religious question, which had been brought before them by Canon Melville, he must say that he felt such profound respect for parental authority, that if he believed that the majority of the people of England really wished that the education of their children should be separated from religious influences, he should, however much he regretted it, bow to that feeling. But he was persuaded that the contrary was the case, and that the reason why they ought to avoid separating religion from education, as was now proposed by some advanced educational reformers, was that they would be acting contrary to the wishes of the parents throughout the country in so doing. And, happily, the force of public opinion had made such rapid progress during the last few years, that the religious difficulty of which they used to hear so much had really almost vanished. He remembered the time when it was thought an act of extraordinary conrage and independence of mind on the part of Sir John Pakiugton when he broke away from what were considered the traditions of his party, by advocating a conscience clause. Now he was happy to say that all classes, Liberals, Conservatives, High Church, Low Church, and Nonconformists, were all, with very few exceptions, in favour of a really stringent conscience clause being imposed wherever government assistance was given to a school. And in that way he believed that they could with perfect safety maintain the religious element in schools, without risk of trespassing on the convictions of anyone. They had now, however, to consider how they could carry the work of education a great deal further than it had yet been carried, and provide that there should be sufficient school accommodation for all who required it, and they must also take steps to maintain the regular attendance of the children, and to keep them there as long as possible. With regard to the increase of school accommodation, no doubt the central authority would have to make very careful investigation into the circumstances of those localities where it had hitherto been deficient, and by largely increased grants towards the building of schools, and by other means, they would soon be able to supplement the present accommodation, and, if there were still a deficiency, he should not be adverse to throwing the burden upon the ratepayers of the different localities. His own opinion was, that it would be much better to do it by means of government grants awakening voluntary assistance from the people, than to throw it upon the ratepayers, but if that were not found to be practicable, they must then appeal to that source; but he could not at all acquiesce in the proposal made by the Birmingham League, that the whole country should be divided into educational districts, and that in each of them, whether there was school accommodation already existing or not, the ratepayers should be compelled to provide sufficient accommodation for all the children in the district. He should shrink from throwing such an overwhelming burden on the ratepayers of this country, who were already in many instances over-taxed. He believed, also, that the inevitable result of such an arrangement, which would of course include the putting into the hands of the ratepayers the management of the education for which they would have to pay, would be disastrous to education instead of tending to promote it. He did not think the men chosen to manage these matters by the ratepayers would have their hearts in the work, or the same experience and skill in the management of education as was to

be found, in many instances, amongst those who were at present the patrons and managers of schools. He also trusted that they should not see another part of the programme of the Birmingham League carried out, viz., that the education should be given away. Of course, there were a number of children whose parents could not afford to pay for their schooling, but there was no practical difficulty in arranging for such cases, without throwing open the schools gratuitously to all children alike. By so doing they would really relieve parents from a responsibility and duty which was very wholesome for them, and from which they did not appear, in the general way, to shrink. So far from that being so, he believed there would be no difficulty in getting parents to pay even more than they now did for the education of their children. On that point he trusted the Birmingham programme would not be carried out, but that, on the other hand, they would still retain the parents' fees, which already amounted to an income of no less than half a million per annum, and this sum was steadily increasing. But the worst effect would be that it would inevitably bring about the total destruction of existing schools. If schools were set up in which education was supplied gratuitously, it must follow that the existing schools, which were dependent to some extent on the parents' fees for support, must go to the wall. Turning for a moment to the question of compulsion, he should be glad if they could carry the principles out thoroughly, so that every parent should be obliged to send his child to school; but there were enormous difficulties in the way of any such measure, and he did not believe that the same measures which could be carried out in small communities, like Saxony, would be practicable in the crowded cities of England, and even less so in agricultural districts, without raising such an amount of indignation as would produce the very opposite effect to that which was desired. He believed that all that could be done at present was to extend the Factory Acts, but even that ought to be done tentatively and gradually, so as not to arouse that resistance which he feared they might meet with if they acted too rashly in that direction. They must gradually leave the employers throughout the country to a sense of the extreme importance of having all children educated, but that should not be done so rashly as to endanger the success of the measure. He trusted that this question would not be treated in any way as a political one, but he feared there was a disposition in some men's minds to look upon it rather as a political weapon than as a question of how they could give the most effective education to the children of the nation. He had been delighted with what had been said by the Chairman and Sir John Pakington on this point, and he rejoiced that the government bill would, as he supposed, be brought in by a man like Mr. Forster, in whom both sides of the house had so much confidence, not only in his ability, but also in the fairness and candour of his mind. In conclusion, he would say that, although he objected to some points in the programme of the Birmingham League, they must feel indebted to them for what they had done in rousing the attention of the country on this important matter.

Mr. Corrance, M.P., said he was happy to find, both from the Chairman and Sir John Pakington, that after all there was but little divergence in the scheme submitted and that put forth by the Union. Sir John Pakington had fairly admitted that the present denominational system was not one which would now be introduced, although, being established, it was impossible to ignore its existence. So far he entirely agreed, but he could not go so far as the right hon. baronet, when he expressed a hope that some measure would be introduced in the coming session which would definitely settle this question. He did not believe any bill now produced could ever be considered as a final settlement of a question which must depend in a great measure on the condition of society, and upon the aptitude of that society to receive a more or less extended system of education. Three great requirements had been spoken of, one of which it was said the programme of the Union did not entirely cover, viz., a provision for setting up schools in those deserted places which usually existed in populous towns. He was quite willing to admit that this was true, but he could not admit that the scheme of the Union would exclude any sort of system which might hereafter be found applicable to such cases; on the contrary, he himself might humbly venture to suggest some such scheme, viz., a power to erect schools out of the local rates. In country places he feared the difficulty would be greater, and he had not yet heard any scheme suggested which would meet such cases. In districts where all the farmers and proprietors were in very moderate circumstances, they could hardly contemplate forming a school board out of such materials. Of course the funds could be raised out of the rates, but the great difficulty was, who should have the discretion of applying it. He should, therefore, incline to the suggestion of Mr. Buxton, that the necessary funds be provided by government, and the schools be placed under government management and inspection. Sir John Pakington had given an assurance that any government bill which contained provision for religious instruction would receive his support, and he believed that such an assurance would be a matter of congratulation to the country. With regard to the education of the pauper clauses, he did not think any one scheme which had been brought forward effectively dealt with this branch of the question, although after all it was one of the most important. It appeared from a report which he held in his hand, that there were about 350,000 pauper children in the country, of whom about 36,000 were receiving some sort of education in unions, which it was desirable should be placed on a more satisfactory and broader basis, and it was proposed that this matter should be dealt with by an extension of Denison's Act, but he feared this would be found entirely inadequate to meet the requirements of the case. In conclusion, he gave in his entire adhesion to the resolution, and could appeal to his own experience in the House of Commons to show the anomalous character of the duties performed by the Vice-President of the Council on Education. Soon after he entered Parliament, he wished to ask a question with reference to the marking of cows' tails, and on going to the officials of the House to have his question put into proper shape, he was informed that he must address it to the Vice-President of the Council on Education. He was so much surprised, not seeing any connexion between his question and the subject of education, that he was inclined to think a practical joke was being played upon him, and he refrained at first from putting his question. He, therefore, had much pleasure in supporting the resolution, which he was also sure would be gladly embraced by the Union.

The Rev. Wm. Rogers, M.A., wished to say a word or two in answer to his friend, Canon Melville, who had rather seemed to imply that the question of religion had been left out of the programme by the Council of the Society of Arts, whereas nothing could be further from their intention. One part of the programme stated that each denomination should attend to its own religious teaching. He thought all were agreed that religion must be taught in the schools, but the great difficulty was to find out what was meant by the word "religion," though what had been said by the seconder of the resolution had certainly tended somewhat to clear up matters. By the recommendation of Sir John Pakington, he had been honoured with a seat on the Duke of Newcastle's commission on education, and he had learned something from his three or four years' experience there. The sub-commissioners or inspectors thoroughly investigated the subject committed to them, and, of course, these gentlemen differed very much amongst themselves on many points, but on one they were all agreed, which was this,

that the people in this country did not care in the least which school their children attended, whether Church, Unitarian, or British and Foreign, so long as they got a good education. He maintained, therefore, that this question of religion was not imported into the discussion by the people at large, but was forced upon their attention by enthusiasts and doctrinaires. He was persuaded that the people of England were determined that religion should be taught, but that dogmatic or theological religion they would not have on any terms, and if they could only hit upon some provision which should secure this, he believed that League, Union, and everyone would all agree to it. There was a sort of fear in some people's minds that certain men were being trained up as schoolmasters for the special purpose of teaching atheism in schools. He supposed this idea had got abroad from some events in the history of the French revolution, but he believed it was entirely without foundation. He maintained that schoolmasters, as a body, were a most religious set of men, and that, if otherwise, they would not undertake their duties; in fact, he thought they would have a difficulty in finding men to undertake to give a purely secular education, by which he meant simply reading, writing, and arithmetic. They must teach virtue and morality, under the guidance of the great God, and he believed this always would be taught in all English schools; but when they came to dogmatic theology, it was a very different thing; and this should be taught by each separate denomination as they chose. It had been said, "What was to be done with existing schools, if fresh ones were established on a more secular and national system?" It seemed to him very simple. In a Church school, reading, writing, &c., would be taught as in others, but the theological teaching would be on Church principles, on those days, or at those times, at which it was considered desirable, and the same with British and Foreign and Unitarian schools. In other words, at the times when religious teaching was given, the religious teacher belonging to the particular denomination would have the monopoly. He could not see any difficulty about it. He did not understand what was meant by sorting sheep. They did not want to go into a school and say to one child, "You go there, you are Church;" and to another, "You are a Roman Catholic, you go there;" but those to whom the school belonged would teach in it. He believed the Church would assent to this arrangement, if it were properly put before them, and nothing would tend more to the advancement of the Church than the clergy coming into such a scheme. At present the clergyman's idea was that the schoolmaster taught religion in the school, by religion meaning the Ten Commandments, the catechism, and so on; and consequently he seldom or never went near the school himself. When he did, he asked if Johnny or Tommy knew his catechism, and was told he did, and so far as being able to repeat it, probably he did, though, at the same time, he understood nothing whatever about it. He (Rev. W. Rogers) maintained, on the contrary, that it was the duty of the clergyman to teach religion; for that purpose he was endowed by the State, not merely to preach on Sundays, but to teach religion to all classes of his flock. He believed nothing would tend more to advance the Church—and he spoke as a good churchman—than to do away with what was called dogmatic teaching out of the church school. In conclusion, he believed if they could agree on a definition of the word religion, there would be no difficulty in providing for its being taught.

Mr. J. S. Wright (Birmingham), in supporting the resolution, said that his friends in Birmingham generally considered it of great importance that there should be a distinct educational department. As the discussion seemed to have become somewhat general, he would take the liberty of referring to a remark made by Mr. Buxton upon the question of compulsion, and he was the more led to this because there seemed to be a disposition to ignore the principle of direct compulsion, and to rely upon secondary and indirect means of getting the children to school. He considered it of great importance that they should all unite in recommending compulsion throughout the country, and he thought that compulsion should be direct—that it should be obligatory on every parent to see that his child had some education, in the same way as it was now obligatory upon him to see that he was provided with food. There was a disposition on the part of some persons to rely on indirect methods, such as an extension of the Factory Acts, but in so doing, he believed, they would be relying altogether on a broken reed. In the first place, it was not right to put such an obligation on employers; they had quite enough to do to meet the increasing competition to which they were exposed, without making them primarily responsible for the education of the hands they employed. They did good service by finding employment for the children, and thus increasing the wealth of the country. But if this consideration should not be sufficient, the experience they had had of the working of the Factory Acts and the Workshops Act should be conclusive. The principle of the Factory Act was by the latter Act extended to all manufacturing employments throughout the country, but how many children did they think was sent to school in London, Birmingham, Sheffield, and Manchester, by the operation of these acts, or even where it had been in operation for 30 years, in Scotland. In some of the textile districts scarcely a child was sent to school under the operation of these acts, and until there were some further compulsory enactment, in a large number of cases the population would remain without education. The manufacturers would refuse to employ the children, and in consequence they would be found in the streets. At the present moment, although the Factory Act had been in operation for some time in Birmingham, he believed there were only 300 children at the present moment sent to school under its provisions. At any rate, 12 months ago the number was only 230. It was the same in London. To a certain extent this Act had succeeded where the circumstances were very favourable, as in cases where a manufactory employed a large portion of the labour of the district, and the school and factory were contiguous to each other. He therefore hoped the meeting would support that part of the Birmingham programme which provided that education should be strictly compulsory, and that the onus should lie on the parents themselves.

The Dean of Canterbury regretted that the discussion had not been kept more strictly to the terms of the resolution proposed, but seeing that had not been done, and that challenges had been thrown down and opinions expressed on wider matters, he felt anxious to say a word or two, principally in consequence of what had been said outside the room as well as in it, that the religious difficulty was fast vanishing. With regard to what the religious difficulty once was, he believed that was perfectly true, and that it had altogether vanished. The religious question of old, as now, was to reconcile two great principles. The clergyman felt drawn by his own conscientious belief to teach the children that belief, and he also felt that the great principle of universal tolerance acted upon him as it had acted upon all mankind during the latter ages, and these two conflicting principles it was exceedingly difficult to reconcile. They had, however, now been reconciled, for the conscience clause had been universally adopted, or at any rate by almost all intelligent men, as a solution of that difficulty. There were a few who still objected to it, and in particular one most strong-minded and pertinacious friend of his own, a certain archdeacon, who stated, within two years, that he should like to have pointed out to him any reasonable being who advocated the conscience clause. Still, there were very few of that way of thinking in the present day. That difficulty, he believed, therefore, was got over now; but there was another question now coming up, and

the two principles that now required to be reconciled were these. The State, he believed, was bound to take care that every educated child was religiously educated, and, on the other hand, it was undoubtedly true that the State had no manner of business to interfere with what religion was taught. He should like to hear—and for that purpose he attended the Conference—any proposition which might be made by which these two principles could be brought into harmony, for if that could be accomplished, that difficulty would be at an end. Thank God, it was not a difficulty which now he believed would set one man against another, but one on which all men should apply their abilities to arrive at a sure solution, with due regard to religious charity, truth, and justice.

Mr. Bastard desired to avow himself distinctly a member of the Education League. There seemed in some minds a degree of alarm lest by the views of the League being carried out the denominational system and the schools which had been set on foot under it should be altogether subverted. He could see no reason why any such fear need be entertained. Let there be as many denominational schools as voluntaryism could support; but then there came in the question, how should the public funds be applied; and where any kind of public funds were to be applied to a subject of education, he did contend that secular and religious education should be divided. He believed this had been sufficiently tried and carried into experience to show that the thing was perfectly practicable, and could be carried on with great success, and in proof of this assertion, he would allude simply to the schools, which were very well known to many gentlemen there, called the Birkbeck schools, in London, and also to large schools in Manchester and Glasgow, where the same system was pursued—in point of fact, those were the most popular schools in those towns. With regard to the main object of the resolution, no one could be more in accordance with this spirit than himself. Nothing could be more necessary than the calling into action of a responsible minister of instruction. The subject of compulsion he really thought was made a bugbear, and he certainly could not see how the children of many parents were ever to be got to school without it. His experience was chiefly in the rural districts, in the benighted county of Dorset, and he was satisfied, from what he had seen there, that there were many labourers in the villages so ignorant and besotted, that they were perfectly indifferent about their children going to school, and they never would send them unless they were compelled. On the other hand, he knew that these persons were comparatively few, and that the main part of the population would send their children to school voluntarily. He believed this also was the case in the large towns, and therefore it was not such a very serious matter after all. But there was one thing connected with compulsion. If it were to be resorted to, the school must be free. He did not see how they could insist on the parent sending his child to school, and at the same time telling him he must pay for it; but they could do so, if they said at the same time, you must send your child to school either at your own expense or ours. With regard to the religious question, he could not go quite so far as some of the remarks of Sir John Pakington, that is, as to children being taught the Lord's Prayer, the Belief, and so on. With regard to the Belief, that surely carried with it the teaching of doctrine, and that would militate surely against its adoption. He for one was more afraid of the sectarian hatred that might arise out of the religious teaching in schools than of any one thing whatever. The very circumstance of one child being withdrawn from his class was, he contended, an injustice to a Dissenting child in a national school. He lost so much time whilst the others were being taught, and when two or three children out of a class were told, "You may withdraw now, because we are going into the subject of religious instruction, and your parents do not agree in the religious instruction given here," it raised in the child's mind a suspicion that his parents were wrong some way or other, because he found himself differing from the greater number of children in the school, and he experienced a certain amount of shame which ought not to be allowed to press upon him.

The Rev. Dr. Hodgson expressed his regret that there had been so little connection between the resolution and the discussion, and, in fact, he was reminded of what he had once heard Mr. Emerson say with respect to a sermon, "that if the text had the small-pox, the sermon wouldn't catch it." There were many points which he should much have liked to touch upon, but in so doing he should be following the example which he had condemned in others. But there was one remark which fell from Mr. Buxton, to which he must take exception. He (Mr. Buxton) desired to thank the Birmingham League for having called the attention of the public to the subject of education, and therefore it was to be regretted that it had failed to call his own attention to the subject, inasmuch as he proposed, as the true scheme for getting over the difficulties which he attributed to the National League, the very scheme which was that of the National League. He said that, instead of throwing the burden on the rates, it would be far better to combine assistance from the rates with assistance from the national fund, and that was precisely, in one or other proportion, the plan of the Birmingham League.

The Chairman put the resolution, which was carried unanimously; and the meeting adjourned for half an hour.

Professor Owen moved the next resolution, to the following effect:—

"That the means of instruction in reading, writing, arithmetic, with moral training, and, where practicable, in drawing, singing, and drill, be provided for all, and encouragement given by government to the higher branches of general culture, science (especially that bearing on health), and art, and that infant, primary, and secondary schools, colleges, and universities receiving government aid be helped to act in union, as far as possible, as parts of a system."

He said he would confine his remarks to the subject on which he alone felt himself competent to speak with advantage, viz., the element of science in the scheme of secondary education. The applicability of that element would depend in a great degree upon the success with which might be carried out a proper system of elementary or primary education. He had read with interest and with feelings of gratitude the amount of information which the Society had collected, and was pleased with the rapidity with which it had diffused that information, as to the best system of primary education. He felt convinced that the conclusion to be founded upon the evidence thus gathered in favour of the half-time system was supported by the harmony of that system with the known laws of organisation, and of the growth of the human body and mind. He felt convinced therefore that it was the true system, and he was bound to say he believed that after times would regard the originators and developers of that system as amongst the great benefactors of mankind. By means of that system, and that system alone, through the saving it effected in the hours of the day and the months of the year, could there be in secondary schools scholars of 10, 11, or 12 years of age capable of receiving the elements of natural history. In the education of children, the aim of the teacher was not only to impart a knowledge of what he directly taught, but to educe certain faculties and habitudes. So, when it was objected to this or that subject that a knowledge of it might be of little if any use in after practical life, the teacher's reply was, that he had given the power of endurance of labour, increased the aptitude for acquisition of knowledge, strengthened the faculty of memory, &c. Now, instruction in natural history, whether of minerals,

plants, or animals, tended more especially to educe the habitude of close and exact observation, the tact of comparing, and the faculty of methodical classification. No one would contest the value of these habitudes of faculties in the various ordinary businesses of life, whatever might be his judgment of the worth of a knowledge of the nature and characters, powers, and relations of living beings, and the world they inhabit, as compared with that of the genius, structure, or niceties of a dead language or of classic literature. Therefore he (Professor Owen) had, on every suitable or available opportunity, advocated the same position and share of natural history in the scheme of education of British youth which natural history takes in the educational systems of Germany and other continental nations. The objection, of which he had most felt the weight, has usually taken the form of a question:—"Where shall we find the teachers of the elements of zoology and botany?" We know that every school-teacher in Germany professes and can impart those scientific elements; but where is the British schoolmaster or schoolmistress equal to the function?" This, of course, led him to think on the subject, and one of the steps taken to supply the want would be found detailed in a Parliamentary paper "No. 126—I., ordered by the House of Commons to be printed, 11th March, 1859," in a "Return relating to the British Museum." Any member of the Society, or gentleman interested in the subject, might get this "paper" or "return," for a few pence. In it would be found a proposition to add to the utility of the national collections of natural history by a direct application of them to national education, viz., that the head of each department of natural history should have assigned to him, as one of his duties, the delivery of an elementary course of lectures on the subject of his department, the ornithologist on birds, the conchologist on shells, the entomologist on insects, the botanist on plants, and so on, through the entire range of natural history. These lectures would of course be free. The realisation of this idea involved some mechanical or natural developments in addition to those supplied by the British Museum-galleries, for example, adequate to the display in systematic sequence of the several classes of natural history objects, and a lecture theatre. In every plan that Professor Owen had been called upon to make, to suggest, or to report upon, he had made the lecture-theatre an essential element. It would be found in the plan of the Natural History Museum, accompanying the "report" in the Parliamentary paper of March, 1859, to which he had referred. Professor Owen ventured to affirm, if that proposition had been promptly carried out—if five acres of ground had been secured for the national natural history museum—and if so much of the building, absolutely needed for present pressing wants and educational applications, had been erected, including the lecture-room—he asked for no more, he had never asked for more—the nation might now have had a generation of schoolmasters and schoolmistresses capable of imparting to children the elements of natural history suitable to their capacities, and of educing the useful and valuable faculties of close and accurate observation and comparison, and of methodical and systematic arrangement or classification of things, of facts, and of ideas. In illustration of this practical mode of developing in the young mind a most useful element in logic—the genus and the species—the professor cited the answers to a series of questions on the natural history, character, and systematic position of the sheep, given by a boy of twelve years, of average intelligence, in an examination of a German secondary school. What, thus it might be asked, was the reason of the delay already incurred in giving to the nation this boon—this grand and free educational instrument—the delay of a duration already exceeding that of the siege of Troy? Professor Owen attributed it mainly to committees and commissions of inquiry. At present, the practical issue was a collection of blue books, at a cost of several thousand pounds, which if applied to the simple galleries needed—irrespective of architectural ornamentation—would have gone far to meet present pressing needs. The remedy, in his humble opinion, was, that the administration, turning a deaf ear to all further agitation for fresh commissions of inquiry, in regard to applications of science—losing no more time in quest of further information or advice—should act on the knowledge they already abundantly possessed.

Mr. Edwin Chadwick, C.B., said the first resolution proposed the creation of a new department of education; it may be said that it would be overloading it to charge it with functions for the promotion of art and science, or superior education, in addition to those for the promotion primary education, as was proposed by this resolution. But the reform of primary education improving its quality, and reducing the time occupied by it, completing it in half the usual time, makes time for secondary and superior science education, necessitates connected provision for secondary education, including in that secondary education all the art and science force that can be derived from superior science and art departments. It will, if competently administered, be a means of combining, improving, and at the same time economising those superior departments in which there is now a loss of force, as well as waste of money, from separation and misdirection of which the public have yet to be made aware. It is to be asserted, as a principle of administration, that the more a department has to do with related subjects, the better it may perform the whole of its work. The loss from the separation of connected functions may be illustrated in relation to primary education. For years, there went on an expenditure of public money in the Greenwich School on a primary education, the outcome of which was bad, turning out unfitness, at double the expenditure of money that was expended in another school giving a special maritime training, the outcome of which in qualifications for service was pre-eminently good. Now, it may be set down as impossible that, had the results of the single school been brought before a competent department, the deplorable waste of the public money could have gone on for years—still more impossible that it could have continued, with the instructive contrast presented to that same responsible department. The Greenwich School was, after a long lapse of time, reformed as to the system, when there arose in it an improvement in method of testing primary education, which was confined to that institution, but which, if it had come before a properly organised department, must necessarily have been promulgated, and everywhere applied for the common benefit. In the same manner, the improved methods of mixed physical and mental training, with improved religious, and moral, and economical results, involving most important improvements in secondary education, leading to improvement in superior education, have gone on for years unknown and unnoticed, there being really no department so constituted as to be made to see, and know, and profit by them for the public service. The improvement of secondary instruction, which forms a necessary part of a national education, must be derived from improved art and science instruction, and that from the superior art and science institutions. These, too, present examples of the waste from separation, to be remedied by bringing them under one department. Thus in art, we have the highest original art specimens in one department, separated from the superior teaching power, from lecture rooms and from theatres, from classes and class teaching, very much of which is carried on with secondary and inferior, yet unnecessarily expensive means; whilst the superior means are in great part unapplied and wasted. The means of art and science, secondary as well as superior instruction, for the mining districts, are comprised in collections of rare specimens, under the care of superior curators of superior teaching capacity,

in one department, on which much public money is expended, but without the duty or conditions of teaching or applying the instruction properly; whilst by reason of the neglect of the teaching power there, the public money is expended in the creation of a second school, with lecture rooms, with duplicate teaching power, and with double collections of specimens, much inferior, or if equal a wasteful reduplication. The waste of money and force in other directions admitted of large exemplification, and the first step for its prevention, and for the efficient and economical application of the natural means for secondary and art and science instruction, would be to bring them under one properly constituted department, and under the undivided and responsible attention of officers of special aptitudes.

The Rev. Canon Melville moved an amendment. He said that throughout the five resolutions there was not the slightest recognition of the religious element at all, though there was in the seventh proposition of the programme of discussion; therefore, he begged to move that there should be inserted in the resolution, after the words "moral training," the following words—"with religious instruction."

The Rev. Dr. Barry (Principal of King's College, London,) seconded the amendment, saying that he came to the meeting not at all prepared to make a speech upon the subject, and asked the meeting to pardon him if the remarks he made upon it were in some degree crude. But, seeing that that was the only opportunity they would have of asserting their views that moral training without religion was simply impossible, he ventured to rush into the breach, hoping that, leading a forlorn hope, he should not be without followers. He observed that one of the resolutions dealt with existing denominational schools, and proposed that they should still receive in some sort public aid. But the resolution now before the conference was to provide for the schools of the future, and in it no provision was made under any circumstances for religious instruction. He would remind them that religious instruction was one of those things which if it be absent, was conspicuous by its absence; and if passed over in such a resolution, it would be looked upon as an extra which might be considered an article of luxury. Against that view he wished formally to protest. That was not the place for elaborating a scheme. They were merely generally asserting that such schools ought to exist, and he apprehended the resolution would go so far as that. Where such schools were not supplied by voluntary agency they were to be supplied by some compulsory action on the part of the government. It was, therefore, a most important resolution, marking out what he supposed were to be the schools of the future. He was not one of those who desired to have all schools of one special type. The government now recognised two classes of schools. Their system was wrongly called a denominational system, for the government recognised not only certain denominational schools, but schools which were not connected with any religious body, provided that in those schools the authorised version of the Scriptures was read—a very small provision indeed, but still some provision. He was willing to give all systems of voluntary agency government aid. If the secular party had sufficient earnestness to found schools, and if those schools were good, then let the government aid be extended to them; and let all schools—denominational, undenominational, and secular, if they deserved it, receive government aid. He was perfectly ready to do that, for the sake of consistency; and he did it the more readily because he thought that the religious element might be safely left to take care of itself. He believed, from the experience of the past, that religious principle and zeal would be in the future, as they had been in the past, the great moving forces of education. He was quite ready to give a fair field and no favour, and was not at all afraid that religious schools would be left behind. But if they were to have new schools set up, which he apprehended in many cases would be free, and at which attendance would be more or less compulsory, and those schools were put by the side of existing schools, he considered that was a want of perfect fairness, and not giving fair play to all parties. They had heard a great deal of the conscience clause. He accepted it *ex animo*. They were told that wherever there was religious teaching in a school, any parent might, by giving proper notice of a conscientious objection, withdraw his child from that teaching. He wished that had been accepted and acted upon long ago, though it had been acted upon in a large majority of cases. Speaking as a clergyman, he regretted, for his own order, that that principle of the conscience clause had not been acted upon long ago. But the point he was anxious to put to the meeting was that, if there was a conscience clause on one side, so there ought to be on the other. If a parent desired that his child should not receive denominational or even scriptural instruction, and his wish was to be gratified, then he said those parents who really desired religious instruction for their children ought to have an opportunity of receiving it in the schools of the future. No measure could possibly be right which did not, on the one hand, provide for the establishment of schools where definite religious instruction should be given where that could be done, and which did not provide that in secular schools all facilities should be given for religious instruction out of school, but with the advantage of the school premises to those ministers or other accredited teachers of religious bodies who should be willing to undertake it. If there were a conscience clause on the one side, some such provision as that was surely right on the other. But he did not observe that that reciprocity was laid down. In all propositions for secular schools, they were to be kept strictly secular. There might be religious teachers willing to come forward at their own expense and their own time, or even ready to pay a moderate sum for the use of school premises, but it was left to the option of the school managers to say that they would have no such instruction whatever. If that were done, he would submit that a conscience clause was wrong on the other side. If a conscience clause were right on their side, then he maintained the proposed arrangement was most wrong in the case of secular schools. He ventured to submit that they ought to insert in the resolution that there should be religious instruction wherever possible. There were cases where it would be simply impossible; but they would be very few indeed; and he thought it only fair that in all free schools facility should be given for the communication of religious instruction out of school hours. In that way, and in that way only, they would provide at once for religious education and perfect religious liberty. He knew no other system that could secure either, and he maintained that no other system would thoroughly provide for religious liberty. He, therefore, ventured to second the amendment, and, in throwing himself into the breach, he felt that, if he fell, there would be others ready to pass over his body, and win the fortress for them. He would conclude by suggesting the addition to the amendment of the words, "wherever possible."

The Rev. A. J. D. D'Orsey thoroughly agreed with a great deal of what Dr. Barry had said. Nevertheless, he was inclined to propose an amendment to the following effect:—"That this conference, holding that to be the only true education which rightly developes the faculties of man as a moral, intellectual, and physical being, fully recognises the necessity of religion as a basis of morals. But it distinguishes between dogmatic teaching and moral training; and whilst it leaves the former to be provided by the ministers of various denominations, insists on the latter being an essential part of the discipline of every national school." He asked the attention of the conference to the point

upon which the whole matter turned. It seemed to him that the two hostile camps in which the education lists of England were at this moment divided were not very liberal in their treatment of each other. There were certain true principles in both plans; there were certain errors, and he thought that they, occupying what might be considered a neutral ground, and convened for the express purpose of considering the possibility of a compromise or accommodation, were bound to consider, as Dr. Barry had said, what was after all a most important part of the question. It was impossible to put it aside. Religious men would not have it put aside; and irreligious men insisted upon its discussion; the one holding with proper pertinacity to what they conceived to be a right view of religious teaching, the other indifferent to a certain extent, but yet determined, as they thought, to make the matter perfectly plain and impartial. The point seemed to be this:—Was religious education, as at present communicated in the great majority of the national schools of England, the religious education which religious men would wish to see the religious instruction of the country? Was it in quantity or in quality sufficient? Was it not, as every practical schoolmaster knew, deficient in quantity? The time was not adequate. In quality it was also deficient; for they all knew that whilst here and there they had a great many admirable teachers, there were too many who considered religious instruction what might be called the dry bones of education; and they went through scriptural geography and history, a repetition of the catechism, the singing of psalms and paraphrases, without that careful, judicious, painstaking and affectionate teaching which a well-instructed and thoroughly-principled clergyman would administer to the young of his congregation. It was not natural that he, as a clergyman, should be opposed to religious instruction, and it was because he was contending for a much higher, much better, and much more effectual kind of religious instruction than that which at present obtained, that he asked, even if they were all of one faith to-morrow, for a division of labour upon that great question. The schoolmaster had already too much to do, when engaged in the ordinary work of his profession. He could not with propriety arrogate to himself the peculiar functions of a religious teacher. He had no doubt that a clergyman, doing what the rubric of the Church of England enjoined him to do, namely, giving religious instruction to the young of his flock, and the various ministers doing this, if a certain time were appropriated for the purpose, there would be no difficulty in carrying it out. It seemed to him that they would not hinder, but promote true religious education, by dividing it between the clergyman and the schoolmaster. They should give the clergyman every opportunity of communicating religious instruction in the school, encouraging him to teach the young where it was intended that they should be taught, namely, in the church, and exact from the schoolmaster, not a teaching of tenets or dogmas, though he had admitted they were the basis of morals, but requiring him to appeal to religion to teach the children justice, truth, honesty, cleanliness, kindness, and all those things upon which he was certain every man in the room would agree with him, although, were they to compare creeds, he had no doubt they would have many important differences. Dr. Barry and he so nearly agreed, that he did not think it advisable to press his amendment.

Mr. Hyde Clarke, LL.D., thought it would be much to be regretted if the amendment were to be pressed at what he conceived to be an inconvenient period in the proceedings, and it would be more to be regretted if an amendment were to be carried which did not express the views which had been propounded by the seconders of the amendment. If he rightly understood Dr. Barry, what he required was, that there should be what might be called architectural facilities for communicating religious instruction—that in all buildings devoted to school purposes there should be a freedom of their use by all religious bodies, for the purpose of communicating religious instruction.

Dr. Barry explained that his idea was, that where schools were to be secular, architectural facilities should be afforded, but he was not prepared to say that no school should not afford anything but architectural facilities.

Mr. Hyde Clarke was very glad to have elicited the explanation; for if that view were to be enforced against secular schools, it would follow, as a matter of principle, that in the case of denominational schools, the same architectural facilities must be granted to the members of all religious denominations. It appeared to him, with deference to those who supported the amendment, that the period was most inconvenient for introducing the question. It was one which all who felt an interest in religious instruction must desire to see carried out as a matter of detail, ultimately in conformity with the views of all as far as possible; but it would be perfectly impossible in such a conference to define the mode in which it could be carried out. He thought they had already anticipated the details to a great extent by the first resolution, and that it was with a view not to enter into questions of arrangement, and questions of detail, that they passed a resolution that there should be a government department, responsible not merely to Parliament, but responsible to public opinion, to which should be intrusted the carrying out those arrangements, because it must be by the operation of public opinion alone that it could be ultimately adjusted. The whole question of religious instruction was not to be settled according to the views of any individual or any party in that conference, or even at that moment outside. It must be settled practically by the government department, acting in conformity to the inspiration of public opinion. Why, then, should they seek to trammel the cause of education in the resolutions which they were about to propose by what, after all, was a question of detail, which had been defined by the seconder of the amendment as depending upon the application of structural facility. He called upon the conference to pause before they adopted such an amendment. They knew by their own convictions, and what was taking place outside, that it was impossible, in the ultimate arrangement of the question, to exclude religious instruction. By introducing difficulty as to the mode of religious instruction in their discussion that day, they might even create difficulties with regard to the practical discussion of the measure in the legislature, where they hoped a bill was to be passed. He called upon the members of the clergy who had taken up such a patriotic attitude upon the question to avoid introducing a topic of discord, but to unite, if possible, the whole community in carrying out a national system of education.

The Rev. Canon Melville said, with regard to going into details, if Mr. Clarke would look at the resolution, he would see that the three "R's" were mentioned; and he did not think it was going much more into details to propose a fourth "R"—religion.

Professor Owen, F.R.S., thought it would be well if the gentlemen who proposed and seconded the amendment would give their definition of religion, the terms or limits within which they would impart instruction, because the meeting would then know what they were called upon to express their opinion about.

The Dean of Canterbury was afraid the amendment would commit them to something more considerably awkward than anything that had yet been mentioned. It spoke of "the means of instruction." Surely if the department spoken of were to provide "the means of instruction" in all those things, it amounted almost to a levelling up of all the religious denominations.

Mr. Chadwick called attention to the instructions sent to the delegates attending the meeting of the League and the Union, which were to the following

effect:—"In respect to instruction in religion, the only desire must be that it may be improved beyond that now given, as described by the clerical inspectors in the last report of the Committee of Privy Council on Education (which *vide*). Merely for industrial purposes, what is needed is the substitution of habitual liars, cheats, and drunkards, requiring perpetual, painful, and expensive supervision, by a commandment-keeping, truthful, sober, law-abiding, contract-performing, conscientious, trustworthy class, thoroughly imbued with practical Christianity, for which the clergymen of all denominations ought to be made really responsible. The Faversham School Union, approved by the late Archbishop of Canterbury (Sumner) and the Protestant dissenters living there, is an admitted example of how the anticipations of the late Dr. Chalmers may be realised, and religious differences set aside, and education be placed on the basis of a common Christianity. Since 1857, this system has been in vogue in Holland, and the Council is assured that it works excellently."

Mr. Samuel Morley, M.P., said the resolution, without the insertion of any words at all, did not mean a secular system. He had not been able to connect himself with either of the two movements, because he thoroughly believed it to be a duty to exclude from the teaching in schools which received aid from the state anything which could in any sense be called denominational or sectarian. His conviction was, that the great mass of the working people of England were not indisposed towards a religious system. He had taken great pains in his intercourse with them to try and find out what their wish really was. They believed in the word "unsectarian;" and they were determined, so far as they could influence the legislature, to prevent their children being used for the mere purpose of swelling the numbers of any denomination. He believed that to be the real feeling of the great mass of the working men, and with that feeling he most heartily sympathised. He wished to leave religion free. He had not the least fear of secular schools. If the people called for them, let there be schools from which, by legislative enactment, religion should be excluded. But he would enter his protest against any attempt to drive from existing schools that which he believed the judgment of the country would sanction the maintenance of, namely, religious teaching in those schools. His conviction was that the working men would say, if a child of theirs committed a theft, they would wish the teacher to tell that child, not only that it had committed a crime against man, but against God. He thought a religious teaching might be secured which would satisfy all denominations, and that arrangements might be made by which in all schools aided by the State there should be a security for that amount of religious teaching which would satisfy all. He rather doubted whether the resolution, without some explanation, would not commit them too far. As to their saying that the whole education of England should be arranged upon a system from which by penalty religious teaching should be excluded, he was persuaded that that was not the wish of the great mass of the population. He was quite prepared to support some addition to the resolution which should secure them against being committed to what seemed very much like a purely secular system.

Mr. Charles Buxton, M.P., thought that if words were introduced as now proposed, without anything to qualify them, the Society of Arts would be understood to disapprove of any government assistance being given in any case to secular schools, and to this he did not think they should commit themselves. He himself was very strongly in favour of religious instruction being given generally, but he should be sorry to appear in any way to object to aid being given by government to secular schools where the people preferred them.

Mr. H. M. Holmes (Derby), having had a great deal of experience in schools throughout the country for the last thirty years, wished to record his opinion in favour of the amendment. It was really lamentable to find on inquiry the large proportion of persons amongst the lower classes who really never received any religious instruction whatever after they left school. There were large numbers of such persons who had really hardly any idea of a future state; and many had confessed to him in old age, that the only religious instruction they had ever had was contained in the hymns and portions of Scripture they had learned when children at school.

Mr. Chandos Wren Hoskyns, M.P., suggested that the words should be "religious, but unsectarian."

Dr. Bennett said he rose to speak on behalf of a class which he believed was hardly represented in that room. They had met at an hour when the working classes could not be present, and from some of the observations he had heard made, he thought they were rather assuming to represent the working classes and their opinions as they imagined them to be than as they were. He believed that if they had had present there some of the leaders of the great trade organisations throughout the country, they would have had widely different ideas as to what were the feelings of these men. He had mixed largely with them, having spent the greater part of his life in raising one of the largest mechanics' institutions in the south of England, and also in establishing a large cheap proprietary school which would benefit, as he imagined, the working classes. All his knowledge of this class of his countrymen led him to this opinion, that they regarded the question of education as one apart from sects and apart from churches. He believed their opinion was that the State had properly nothing to do with the moulding the religious opinions of the people; that was the duty of the churches and of the churches alone; and it must be remembered that if they inserted the words of the amendment, they would be doing a thing the importance of which was perhaps hardly at first sight apparent—they were taking up the great question of whether it were the duty of the State to mould the religious opinions of the people, or whether it were not. He asked them to remember what was the whole set of the current of public opinion on this question. It was only a few months since the passing of a great measure which certainly asserted the principle that the State had nothing to do with the religious instruction of the people. They had had the question levelling-up and levelling-down settled unmistakably, and it had been determined by the legislature that all sects should be left to form the opinions of those who adhered to them. Now, it was proposed by this amendment to set up a principle entirely antagonistic to that, the principle that it was the duty of the State to instruct the children of all sects.

Dr. Barry—No, no.

Dr. Bennett—They were asking that the State should religiously instruct the people.

Mr. Thomas Hughes, M.P., said the amendment did not say that.

Dr. Bennett said that appeared to him to be the meaning of the amendment. They were calling for a system of national education for England and Wales, and had carried a resolution that a great State department should be called into existence to deal with this subject, and they were now defining by the present resolution the particulars of the education which that department should deal with, and, as he understood it, by the insertion of these words, they were called upon to declare that it was the duty of this State department to deal with the religious education of the people, and in so doing, as he contended, they were running counter to the whole current of modern thought. If anything were clear politically at the present moment it was this, that instead of the State busying itself with the religious instruction of the people, the tendency was rather towards

the separation altogether of Church and State. By carrying this amendment, however, they would be asking the State, while it did not feel it its duty to instruct adults in religion, at the same time to undertake the instruction of children in religious faith, and in so doing he believed they would be setting their opinions against those which he believed would ultimately prevail. This was a matter requiring very gravo consideration, and he could hardly attach too much importance to the question put by Professor Owen, which had not yet received an answer, "What did the word 'religion' mean?" In such a discussion it was of the utmost importance that each party should attach to the word the same meaning, and that was not at all clear at present. It had been explained by the right hon. baronet that religious instruction meant the teaching of the Lord's Prayer, the Ten Commandments, and the Belief. What did the Belief mean? Was not that dogmatic teaching? And was the reading of the Bible to be included?

The Rev. Canon Melville said that followed necessarily on learning the Creed.

Dr. Bennett said it was abundantly evident that a religious teaching which included the teaching of the Creed and the reading of the Bible was a sectarian one. That was not a common ground on which all sects could agree. They were proposing a great scheme which should affect every untaught child in the United Kingdom, and also that the attendance of such children should be compulsory, whilst everyone was to be liable to be taxed and rated for the support of these schools, whatever might be the religious faith of the ratepayers. It followed therefore, in his opinion, that the education given in such schools should be such that every one could conscientiously support it, and also such that every child, of whatever creed, should be able to receive it. If they were to insist upon the Creed and the reading of the Bible, they would be seriously limiting the use of these schools to sections of the people. How could they read the Bible in a school, and then compel the child of a Jew, or even a Roman Catholic, to attend it apart from any others. The Protestant version would not be accepted by Roman Catholics—it would be regarded as heretical and false, and therefore, while all paid for the schools, a large section of the children would be prevented from attending on conscientious grounds. It must also be remembered that they were dealing with the question which would not be ultimately confined to England and Wales—it was a question which would affect Ireland, and if they claimed denominational instruction here, they would be compelled to give the same thing there. He asked whether the Nonconformists and Churchmen, who were claiming denominational schools for themselves in England, would be prepared to give denominational schools to the Roman Catholics in Ireland, for they knew now what Roman Catholics understood by denominational education. Cardinal Cullen and the Irish Bishops had told them what they claimed as the meaning of that term, an entirely different thing from what was understood by it here. They required that the whole of the State fund given for the education of their children should pass through their hands; that the whole programme of instruction in those Irish schools should be under their sole guidance and control; that all the teachers in those schools, and also the inspectors should be appointed by themselves; and they also required another thing, that the teachers should be priests. What would that amount to? Whilst they disendowed the Protestant Church there, they would be endowing the Roman Catholic priests, under the guise of teachers. Were they prepared for such a thing as that? Yet, if what was proposed by this amendment was carried there, they would make it a grievance with the Roman Catholics of Ireland if they did not give them what they meant by denominational education; and he thought they must all agree that they did not want any more Irish grievances. He did hope, therefore, that churchmen and ministers of religion would pause before they placed themselves in antagonism, as he believed, to the great body of the working classes. He knew what their feeling was, and if gentlemen whom he was addressing did not know, let them attend any great public meeting on the subject. It was very easy for them to sit there and imagine what were the feelings of the working classes, but the right way was to go to public meetings and hear what they said on the subject. He could assure them that the feeling was that the word "unsectarian" did not go far enough, for in many quarters they required the word "secular." He spoke from his own experience. Only ten days ago he attended a large meeting of the Marylebone branch of the National Education League, which was held in St. George's Hall, and the feeling there was universally in favour of the word "secular" rather than "unsectarian." So marked was this feeling that when a gentleman presented himself and wished to substitute a word in favour of religious education, he could not obtain a seconder. In that large meeting, and at a later period, when the Roman Catholic priest of the district moved the omission of the word "unsectarian," the result was that he could only get the same gentleman to second his amendment, and when it was put to the meeting, there was not a single hand held up for it. They wanted the opinions, not of sections of society, but of the great mass of the people, with whom it was the question of the day; and he believed that, if they took any means of ascertaining the real feeling of the working classes, it would soon be made manifest that the opinion was strongly in favour of an entire separation of secular from religious education.

Dr. Barry asked if it was to be understood that the resolution pledged them to ask that the means of religious instruction were to be provided for by the government, because it did not say so, nor could he give in his adhesion to such a proposition.

Dr. Bennett said it did not affect the principle for which he was contending whether the government provided part of the money or the whole; but the injustice would still be the same.

Sir John Pakington said, in reference to what had fallen from Dr. Bennett, he would only refer in a single sentence to the extraet which he had read in the morning from Mr. Miall's letter; and without any disrespect to Dr. Bennett, he believed Mr. Miall might be taken to be quite as good an interpreter of the sentiments of the working classes as to the religious teaching of their children as he could be supposed to be. He rose, however, to offer a suggestion with reference to the amendment which he hoped would avoid any difference of opinion, and he would once more ask the meeting to bear in mind that a conference of that sort was not intended to settle details. They were not assembled to lay down, and must not presume to lay down, in what mode this or that thing was to be taught. All that must be left to government and to Parliament. They were simply considering broad principles. This was a broad principle—was religion to be excluded or not from the schools? As far as he was concerned, and he believed he spoke the sentiments of many others, when he said that, in any national system, religion ought not to be excluded from the ordinary school teaching They had no desire to advocate any sectarian views, or anything that would be favourable to any particular branch of Christians more than another. He had listened carefully to this discussion, and had seldom heard speeches with which he more entirely concurred than those he had heard from Mr. Morley and Mr. Charles Buxton. He agreed with both gentlemen, that religion ought not to be excluded, and, although in the programme issued for the conference there was an entry on the subject, no reference was made to it in either of the resolutions intended to be submitted, and, therefore, he thought it was necessary to introduce the amendment.

He should be very sorry if it were to go forth to the public that the opinion of this conference was that religion ought to be excluded. It was a question which ought to be discussed with very great caution and care, but he was sure that neither Canon Melville nor Dr. Barry intended—by the introduction of these words, to do more than to take care that these resolutions should not be passed without some reference to the subject of religion, and without showing, as he hoped they would show, that this conference, without presuming to lay down dogmatically what course should be taken, was of opinion that the schools ought to teach religion. In order, however, to meet some objections which had been made, he would suggest that the words should be, "with due regard to religious instruction and moral training," meaning thereby, that in any system for teaching in the schools of this country religion should not be legislatively excluded.

The Rev. Dr. Butler (head-master of Harrow School) said he should have been extremely glad had he been able to concur in the amendment moved by Dr. Barry, but he felt that there was an excluding as well as an including element involved in it; and if this conference were to carry out the object for which apparently it was convened, viz., to combine the various systems which had been put before the country, and which had severally won the sympathy of large masses of Englishmen, they must be careful not to exclude anything when they were attempting to establish a great principle. The question he asked himself was, if they had the amendment was now put, would it be competent to the government to give aid to such schools as might not find it possible to admit religious instruction as part of their regular system. For himself, he felt as strongly as Dr. Barry could do, that any system of instruction which contained no element of religion was seriously defective. He went further, further perhaps than anyone present, for he thought that religious instruction would be best given by the actual master of the school in the great majority of instances, and that it would be seriously interfering with his duties to hand over the instruction of the children in religion to the ministers of the various religious denominations. At the same time, he could not close his eyes to facts, and he found that such a man as the Bishop of St. David's, whose views were never wanting in gravity and moderation, in that charge which he issued a few weeks ago, admitted in the frankest manner, not only that it was perfectly feasible that there might be schools where religious instruction could not be given in the regular school hours, but that those schools did not deserve in any way to be stigmatised as irreligious. He not only said that, but he also agreed in the frankest way with one of the government inspectors that in some parts of Wales—and he had no doubt he would be willing to extend the principle to some parts of England—secular schools would be the best which could, under the circumstances, be established. Assuming, then, that a religious education was the very best possible thing, they must still recognise the necessity of taking into account schools where less than the best possible education could be given; and, looking to these contingencies, he was afraid to commit himself to the words of this amendment, unless guarded by some qualification. He quite felt that it would be a very serious thing to place themselves in opposition to that large body of men who, while they recognised in the highest degree the importance of religious instruction, still felt that there was a large and an increasing number of schools, where from unhappy religious divisions it was impossible to give religious instruction during school hours. He should have been very glad if the words which Dr. Barry originally proposed—"if possible"—had been included in the amendment, and he did not see any reason why they should not. It was no answer to say that if a thing were not possible it certainly would not be done, for though he was not prepared to canvas that proposition on physical grounds, he thought what they had to do on that account was to lay down what they believed to be the best principle, not only the best ideally, but the best which, under the very peculiar circumstances, he might almost say the solemn critical circumstances under which the conference was summoned, they could recommend to their countrymen and to Parliament. He therefore implored the meeting not, in their zeal for religion to even appear to turn their backs on that large portion of their fellow-countrymen who, whatever their zeal for religion might be, still felt that the establishment of secular schools was, in many instances, the only practical course.

The Rev. Canon Melville said he would willingly accept the words proposed by Sir John Pakington, and the more so because he thought that would meet the objection of Dr. Butler.

The Rev. Canon Cromwell (principal of St. Mark's Training College) said he supported the amendment as suggested by Sir John Packington. This was not, as one gentleman had said, a mere matter of detail. There was an important principle included in it. To what class of schools did this practical difficulty apply? Only to those who were required for localities not at present well provided with education. That number was doubtless a very small one, but unless they introduced, somewhere or other, a record of their opinion that religious instruction should be given, they would be in danger of giving an impression that they were in favour of secular education. Therefore, although he felt the grammatical difficulties pointed out by the Dean of Canterbury, and some others of the same character, with regard to the position in the programme in which this question was introduced, he still thought it necessary to support the amendment, and he would remind the meeting that the words did not commit them to saying that the government should provide religious instruction. The connection of the government came further down in the paragraph. He thought that, at the present time, the government did not pay for any part of religious instruction. He held that that now provided in schools was paid for by the denominations themselves, and he did not see that the amendment would pledge them to ask that the government should insist on paying for religious instruction. On the other hand, if they did not interpose these words here or somewhere else in the programme, they would seem to imply that they were in favour of a secular system. Every one said they were in favour of moral training, but he maintained that they could have no moral training worthy of the name unless it rested on definite religious instruction, and was accompanied by Bible-reading in school, with comments on the Bible. Mr. D'Orsey had suggested that the clergyman or minister of religion of each denomination should enter the schools, and should be responsible for giving religious instruction, but he contended that that was absolutely impossible. As had been already stated, where there was a clergyman with a large parish of some 7,000 or 10,000 persons it would be absolutely impossible for him to give a religious instruction of the barest possible kind to all the children in the parish, and if they called in the ministers of various denominations in the district, then they would be landed in various practical difficulties, of what had been called of an architectural kind. The religious instruction must be given to the whole school at the same hour, and being given by different persons it would require a number of separate class rooms which it would be impossible to provide. It came then to this. If the ministers of religion could not give religious instruction in the school rooms, and the ordinary teachers were forbidden or not required to do so, it would not be given in a great number of cases; and they must remember that they were now asking the government to legislate for that particular class of parents who were most lost to all ideas of moral right and wrong. Further, if they did

not insist on religious instruction and the Bible as the basis of that instruction, they would eventually come to that which had happened in some parts of the United States. He had in his hand a very recent report on the condition of the schools in St. Louis, one of the most flourishing cities in the States, and which represented, therefore, what might be supposed to be one of the highest outcomes of that system. The superintendent of these schools, a man, therefore, interested in maintaining, supporting, and recommending the system, said that many of the friends of these public schools were now regarding them as godless and irreligious. He went on to say that he regretted they should use such hard language, and says that the teachers of the schools are required to do what one gentleman in that meeting had suggested, to teach them the principles of morality, truth, justice, industry, sobriety, and frugality. He said further, that the teacher's own daily walk and conversation was one of the most practical agencies in accomplishing this end. But what did he say next? He said it "was necessary that the teachers should have some book to which they could refer, and, in the absence of the Bible"—for the Bible had been excluded under circumstances to which reference had been made, because the whole body of sects in that town could not agree upon their interpretation of the Bible—"he knew of no book that supplied its place so well as Cowdrey's moral lessons, and this book was used with very good results in the public schools of San Francisco." Were they to come to that—to look upon some small book, such as they might imagine this to be, to take the place of the Bible in their schools? He believed that would be the consequence of excluding definite religious instruction. He had but one word to add, and that to quote the opinion of Mr. Matthew Arnold, who visited the Continent some years ago, in order to ascertain the condition of education there. He said it seemed to be the opinion of many Liberals, that if you have a general and compulsory system of education, it must follow that the education should not be denominational or religious. He went on to say that that was a mistake. He himself, of course, must be classed as a Liberal, and he said his brother Liberals were mistaken on this point, for all over the Continent, except Holland, to which reference had been made by Mr. Chadwick, the system of education was both religious and denominational. Therefore, even supposing that a compulsory system was adopted in England, it would not follow necessarily that it must be non-religious or non-denominational.

Sir John Pakington said, after what had fallen from Dr. Butler, he should be willing to withdraw any objection he had made to the words "where possible." Therefore, if it met the views of the mover, the amendment would run—"with due regard to religious instruction, where possible."

The Rev. John Oakley, M.A., said he only wished to add one word upon the point. He took it, at all events, that a very large number of those present, who were all more or less friends of education, were resolved to affirm the principle that religious teaching should at least not be wholly excluded from the national schools; and the question simply was, how to secure that result. He thought the introduction of the words "where possible," which had just been suggested, would meet all the difficulties of the case.

The amended resolution was then put, and declared to be carried by a considerable majority.

Mr. Edgar Bowring, C.B., M.P., proposed the third resolution:—

"That no child be hired for labour who is under a given age, and not receiving satisfactory instruction; and that compulsory attendance at school be obtained by dealing with the question according to the principle of the Factory Acts, while industrial schools, Union schools, Reformatory schools, and the like, should be brought under one direction, and compulsory powers given to take and educate children of the vagrant or destitute class."

Although he had carefully studied all the papers which had been circulated upon the subject, except the last batch delivered that morning, he had carefully held himself unpledged to join any of the contending parties, because, feeling that very shortly they were to have a scheme submitted upon the responsibility of Her Majesty's government, he thought it desirable, as a member of the House of Commons, that he should hold himself entirely free, so that he might not be compelled to decline any compromise between the contending views which had lately been presented to the nation. He had very recently attended a large meeting of his constituents on the subject of education, and he found that the view which he ventured to express met with general approval. He had, therefore, ventured to come to the conference, because some of the views he had expressed were embodied in the resolution just read. He much regretted the extreme discrepancy of the statistics presented to the country upon this important subject. On the one hand, the more extreme party, the League, stated that something like a million of children were entirely uneducated, whilst the opposite party said that the number did not exceed 300,000 or 400,000. An accurate knowledge of the facts of the case was very important, in order to enable the House of Commons to legislate satisfactorily, and he should gather, from the interesting paper referring to the parishes of Ealing and Brentford, that the statements put forward by the League had certainly been exaggerated, for he found that in these parishes, instead of one-third or one-eighth of the children of school age being absent from school, as was represented, the proportion appeared to be about one-sixth. If that were the case with regard to the rest of the country, the task of Parliament would be very much simplified, and at any rate it enabled him with more satisfaction to support the present resolution, which had special reference to the question of compulsion. The first clause, which referred to the age of children, clearly required no argument to support it, as it merely asked that the physical strength of the children of this country should be husbanded, to enable them the better to perform the manual labour they would afterwards have to undergo. Then it was also provided that they must receive satisfactory instruction; and as the programme they had already adopted provided that every child in the country must be educated, of course no child could be hired for labour without being educated. Then he came to the question of compulsory attendance at school, and the best consideration he had been able to give to this subject had brought him to the conclusion that the plan of indirect compulsion now advocated was preferable to that of direct compulsion, which was proposed by some who went in for extreme measures. If they refused to allow the employers of labour to hire children who had not received a certain amount of education, it would have the effect of inducing the parents to send them to school, and thus they would very shortly, he had no doubt, attain all the results which they hoped for. With regard to the latter part of the resolution, referring to industrial schools and the like, he should have preferred that it had been more accurately defined. But no doubt the principle was very important that there should be a system of concentration and uniform supervision. With that he believed they would all agree.

Mr. Alexander Redgrave (Inspector of Factories), in seconding the resolution, said he would confine himself as much as possible to the first part, that no child should be hired for labour under a given age and not receiving satisfactory instruction, and compulsory attendance at school, according to the principles of the Factory Acts. That part of the resolution was very nearly in unison with the actual fact; for, with the exception of agri-

cultural labour, every child at work in this country at the present moment was bound by law to attend school; and that which was mainly required, but which, from the general nature of the resolutions put to the meeting, did not appear, was, that further means he provided for administering one of the Factory Acts, that commonly called the Workshops Act. The Factory Act was administered by himself, his colleagues, and their assistants, and they took care that the children labouring in factories attended school. But the Workshops Act, being under the local authorities, was not administered in anything like the same effective manner, and it was absolutely necessary—and he trusted this necessity would be so apparent in the coming session that government would pass a bill for the purpose of meeting the difficulty—that local authorities should be compelled to do their duty and carry out the law. A gentleman in the meeting had made an observation that the educational provisions of the Factory Acts had been a failure. He should be happy to take issue with him upon that point. Undoubtedly when they were first passed, the number of children that attended school was not very large. But there were many reasons to account for that. It was a new system, somewhat opposed to the ideas of Englishmen, and they were naturally indisposed to carry it out. The legislature having, in the first instance, declared that children should only be kept to work for half-a day, it was proposed as a system by which the other half might be utilised; and the half-time system, which had been so much advocated by Mr. Chadwick, had now come pretty fully into operation. In those districts where the labour of children was necessary, in every point of view, the half-time system was a perfect success. He referred to special localities where on the whole the labour was employed under the Factory Acts. There it was found that the education of the people bore a very favourable comparison with that of the most highly educated countries in Europe. Take Blackburn, for example, where only about 25 per cent. of the children were unable to read. Halifax and other manufacturing towns of the same class showed the same results; and he found that there was as large number of children attending school in those towns as in Prussia. Therefore where this system had its full and fair scope, it answered as a thorough national system of education. There was one marked feature, too, in the factory system which had commended itself to the promoters of the National Education Union and the Manchester Education Bill, and that was that it provided for means of adding to it that which was required to make it meet every want. The Factory Act said that when a child did work it should go to school, and all that was wanted to supplement that was that before it could be allowed to work it should be made made to go to school. Many years ago—he would not say how many—he had the honour of making such a suggestion in that room, but the time was not then come for such a plan to be thought of. But he was very happy to see, from what had taken place at Manchester, that employers were now quite prepared for an extension of the Factory Act in that direction. But when the Factory Act was first passed, there was a strong idea that wherever the State required children to be educated, that education ought to be secular, and many manufacturers in Lancashire felt that so strongly that, instead of letting the children they employed go to the ordinary schools of the district, they set up schools of their own, in order that there should be no coercion on the children to attend any denominational teaching. Schools were consequently established in which nothing but the "three Rs" were taught. But he was happy to say that these schools were now dwindling away, because the parents preferred sending their children to schools of their own denomination. There was a school established in Manchester on purpose for factory children, one of the best schools in the district, expressly upon the factory system; but the attendance there was now diminished, because the parents wished their children to go to schools of their own denomination. As these facts came before him in his official position, he thought it only right that he should express the opinions which he had formed in consequence upon such an occasion, and he hoped such facts as he had stated would be useful to the meeting in coming to a decision.

Dr. Barry said of course it was not intended to deal with the general principles of the Factory Acts, because, if they applied the law to agricultural labour, it must, as a matter of detail, be considerably modified. There could be no system of half-time with reference to days. They must have the children at school at certain times of the year, when they could be spared from agricultural labour, and many other points would have to be modified to meet various circumstances. He presumed, of course, that they only pledged themselves to the principle.

Mr. Chadwick said the resolution only addressed itself to the general principle. But still he might be allowed to say that it had been tried very extensively, or rather in a sufficient number of instances, in agricultural districts, to prove that the alternate-day system would succeed perfectly; and he believed it might be generally carried out on that system.

Sir John Pakington wished to add, with reference to what had fallen from Dr. Barry, that of course there was no attempt, in drawing conclusions of that kind, to lay down anything like detail. But, whilst he for one went entirely with the principle declared in the resolution, he would also add that he considered it most desirable to apply this principle to agricultural districts; and he was encouraged in stating this by the fact that he believed it to be beyond question that there were cases where the half-time system had been applied with the greatest success. He remembered two cases—one that of Mr. Paget, for some time M.P. for Nottingham, who had always devoted great attention to questions of this kind, and he had always understood that on Mr. Paget's estates he had carried out the half-time system with the greatest success. The other case was that of the late Lord Atherton, who had done the same thing, and also with success. He did not know whether the present Lord Atherton followed the same plan, but he presumed he did. He also thought the suggestion of the resolution a very wise one, that the penal consequences and neglect should be visited on the employers, as much as if not more than on the parents.

Mr. Seymour Teulon also supported the resolution, one part of which, he said, possessed great elasticity, whilst the other did not. In the first place, it stated that no child should be hired for labour under a given age, and not receiving instruction, and, so far, they needed a strict rule which could not be broken through. But the remainder of the resolution was of an elastic character—that, as far as possible, this should be carried out on the principle of the Factory Acts, and in this he quite agreed. It was quite true that the agricultural population were very differently situated, with regard to the capabilities of attending school, from the manufacturing population. For instance, his own parish was six miles long, with a village school situated at the extreme end, and it was quite clear that no child could traverse the parish from one end to the other and back again. But all these things were matters of detail, which, no doubt, would be easily arranged.

Mr. Ashby said that to him, as a working man, it seemed rather curious that they should shirk the most important question of discussion. They said it should be compulsory on certain children to attend, and that employers should be fined or be subject to some penalty if the children did not; but it seemed to him that this was the most difficult part of the subject, how they were to ensure this being done; and no speaker had addressed himself to that point. He wanted to know what regulations could be made to make the attendance compulsory. He was not setting this up as a difficulty which could

not be overcome, but he thought it should be met in some way. The Workshops Act provided that no children could be employed under the age of eight, but there were plenty of boys—thousands, he might say—employed in London in all kinds of businesses under that age, in fact, in two or three, such as machine-ruling, it was absolutely necessary that boys from eight to ten years of age should be employed. If a father had three or four boys under that age, he did not see how the employers were to know whether they were receiving education or not. He would get some voucher from the master that the boy had been to school, but he did not see how he could be in a position to prove that he really had been there. With regard to the first part of the resolution, that no child be hired unless he was receiving satisfactory instruction, he would make it simply, "that the child should not go to work at all under a certain age," and, therefore, he must be placed at school; he would not have any half-time at all. He did not believe in the Manchester business, and was convinced it was a miserable failure. If a child did attend school during half the day, he did not get anything like the benefit which he would if he were there continuously. He would much rather, therefore, that the children should be at school instead of being at work, and that the age should be limited to ten or twelve. Do not let the children go to work until they are ten years of age, and then they would be at school in the interval. He thought that course would be the best, both for parents and employers.

Mr. Alexander Redgrave said he had been anxious to save time, or he might have gone more at length into the working of the Factory Act, with reference especially to what had just been said, which was undoubtedly very much to the point, but there was machinery provided in the Act by which it was known whether children attended school or not. It had now been in operation for upwards of 30 years, and had succeeded perfectly. He might say with reference to compulsion, and to a remark made in the earlier part of the day about the hardship to the employer, that the compulsion really was upon the parent. The Act said that the parent should send his child to school every day, though he might select the school at which the child attended. Then, if the child did not go to school, the parent could be compelled, by powers in the Act, to send him, and at the end of the week the employer was bound to obtain from the schoolmaster a statement of the time during which the child had attended school, and if he chose to employ a child who did not bring such a certificate he was liable to fine. By that means, therefore, there was a perfect check both upon the parent and the employer.

Mr. S. Morley believed this was the most important resolution, because it did not go very far in the direction of compulsion, and yet it would secure a very large amount of increase in the number of children attending school. He had found that the great difficulty raised by the parents was not the 2d., or 3d., or 6d. a week for the schooling, but the 1s., or 1s. 6d., or 2s. 6d. which the children would earn if at work. Therefore, if they said to employers, you shall not get money out of these little children unless they are educated, they would be increasing largely the number of children who would inevitably go to school, and they would have accomplished a great deal when they stopped giving wages, however small, to children under certain conditions. With reference to the large number of what were called "street Arabs," there was confessedly a difficulty, and it was a matter of detail how this was to be got over, but the resolution simply asserted the general principle, and it was one in which he believed they might all concur.

Mr. George Sheppard (Mayor of Portsmouth) desired to support that part of the resolution specially which rendered education compulsory. As the matter at present stood, the magistrates had no power to deal with a child in the way of education until he had become a criminal. Every magistrate knew that a large number of children were known to be destitute, vagrant, and living partly by plunder, but until these children were brought before them on a criminal charge, they had no power to send them to a reformatory school. One of the greatest wants of the present time was, that these vagrant children should be dealt with. It was a painful thing to see, in a town with a population of 120,000, such as the one he represented, the number of destitute children wandering about, many of them owing their existence to the vicious habits of the soldiers and sailors who frequented that port. It was most distressing to see the number of them wandering about absolutely destitute, uncared for, and untaught, and with no means of dealing with them until they became absolute criminals. To illustrate this point he mentioned an incident which had come within his own knowledge very recently. The body of a young boy, of 11 or 12 years of age, was found in one of the moats at Portsea, where it had evidently lain seven or eight days. For some time it was supposed the child had been murdered, but on further inquiry it appeared that he was the son of an old pensioner, who was in an almost destitute condition himself, and having no means to support this boy, he had left him in order to find a quiet resting-place for himself elsewhere, and there was every reason to believe that the poor boy had committed suicide. Such an example was a painful instance of what was required in order to deal with the population of large towns, particularly in times like the present, when, from lack of employment, the most sad state of misery and destitution existed. He hoped, therefore, that in any education bill most stringent provisions would be included for dealing with this class of the population.

The resolution was then put, and carried unanimously.

Dr. Barry moved the fourth resolution, as follows:—

"That existing efficient denominational schools to continue to receive Parliamentary grants, subject to the acceptance of a conscience clause, and to proper government inspection, and that existing training schools for teachers be consolidated as early as practicable, and, if need be, enlarged."

He said this would require very few words to recommend it. It was, in the first place, a proposition to utilise a most valuable existing machinery, and, in the next place, a proposition to keep public faith. These schools had been initiated chiefly by voluntary agencies, which had been stimulated by government aid in the erection of the buildings, and by the promise of further aid in their support, and he considered that thereby a moral obligation was contracted by the State, unless it could be shown, which he believed it could not be, that these schools had manifestly failed to do what in the first instance they undertook to do. The proposition was simply to utilise valuable existing machinery, and that, whereas the government chose to make, some thirty years ago, a great scheme for government aid, which was met in a very noble way by voluntary exertion, that with those who made that exertion public faith should be maintained, but, he should add, subject to the acceptance of a conscience clause. The resolution did not affect in any way the trust deeds of existing schools, but it simply showed that so long as they received a government grant they should admit a conscience clause, in other words, the religious teaching should be left free, so that any parent should be at liberty to withdraw his child therefrom without any evil consequences, direct or indirect, to that child. Of course he was aware that there were a large number who support the existing schools to whom this condition was altogether unpalatable; but he was himself profoundly convinced that the time was come when a conscience clause was absolutely necessary, and he was convinced of something more, that the conscience clause, if it was now included, would only do what had been done over and over again in England—stereotype an

existing institution. In the mass of schools he believed it was acted upon to the present moment, but to that action there were unfortunate exceptions, and as the law was not made for a righteous man, but for those who disregard a moral obligation, so it must be in this case. They wanted it in order to stereotype the existing practice, and to meet existing ideas. He himself, as a very zealous advocate, would go further. He considered the necessity of a conscience clause as an evil, because it involved the great evil of religious strife and diversity; but accepting the state of things as it was, and finding these divisions and diversities on religious subjects, those who were anxious for a definite religious teaching ought to be glad that a conscience clause was asked for, because it showed the same consciousness in others with regard to definite teaching which they held themselves. If any one valued definite religious teaching, they must equally object to it if they believed it wrong, and therefore the requirement of a conscience clause showed conscientiousness and adherence to religious principle in those who insisted upon it. He knew that people who were in earnest in religion were very long in learning the lesson of religious toleration, but if they were consistent, they ought not only to accept a conscience clause as inevitably arising out of the set of circumstances which had grown up, but to welcome it. Of the latter part of the resolution he could say but little, because he knew but little, but he understood it simply to mean that where there were existing training-schools near to one another too weak to maintain themselves individually, they should be united, and the staff economised. He was glad to see, also, that where necessary these training-schools should be enlarged. There was a time when these training schools were full, and their numbers increasing, on account of the demand for trained teachers, and that this was not the case now was due to certain provisions in the revised code. He firmly believed, however, that the time was now come when that would have to be again revised, and when education would be dealt with more generously than it had been in times past. More training schools would then be required, or the present ones must be enlarged. Hitherto the voluntary system, as it had been called, had not been fairly encouraged; it had been pressing on, and the action of the government had been to push it back, and one reason, therefore, why they were suffering from so much educational destitution was, not the weakness of the voluntary system, but the lack of encouragement which had been given to it.

The Rev. **John Oakley, M.A.**, seconded the resolution, not only on the ground that it contended for the maintenance of a highly efficient instrument of education, which the nation had at present in its hands, in the shape of the existing denominational schools, but also because it pointed to the possibility of the continuation of that machinery, even with the utmost development, as far as such development might be reasonable, which was proposed to them by the most extreme advocates for maintaining a system of compulsion. The resolution said that existing efficient denominational schools should continue to receive Parliamentary grants, subject to a conscience clause. Dr. Barry had already well argued the principle of a conscience clause, and he would only supplement that by saying that it should be not a partial, but a whole conscience clause. He was far from maintaining that the final shape of that much-debated clause had been attained, but he was quite sure that some such settlement must be arrived at as soon as the wisdom of Parliament was brought to bear upon the matter. What he meant was this. In the first place, it must go to the total exemption of any child from even any religious teaching at all if the parent so desired; but there must be on the other hand a corresponding provision, as had been said in the House of Lords, for the conscientious teacher, who wished to connect religious teaching, say with his history lessons, or other subjects. He saw no other solution of the difficulty but this, that there should be perfect freedom on the part of the parent or guardian to withdraw the child from any formal, express, religious teaching; but subject to that there must be a definite understanding that for all the remaining purposes of education, the teaching was given subject to the conditions of the denomination to which the school belonged. He did not think there would be any real hardship then remaining. He ventured to think, therefore, that the resolution as it stood, pointed to a very adequate arrangement, by which existing schools might be brought into relationship with a system of local rating, which he felt sure must be looked to in some degree to contribute to the maintenance of schools; and, even if compulsion were found necessary, he felt satisfied that the enforcement upon all schools of an adequate conscience clause would really secure that amount of freedom which was absolutely required, both by teacher and taught. With regard to additional means for training teachers, he was not himself in a position to say much, but he was glad to see present the Principal of the Chelsea Training College, who would doubtless supply any omissions on that head. The only reflection which occurred to him was that any further organisation of such institutions could hardly be any other than desirable; and if training schools existed at all, the consolidation of them, if too much scattered, and their enlargement, if too small, were obviously advantageous.

Sir John Pakington said it had given him great pleasure to mark the language of both the mover and seconder of this resolution, especially as clergymen of the Church of England, on the subject of a conscience clause. He did not exactly know what was referred to in the latter part of the resolution, but he presumed it meant to convey this idea, that as they increased and improved schools, so from day to day must the demand for efficient teachers increase, and that to provide such teachers was a necessary part of any great educational scheme. He was, however, willing to hope that any words of this kind were the less necessary, because he looked with great confidence for a supply of well-conducted efficient teachers as likely to arise from the second part of Mr. Forster's Endowed Schools Bill. It would be recollected that the Endowed Schools Bill was divided by the Committee into two parts, the first of which, relating directly to endowed schools, was passed almost unanimously, whilst the second part, which related to the creation of what was called a Council of Education, which should take care that there was a supply of schoolmasters properly trained, was postponed for future consideration, and he hoped that in the coming session, that also would become the law of the land.

Sir Walter Stirling heartily approved of the resolution and of the terms in which it had been proposed and seconded. He should not, however, have trespassed upon the time of the meeting, but from the circumstance of having, as many others doubtless had done, built a school at his own expense, in his own neighbourhood, and having made over that school to the minister and churchwardens of the parish, it was of course out of his power to lend much assistance in the direction pointed out by Dr. Barry; but he might, perhaps, be permitted, as the representative of the class of country gentlemen who had either built or largely supported the erection of schools, to express his cordial approval both of the resolution itself, and of the terms in which it had been brought forward.

Sir Tilson Marsh said he cordially agreed with the opinions enunciated by Dr. Barry and the rev. gentleman who had seconded the resolution. It would certainly not be keeping faith, on the part of the nation, with the founders of existing denominational schools if they were at once to be swept away, since large sums had been expended on their erection and maintenance, on the faith of the existing government system. At the same time he quite agreed, on the other hand, with what had been said on the subject of a conscience clause, because

it would not be keeping faith with the parents of the children if such a conscience clause were not enforced in the case of every school receiving State aid.

The Rev. Canon Cromwell said the resolution referred to the consolidation and increase of existing training colleges, but said nothing about the system of education which was carried on therein, which he considered rather an unfortunate omission, as he considered that ought to be one of the principal considerations in such a meeting as the present. Seven or eight years ago, the subjects of instruction in training colleges were much diminished by the omission from the syllabus of various branches of natural science, applied mechanics, and so on, in order, as he supposed, to economise. He considered this a most unfortunate step on the part of the government, and should be most delighted to have these subjects re-introduced. He would therefore suggest the addition of some such words as these—"and that a wider system of instruction be adopted in them." He recommended this in order that the teachers in elementary schools might be competent to give lessons to the children of artisans and those members of the working classes who would continue their children at school until the age of 13 or 14, in the principles of applied science, and also that they might be gradually training up a body of teachers who might go into those secular schools to which allusion had been made by Professor Owen, so that it should no longer be said—"These subjects are required, but where are the teachers?"

Mr. Chadwick thought the proposed addition very desirable, and had much pleasure in seconding the proposal.

The Chairman put the resolution as amended, and it was carried unanimously.

The Dean of Canterbury moved the next resolution, as follows:—

"That school fees be maintained, and be applicable to the augmentation of the incomes of the teachers, who will thereby be stimulated, and the schools kept efficient; and that the fees of destitute and pauper children be paid out of the rates."

This resolution naturally divided itself into two parts, and with reference to the first, he was very glad to find that the Council of the Society of Arts were disposed to maintain school fees as a principle. He believed it was an economic axiom that one half assistance, to meet efforts on the spot, was better than whole assistance without such efforts. You should never pay a bill for a man, but help him to pay it, and on the same principle you should not give an unconditional grant, but a small grant to meet efforts made on the spot. He believed that the carrying out of the same principle with regard to schools was the only way to keep them efficient. Clergymen in charge of parishes had found that even paying for the attendance of children at school had led to their going less regularly than before, and that the only means of awakening and continuing interest in education was by insisting that those who had the benefit of it should pay for it. It was said by some that if attendance were made in any way compulsory, it must follow that education must be free; but he confessed he did not see the cogency of that conclusion at all. By making school attendance compulsory, the State merely interfered to compel the citizen to do that which he was already morally bound to do, to put him right with his own unenlightened conscience, so to speak, and it had a perfect right to demand from him such a payment as he would have made had he voluntarily done his duty. It was to be hoped that a compulsory system would not long require to be maintained, and it certainly would become every year less and less necessary to enforce attendance. Should they, then, found a false system on the necessity for compulsion, which would remain when the necessity had gone by? The second part of the resolution, which declared that the fees for destitute and pauper children should be paid out of the rates, might be regarded as a truism, for, as long as they were paupers, their necessities must be paid for in some shape by the public.

The Mayor of Portsmouth had much pleasure in supporting the resolution, which he said explained itself. With reference to the fees for pauper children, he might mention that this principle was already carried out as far as possible in his own town, the guardians, whether legally or not he could not say, making it a sort of condition of giving out-door relief to widows with children that the latter should be sent to school, giving relief in proportion. He had wished to have said a few words on the eighth clause in the programme, and as it was not to be embodied in any resolution, he might perhaps be allowed to do so. It was as follows:—

"Where additional schools or increased school accommodation appear to be wanted, an official inspector to inquire what improved arrangements can be effected; in populous places, by organisation and combination of existing schools, or by the adoption of a half-time or any other system. The locality to be invited to establish schools, giving it the option to do so by voluntary subscription under the existing system, or by rates administered by a local board according to rules; but if the locality neglect to do so, then government to establish the necessary schools, charging the cost of buildings, and a proportion of the annual expense, on the rates of the locality. Existing schools to be free to adopt this system."

He had had some experience during the last 20 years with regard to the people of different localities providing these sort of things for themselves, and many years ago, he, in concert with several others, endeavoured to introduce the Public Health Act in Portsmouth. It was made a bono of contention in the corporation for two or three years, until every cleanly person was almost obliged to resign his seat. Again, only last year, some members of the Council introduced a resolution, and carried it by 35 to 2, that the Public Libraries' Act should be introduced. That necessitated the calling a public meeting of the inhabitants, and the result was that the largest room in the borough was crammed with ratepayers, who had been instigated by flaming bills, issued by unprincipled people, calling upon them to resist increased taxation. The utmost increase would not have been more than 1d. in the £, which, on a rating of about £250,000, would have produced a good round sum to commence with. However, every one who attempted to speak in favour of a public library was yelled and hooted down, and almost subjected to personal violence. He was quite confident, therefore, that if they went into the borough of Portsmouth with a permissive bill for establishing schools for the education of destitute children, they would never get a school there at all; and those members of the corporation who voted for the measure would, in all probability, soon lose their seats.

Mr. Ashby did not understand what was meant by destitute as distinguished from pauper children, and he thought it would be wiser so to word the resolution that there could be no ambiguity about it.

Sir John Pakington thoroughly approved of the first part of the resolution, and hoped that the government, in drawing their proposed measure, would not be carried away by the views of the Educational League and of the Manchester Education Bill, and in using these words he was bound in candour to add that he spoke with what was commonly known as the zeal of a convert, for when, in 1855, he introduced a bill into the House of Commons, by which he proposed to establish a system of national education, he was himself bitten by a preference for free schools, and he proposed accordingly that the schools created under that bill should be entirely free. He was, therefore, the more bound to declare that, on fuller reflection, he did not see any sufficient answer to the two objections to the two free systems, which he now thought were fatal; one was, that it was unwise and unnecessary

to throw away the half million of money in round numbers which was now contributed towards the maintenance of the schools from the children's pence; and the other was, that there was a moral question involved in the matter, of no slight importance, viz., that it was one of the first duties of all persons to provide for the education of their children. With regard to the argument that with a compulsory system freedom was indispensable, he agreed with what had been said by the Dean of Canterbury. There was great force in what he had remarked, that when the law compelled a parent to do his duty to his own child, there was no hardship in making him bear the necessary expense, and with regard to the rates, it would, he thought, be only fair to provide that, so long as a man was paying for his children's schooling, he should not be liable to the education rate; at any rate, he would throw out that principle for consideration.

Sir Tilson Marsh concurred in this suggestion, which he thought might be adopted with advantage.

The resolution was then put to the meeting, and carried unanimously.

Sir John Pakington having taken the chair,

Sir Walter Stirling proposed a cordial vote of thanks to Lord Henry Lennox for the able manner in which he had presided over that day's conference. They all knew his recent connection with the navy, but no one could say that he was at sea in his present position. Before attending the conference, he had been somewhat confused by the various schemes put forward, and was rather inclined to acquiesce in the opinion of some of his neighbours, that the matter would be postponed, and that there would be no bill this session; and after listening for several hours with the greatest interest to the discussion which had taken place that day, from the great diversity of opinions expressed on some points, though sometimes by a side wind only, he should not have arrived at a much more satisfactory conclusion, but for the sanguine hopes expressed by gentlemen better informed than himself, such as the noble Chairman, and Sir John Pakington, who had prognosticated something satisfactory as the result of the ensuing session.

Mr. Holmes, in seconding the motion, begged leave to assure the meeting that he felt well repaid for the trouble of making the journey from Derby, which he had done on purpose to attend the conference. He had hoped that something would have been said with regard to the extension of government aid to ragged schools, but doubtless that would come in good time. At any rate, they might all congratulate themselves on having been presided over by so able and excellent a chairman.

Mr. Chadwick said he was only expressing the feelings of his colleagues on the Council of the Society when he joined most heartily in the vote of thanks which had been proposed.

Sir John Pakington said he did not rise to put the resolution, because it was useless to put a motion on which there could not be two opinions, but he desired to express his own thanks to his noble friend for the very able and courteous manner in which he had conducted the business of the day.

The motion having been carried by acclamation,

Lord Henry Lennox, in acknowledging the compliment, said there seemed to have been a little misapprehension in some minds as to the views of the Council with regard to the religious element in school teaching. He was prepared to have laid those views more fully before the meeting in his opening remarks, but a glance at the clock warned him that he was in danger of committing the very worst fault possible in a chairman—that of boring his audience—and he therefore drew his observations to a close with more suddenness than was perhaps advisable under the circumstances. He was exceedingly grateful to the meeting for the manner in which they had supported him throughout the day, and should feel only too glad if any humble services he had rendered were instrumental in advancing, in any degree, the great cause of education.

TENTH ORDINARY MEETING.

Wednesday, February 9th, 1870; Captain Jasper Selwyn, R.N., in the chair.

The following candidates were proposed for election as members of the Society:—

Apps, Alfred, 433, Strand, W.C.
Bates, Rev. Jonathan, Kirstead, Brooke, near Norwich.
Harcourt, Clarence, 8, Moorgate-street, E.C.
Pitman, Henry Alfred, M.D., 28, Gordon-square, W.C.

The following candidates were balloted for, and duly elected members of the Society:—

Francis, John, 11, Burghley-road, Highgate-road, N.W.
Hambling, Thomas C., 7, Westminster-chambers, S.W.

The Paper read was—

ON LOSS OF LIFE AND PROPERTY AT SEA, AND MEANS SUPPOSED TO BE ATTAINABLE TOWARDS THE MITIGATION OF SUCH LOSS.

By J. W. Wood, Esq.,
Collector of Customs, Harwich.

As the time is fast approaching when amendment and consolidation of the laws affecting our merchant shipping and seamen will be considered in Parliament, and probably settled for years to come, it seems to me that a little preliminary discussion, amongst gentlemen representing such a variety of scientific and practical knowledge as the members of this Society, upon some of the subjects connected therewith, may elicit opinions which may ultimately prove of value.

Acting upon this assumption, I am here to-night for the purpose of placing before you some observations and suggestions resulting from a long official experience, but which, at the same time, I wish it to be distinctly understood, are in no sense to be considered official.

It may be as well to observe also, in consequence of so much having been recently written and said by various authorities about over-loading, and some other matters I purpose treating on, that my paper was written so far back as June, last year, before any such opinions had been expressed, or, at any rate, become known to me, and transmitted to the secretary of this Society for approval in the following October.

Referring to the "Wreck Register" last published, I find that no less than 12,625 wrecks and casualties occurred on the coasts of the United Kingdom during the last ten years, resulting in the total loss of 1,397 ships, and partial damage and loss to 1,735 more, all arising from such preventible causes as carelessness, neglect, unseaworthiness, unsound gear, &c., also the loss of 8,645 human lives, besides more than 40,000 more being placed in peril, and saved with more or less difficulty, during the same period.

These are grave and startling facts, more especially as such losses appear, by the return referred to, to be steadily increasing, although they were somewhat less in number last year than in the year 1867.

My purpose is to comment on some of the more prominent indirect as well as direct causes of this severe loss, and, in passing, to submit for consideration such means as appear to me to be the most readily available towards its mitigation.

Scarcity of Seamen.

The first indirect cause I propose noticing is the scarcity of our merchant seamen, necessitating that growing evil, the employment of foreigners; not that such foreigners are less efficient seamen than our own, for, I

am in one sense sorry to say, upon reliable evidence, that most of the merchant seamen, in Northern Europe at any rate, are now-a-days quite as intelligent, more sober, and much better educated than our own, upon which more anon; but it must, I think, be clear to every one that, on a British commander, with a mixed crew, giving orders in the hour of necessity or danger, the confusion that may arise through misunderstanding amongst the foreign sailors may, and probably often does, lead to most disastrous results.

Nor is this all, for, although I am not in a position to be able to state the exact number of foreign seamen employed in our mercantile marine at this present time, I find. on reference to the Report of the Committee of the Society for Improving the Condition of our Merchant Seamen, which was published in 1867, that the employment of foreigners had increased, during the seven years ended in 1865, from 11,458 to 20,280, or 77 per cent.; that they were almost invariably A.B.'s, and that they then formed 28 per cent. of the whole of our able merchant seamen—a proportion the more startling considering its rapid progress, and that during the last four years it may have increased to quite 40 per cent., if not more, so that in case of a maritime war, it might prove of grave national importance.

The three most prominent causes of the scarcity of our merchant seamen I attribute to be:—

1st. The decrease in the coasting trade, owing to railway competition, &c.

2nd. The great increase in the number of steam in proportion to sailing vessels; and

3rd. The abolition of the old system of compulsory apprenticeships.

It is the last I propose endeavouring to meet.

Parish Apprentices.

Why do we not avail ourselves more extensively of parish apprentices, for which sections 141, 142, 143, 144, and 145 of the Merchant Shipping Act afford every facility?

I find, on reference to a return issued by the Poor-law Board, in January, 1869, that there were, on the 1st day of that month, in the English and Welsh unions alone, 21,881 pauper children, of from 12 to 16 years of age, of which number I am informed that about two-thirds, or 14,587, would be boys; and it is reasonable to assume that a large proportion of such boys would elect to go to sea, if owners could be found to take them.

Bearing in mind that the number I have mentioned represents but a portion of the United Kingdom, and for one day only, what a constant and never-failing, but as yet almost untouched source of supply from which to recruit the ranks of our merchant seamen presents itself. Then why do not owners avail themselves of it? The only reason I have hitherto been able to obtain from owners is, that after the boys have been 12 or 18 months at sea, and learned to be a little useful, too many of them take the first opportunity to desert. But may not such desertion be justly and charitably attributed to another cause? We all know the weakness of human nature, even amongst the educated, and it is easy to conceive that an ignorant pauper boy, fresh from the union, and knowing nothing of a sea-faring life, would for some time be a butt, a byeword, and a drudge amongst his rough associates, so as to cause him to desert and leave his unpleasant antecedents behind, as soon as he became at all capable of taking a position as an ordinary seaman.

In endeavouring to devise a remedy, three interests have to be considered, viz., that of the Boards of Guardians, the shipowners, and the boys; and it seems to me that the nearer and closer we ean unite these inteiests for their common good, the nearer we approach a practical solution of the difficulty. Let us now look at the position from a comparative point of view.

The maintenance of a pauper boy, from 12 to 16 years of age, costs, I am told, about £10 per annum. Boards of Guardians, acting in the interest of the public, will therefore be glad to get them off their hands as soon as possible after they have turned 12 years of age; but owners will not take them.

Shipowners want boys, but, under existing circumstances, pauper boys are found to be practically worse than useless. Pauper boys in large numbers, it is assumed, would gladly go to sea if guardians would allow, and owners would take them.

Training Ships.

To meet these difficulties, I propose the establishment at our leading seaports of training-ships for parish apprentices, and hope to be able to show that, once established, they would be self-supporting.

We will suppose, by way of illustration, that government gives a ship, and that a suitable staff of instructors has been appointed. A Board of Guardians sends a suitable boy, of twelve years of age, and, with his own consent and the consent of his parents, if any, apprentices him to the ship, paying, at the same time, the usual union premium of, say £10, and the cost, in advance, of one year's union maintenance, say another £10, or £20 in all. This amount being much more than would suffice for one year's maintenance on board, the surplus would go towards the cost of his training; at the same time the guardians, supposing they would otherwise have kept the boy till he attained sixteen years of age, would be a clear gainer to the extent of the cost of three years' maintenance, or £30.

A shipowner wanting a boy goes to the training-ship, and obtains one who has had not less than one year's training. That boy is of immediate practical use to him. He has received more instruction, and that of a superior class, and he knows more than any other boy who has been twelve months in his service, because he has had not only greater facilities for learning, but nothing else but learning to attend to. The owner can therefore, with advantage, afford to pay a small premium for him, equivalent at the least to what he would have paid the boy for a previous twelvemonths' apprenticeship to him, for has not the boy been carefully trained for him during that period, and that without his having borne the cost of maintenance? Add the amount of premium given by the owner (say £10) to that paid by the guardians (£20), and the result is an income of £30 per head per annum, which amount, it is assumed, would be amply sufficient to defray the cost both of maintenance and training, and render the establishment self-supporting.

The advantages to the boy would also be great. He would be raised in the social scale. He would feel that he was wanted rather than shunned; and instead of going to sea as a drudge, he would be enabled rather to take the lead of his juvenile messmates; while his elementary education would tend to a more rapid acquisition of knowledge, and consequent advancement in life.

The scheme I have suggested, consists, in short, in requiring the first year of a parish boy's apprenticeship to the sea to be served in a training-ship, and his subsequent transference to an owner or master for the remainder of his term, with the mutual consent, and to the mutual advantage of the parties concerned.

In commending what I have advanced to your consideration, I would observe, finally, that the practicability of carrying out such a scheme depends chiefly upon the shipping interest. That, if considered practicable, adopted, and extended, it would greatly increase the supply, as well as rapidly leaven and improve the tone and character of our merchant seamen generally, directly benefiting the shipping interest, and indirectly tending to greater security of life and property at sea; also, that such ships, being available for use as floating churches, a means would be afforded of Christianising as well as civilising not only our future but our present race of seamen.

EDUCATION OF ADULT SEAMEN.

Another indirect cause of the losses we are now considering may, I think, be attributed to the ignorance of a large proportion of our merchant seamen; and when it is considered that on their intelligence as well as bodily strength the safety of life and property at sea is in no inconsiderable degree dependent, and that we should have to rely upon them as England's chief bulwark in the hour of necessity, the importance of endeavouring to raise the tone and character of the men becomes very apparent. That many of the disputes which occur between masters and seamen, causing inconvenience and loss to owners, are the results of ignorance on the part of the men, my own experience could abundantly testify. The unavoidable haste with which crews are oftentimes got together and shipped, although the agreement is read over to them previous to their signing it, does not afford much time for reflection, neither are the men always in a condition to reflect; and what can be the use of the copy of the agreement which is required to be made accessible to them on board if they are unable to read it, and understand what they have bound themselves to perform? It follows that, in too many cases, it is left to the interpretation of a black sheep amongst them, familiarly known as a sea-lawyer, who, generally possessing a little education, is looked up to as an oracle, and, for his own purposes or pleasure, manages to unsettle the minds of his messmates, so as to cause not only general confusion and discomfort during a voyage, but a weakness of discipline which often proves a grave source of evil in the hour of danger. Were all alike able to read and write, this influence, if not entirely destroyed, would be much lessened, and the evil in a corresponding degree mitigated.

That much of the thoughtlessness of our merchant seamen may also be attributed to ignorance will probably be conceded, but it is not, unfortunately, confined to men before-the-mast, for I have met with many masters of coasting vessels, barely arrived at middle age, who could not write their names, while many others could only do so with much difficulty. It is not probable that their reading would be much better than their writing, in which case it is not difficult to conceive that their navigation would be of a rather hap-hazard description. I have seen this to some extent exemplified on taking depositions in cases of shipwreck (especially amongst men of the class alluded to), having found it to be not only most difficult to elicit anything like an intelligible version of the facts, but on asking an opinion as to what the casualty might be attributed, have found them to be entirely at sea.

I would not have it inferred that the class of masters in the coasting and home foreign trade is composed of such men, but they are far more numerous than most people would imagine, in spite of the improvements which have been effected of late years; and the loss of vessels commanded by them, as well as the too often consequent loss of life is not very surprising.

May not those fruitful sources of danger and disaster, neglect of the lead, of the influence of tidal currents, and the non-observance of, or inattention to meteorological changes, also be attributed, to a great extent, to the same cause?

Far be it from me to ignore the vast amount of improvement which has been effected in our mercantile marine of late years, by means of the homes, savings banks, and the naval reserve; still, much remains to be done, and may be done at once with advantage, without waiting till the present generation of sea-faring boys have been converted into able seamen.

Looking at the agreements entered into on shipment of crews, I do not hesitate to say (under correction) that at least one-third of our merchant seamen are unable to write their names, and, doubtless, also unable to read. The remedy I propose, therefore, for consideration is education. Education, even of the most elementary character, tends to self-respect and expansion of the reflective and reasoning faculties. Let us, then, educate our adult merchant seamen. Our *prestige* as a maritime nation requires it, and sound policy demands that no effort be spared towards raising the tone and character of the men on whom the safety of life and property at sea is to so great an extent dependent.

Two questions now arise:—How can we render the education of our present adult seamen practicable; and to what extent shall we seek to educate them? Both being, to some extent, answered in a letter which appeared in the *Shipping Gazette*, of the 6th of May, 1864. I will read it. The writer says:—"It has been a source of regret to me to see, on shipping and discharging crews, the large proportion of men who can neither read nor write; or if able to read a little, are unable to write at all. That there is no insurmountable difficulty in the way of remedying this, I feel tolerably certain, having (under many disadvantages) personally tried the experiment, by opening an adult evening school during the six winter months for the benefit of resident seafaring men, and any sailors in port who choose to avail themselves of it, when seamen, from youths of 17 to bald-headed middle aged men (including Naval Reserve men on drill) availed themselves of it, and evinced such an earnest desire and endeavour to progress, as to afford me a pleasure I am sanguine enough to hope others may also like to enjoy, and I therefore beg to offer the following concise description of the simple plan adopted:—Having obtained the use of a large room belonging to government, which was disengaged two evenings in the week, put a stove into it, obtained the loan of forms and tables, and laid in a small stock of coals and candles, I sought, and readily found, suitable assistants in two of my subordinates, also a military officer, and a gentleman residing at the port, and had placards conspicuously posted, inviting seafaring men above the age of 17 to attend at the well-known room, where, on every Tuesday and Thursday evening, from 7 till 9 o'clock, they might receive instruction in reading, writing, and arithmetic, for which each person availing himself of it would have to contribute one penny towards the cost of coals and candles. Then, borrowing and purchasing a small supply of books and stationery, I arranged the classes, taking the writing-class myself, as the most important, for obvious reasons, especially as the readiest means of conveying the largest amount of general instruction; and selecting some pithy sentences of a useful tendency for copies, I wrote them on slips of paper, pasting one of a different-sized hand on each upper side of a small triangular piece of wood, so that two men sitting on either side of the military table used might, by simply turning the piece of wood, each have a fresh copy. After a time, those who had made sufficient progress were forwarded into a class for writing from dictation, the selections being sufficiently interesting as well as instructive to convey, while improving the reading and writing, a considerable amount of useful information. This class provided their own writing-books, which were corrected and returned to them every night for future reference; and it was exceedingly satisfactory to note the spirit of friendly emulation excited, and the rapid progress made.

"The other classes were conducted in what I believe to be the usual way. I never heard an unseemly or angry word on any occasion, and am persuaded that there is a growing feeling amongst the men that such instruction is a boon. There may not be a free room available at every port, but I am much mistaken if the small amount necessary at starting might not be raised anywhere without difficulty; and if the foregoing, or some more perfect plan should be tried, I have strong hopes that such schools would soon become general at our sea-ports, and self-supporting, especially if the promoter and head should be a man of authority and position, well-known to and liked by the seamen at the port."

The plan detailed is simple in the extreme, and I have reason to know that it was effective. Why not extend

its operations to our larger sea-ports, with such improvements as experience may suggest? Above all, why not apply the principle at our sailors' homes? The answer I must leave to the shipping interest, and to that happily by no means small nor uninfluential class which takes an active interest in the welfare of its fellow-men; but of this I feel assured (although I speak without the slightest authority) that should any efforts be made in the direction I have indicated, they would meet with consistent encouragement and support from that Department of State specially devoted to the superintendence of popular education.

Floating Wreck.

I will now proceed to consider some of the more direct though preventible causes of shipwreck and loss, taking first that which I believe to have been the least considered, viz., the large masses of wreck which are allowed to drift about our coasts, in the direct fairway of ships (say, for example, between the North Foreland and the Naze), and being so low in the water as to be almost invisible, especially at night, must, from their changing position, be even more dangerous than sunken rocks. How much damage and loss of life may be occasioned by the whole or the half of a ship's hull so drifting, before it be sunk in deep water or carried on shore by tidal influence, may be readily conceived on a little reflection.

It would appear, at first sight, that salvage would be a sufficient inducement to those engaged in that occupation to remove it, but practically it is found to be otherwise, The labour, risk, and damage incurred in securing and saving such wreck are generally found to be so great that the ordinary salvage reward which might be derived from the net proceeds of sale is often wholly insufficient as a remuneration. Salvors are, therefore, led to pass it for more certainly profitable employment; and who can blame them? I had a case of the kind to deal with a few years ago. The bottom of a vessel of about 300 tons register was found drifting at sea off Aldborough, and four smacks, with twenty-one men, after unusual labour and risk for four days, in a heavy sea, succeeded in towing it into Harwich. The amount of salvage awarded (and it was all that could be awarded) was £79, yielding, after payment of the smacks, about 13s. 6d. a day to each man, a sum justly estimated as insufficient either for reward or encouragement.

Clause 574 of the new Merchant Shipping Bill certainly proposes to deal with the removal of obstructions which may be caused by wreckage, and, in the absence, or on the neglect of the owner, authorises the conservancy or lighthouse authorities to cause such removal to be effected; also that, in case the proceeds of sale of the wreck so salved be insufficient to defray the expenses of removal, the balance may be recovered from the owner. This provision might answer the desired end where British owners are concerned, so far as regards wrecks stranded on the coast or sunk at the entrance to a harbour, but not I think to the class of wreckage now under consideration, for amongst the wrecks and casualties recorded in the "Wreck Register" as having occurred on our coasts during the last ten years, I find that 2,403 of the ships were foreign, and that there were 754 whose very nationality was unknown. It is clear, therefore, that the owners of such vessels could not be got at.

But I need not waste time in further illustration, being myself rather at sea in regard to a remedy, and having brought forward the subject more in the hope of eliciting than with the idea of offering opinions. I will, therefore, leave it with the following proposition for consideration, viz., that in all cases of the kind I have mentioned, where the proceeds of sale prove insufficient to encourage and reward salvors, the great insurance interests, both British and foreign, should, on a representation of the fact being certified by the Receiver of Wreck, and forwarded through their several agents, supplement the salvage to such an extent as might be considered expedient. It seems to me that the comparatively trifling expense which would be incurred thereby would be far more than compensated by the advantages which would accrue, in regard to the greater safety both of life and property at sea.

Deck Loads.

Passing on to the subject of overloading. I consider that another cause of danger and loss may fairly be attributed to the practice of carrying deck cargoes, especially by steamers—even passenger steamers—more particularly in the comparatively short voyages made in the Baltic, home, foreign, and coasting trades; and here my valued friend, the "Wreck Register," fails to afford me any statistical information, so that I am unable to state what casualties may have arisen from the practice, but will give a single illustration, showing what might, and probably often does result, viz., the vessel capsizing or foundering, with all hands. A beautifully-modelled iron paddle-steamer, of 484 tons register, and said to be over 700 tons burthen, licensed to carry 547 passengers, exclusive of the master and thirty hands (in all 577 persons), with the amount of boat accommodation required by the Merchant Shipping Act, for about eighty of them (supposing it to be all available when required), everyway, indeed, legally well-found, and in good sea-going condition, was recently crossing from Antwerp with passengers, and, besides a large general cargo, 2,030 sheep and 289 pigs. The 289 pigs and 1,000 of the sheep were carried on deck, 500 more being carried on the bridge. Is it surprising that, with a light draught of water (about eight feet), and so much top hamper, she should labour in a cross sea? It is true that the weather was fine when she started in the afternoon, but the wind rapidly freshened, and about midnight, when she was in mid-channel, it came on to blow a strong gale, with a heavy sea. Her commander, a smart and experienced seaman, tried all he could to get her head to wind, but without success, and a more than ordinary heavy sea striking her, she was laid on her beam-ends, and in imminent danger of going down with all hands. He then, with prompt judgment, and the aid of a few of his crew, succeeded, after much difficulty, in getting about 700 of the sheep overboard, and some having cleared themselves, she righted, and lay-to till the gale abated. Had the deck-load consisted of anything else but sheep and pigs, and those loose, it is probable that neither the vessel nor those on board would have been evermore heard of. But if the danger incurred in carrying an unlimited amount of live cargo on deck be so great, what must it be when the deck-loads consists wholly or even partially of dead weight, as I am creditably informed is commonly the case, particularly at our northern and eastern ports? I am glad, therefore, to find, by rule 5 in the second schedule to the new Merchant Shipping Bill, that legislation on this subject (after being many years in abeyance) is again in contemplation, to the extent of adding to the register tonnage such space on deck as may be used in carrying cargo (a regulation which would be useful in more ways than one); but whether it be carried or not, I think that the carrying of deck cargoes might be restricted with advantage, and without being oppressive, to the following extent:—That no dead-weight of any description should be allowed on the deck of any vessel; that no animals or other cargo should be carried on a steamer's bridge; and that the number of animals carried on the deck of any vessel should be restricted, in the same manner as has long been the practice in regard to the number of passengers.

Over-loading and Load Lines.

I now, with some little trepidation, venture into a ship's hold, in order to approach the long-vexed and (to me) difficult subject of over-loading and load-lines. As a large proportion of the loss of life and property mentioned in the first part of my paper may be fairly attributed to over-loading, I propose for consideration, in the first place, what constitutes over-loading.

Setting aside the subject of deck-loads, previously treated on, it is asserted and maintained by admitted competent authority that a vessel well found, and in good sea-going condition, may safely carry any amount of cargo, even if consisting wholly of dead weight (provided it be properly stowed) which does not immerse her beyond her load-line. Admitting for the moment such to be the fact, it is well known that a large proportion of sea-going vessels are not well found, and by no means in good sea-going condition; also that cargoes are anything but properly stowed, and that needy or greedy owners pay no attention whatever to the load-line. But as it is assumed that the load-line affords reliable evidence of safe loading or otherwise, let us consider what ground there is for the assumption.

The earliest information I have been able to find on the subject is contained in an Act passed in the 9th year of the reign of Henry V., cap. 10, for the prevention of frauds upon his Majesty's revenue, in regard to vessels laden with coals, by ascertaining, by means of a dead weight of lead or iron, the carrying capacity of such vessels, which capacity was then required "to be marked and nailed on each side the stem, stern, and midships thereof," in order, as explained in the 15th George III., cap. 27, to denote "what quantity of coals each respective vessel will hold and carry up to the mark so set thereon," which mark it is but reasonable to suppose represented the load-line of safety. These enactments continued in force only so long as they were required for revenue purposes, and I have failed to find in any of the Acts relating to tonnage, from the first passed in the 13th year of the reign of George III., cap. 74, to the present time, any regulations enforcing a load-line to denote the dead weight a vessel may safely carry; and the present register ton merely representing 100 cubic feet of space, certainly cannot of itself be accepted as an evidence of weight-carrying capacity.

We now come to the modern load-line, to denote which it appears to be the builders' practice to allow three inches of freeboard for every foot of depth of hold amidships, but I cannot ascertain that such practice is founded upon any principle, and it may be questioned whether it be equally applicable to long, narrow, and deep vessels, and the opposite, or in the same degree to iron and wooden, steam and sailing ships. Moreover, conceding that a load-line, calculated on capacity for carrying an average general cargo, may be accepted as a fair guide for loading a vessel to her best sailing and consequently safe trim, it is, to say the least, doubtful whether it would be equally so in the case of a cargo consisting wholly or principally of dead-weight. Hear what Moorsom, the author of the present system of tonnage admeasurement, says on this subject, in his explanation of the nature of register tonnage, as given at page 44 of a little work of mine on the registration of shipping.*

"A brief explanation of the nature of the register tonnage of a ship as ascertained under the "Merchant Shipping Act, 1854;" and of the easy means it affords for estimating approximately the measurement and dead-weight cargoes of ships:—

"1. The register tonnage of a ship expresses her entire internal cubical capacity in tons of 100 cubic feet each, so that it is only necessary to multiply such tonnage by 100, and the entire internal capacity of the ship in cubic feet is immediately shown, and from which an owner can, by making such deductions for passengers, provisions, and stores, &c., as the circumstances of the particular voyage may require, arrive at the net space in cubic feet for the purposes of cargo.

"2. To ascertain approximately for an average length of voyage, the measurement cargo in tons measurement, at 40 feet to the ton, which a ship can carry (as many owners may be unwilling to trouble themselves with the above-mentioned deductions), it is only necessary to multiply the number of register tons contained under her tonnage deck, as shown separately in the certificate of registry, by the factor $1\frac{7}{8}$,* and the product will be the approximate measurement cargo required.

"3. To ascertain approximately the dead-weight cargo in tons weight which a ship can safely carry on an average length of voyage (dead-weight bearing a certain qualified relation to internal capacity), it is only necessary to multiply the number of register tons under her tonnage deck by the factor $1\frac{1}{2}$,* and the product will be the approximate dead-weight cargo required.

"4. With regard to the cargoes of coasters and colliers ascertained as above, whose short voyages require but a small equipment of provisions and stores, and whose frames or shells are of a larger scantling in proportion to their capacity than in the larger classes of vessels, about 10 per cent. may be added to the said results; while, on the contrary, about 10 per cent. may be deducted in the case of the larger vessels going longer voyages.

"5. In the case of the measurement cargoes of steam vessels, the spaces occupied by the machinery, fuel, and passengers' cabins under the deck, must be deducted from the space or tonnage under the deck, before the application of the measurement factor thereto; and in the case of their dead-weight cargoes, the weight of the machinery, water in the boilers, and fuel, must be deducted from the whole dead-weight, as ascertained above by the application of the dead-weight factor."

Here, then, is a system by which it may be assumed a load-line may be safely calculated, but what does it involve? Not the marking of one line only, but one for each class of vessels and each class of cargo. But vessels, with a few exceptions, carry any kind of cargo by which a freight may be earned, sometimes of one kind and sometimes of another; where, then, under such circumstances, can a single line be drawn so as to afford a reliable mark for safe loading generally? It would be simply impossible. Many cases may be quoted in illustration of the disastrous consequences of overloading, especially by dead-weight, but that of the *Golden Light*, of very recent occurrence, will perhaps suffice.

In the official report of the abandonment of that vessel, as given in the columns of the *Shipping Gazette*, of Wednesday the 16th June last, it is stated that she was built of wood, 1,051 tons register, and was staunch and strong at the time of sailing; that her cargo consisted of 1,335 tons of pig-iron, as stated on the evidence of several witnesses, was "properly stowed and well stanchioned down to prevent its shifting, and that the vessel was not overloaded as to her draft of water, having, as near as could be ascertained, between six and seven feet clear side; yet she strained to such a degree, and in the course of a few hours made so much water, that it was found necessary to abandon her in order to save the lives of the crew. Is not this a practical demonstration that she was overloaded, especially as her cargo consisted wholly of dead weight, although it was properly stowed; and that her load-line, if observed at all, was so far valueless?

But to the immense loss of life and property by foundering must be added the large proportion caused by stranding or collision, arising from the same cause.

Speaking on the authority of very numerous depositions I have taken, it is by no means uncommon for over-loaded vessels, when riding in a roadstead, and pitching and labouring in a heavy sea, however good their ground tackle may be, to break from their anchorage, or be obliged to slip, after which collision or strand-

* See "Wood's Handy-book on the Registration of Shipping," page 44, published by the author, Custom-house, Harwich.

* The deductions necessary to be made for provisions and stores, &c., agreeably to the opinions of several experienced ship owners and brokers, are allowed for in the selection of the two respective factors; but the spaces under the deck which may be appropriated to passengers, being governed by no rule, must be made by a separate deduction, with respect to the rule for measurement cargoes, as they may be found to exist in each individual case.

ing, or both, with whole or partial loss of life and property, is frequently the result.

Having endeavoured to show that overloading mainly consists, not in filling the cubic capacity of the hold of a ship with a fair general cargo, but chiefly in carrying an amount of dead weight disproportionate to her build and construction, in regard to which neither the modern load-line nor any single load-line can be relied upon as a safe guide; if what I have advanced be sound, a remedy is urgently required, and may, I think, to a great extent be found.

No one can be more opposed, on principle, than myself to excessive legislation, tending unduly to restrict or fetter our commerce; but where the preservation of human life is concerned, it becomes quite another matter. I say, then, let us no longer go on blundering as it were in the dark, but endeavour to find a sound principle as a basis for action, to which end I suggest the classification of our ships. Vessels are classified by Lloyds' for security of insurance. Why should they not, upon a similar principle, be classed for the security of life and property?

Again, has not Moorsom, in his explanation as regards tonnage, which I have read, clearly sketched a plan for ascertaining carrying capacity and determining load-lines under different conditions? However, to place these matters beyond a doubt, I submit the temporary appointment of a mixed committee, constituted upon the plan of our Local Marine Boards, and consisting of scientific and practical men, who might draw up rules for the classification of our sea-going ships (subject to the approval of government) according to construction and carrying capacity, distinguishing cargo from passenger ships, steam from sailing, and iron from wood. Supposing this were done, the Board of Trade Inspector, who has already to inspect every vessel previous to registry, either for crew spaces, passenger certificate, or boilers, or each, might be enabled to determine and certify both the light and deep-load line for each particular vessel. Each of these lines should then be indelibly marked, and the inspector's certificate (or a duplicate of it) being handed to the Registrar of Shipping, that officer would record the particulars in the registry, and on the certificate of registry which always accompanies the ship.

The course of action which could then be pursued by the several collectors of customs and British consuls, at home and abroad, in regard to safety, would be as follows:—Every master or agent, on clearance outwards (except on a coasting voyage), is bound by law to produce the certificate of registry to the collector or other proper officer, also to sign and declare on a document called a content (which represents in brief the whole cargo carried or to be carried) in the following words:—"I do declare that the above content is a true account of all goods shipped, or intended to be shipped, on board the above-named ship, and correct in all other particulars;" to which I would add, "also that the vessel is now or will be when fully laden, on her departure from the United Kingdom (or) this port, immersed to the light-load line or deep-load line (as the case may be) and not beyond." The number of tons of dead-weight carried or to be carried, as well as the load line for the voyage, should be inserted in the "content" before its being declared to, when the collector could check the content with the certificate of registry, and either grant or refuse clearance, as circumstances required.

A similar rule might be observed in regard to the coasting trade, the number of tons of dead weight being inserted in the transire (as it is now in regard to colliers), and the present declaration on that document by the master supplemented in a similar way. By such means not only would a valuable documentary evidence be obtained, necessitating merely an occasional check by Customs' officers, river police, or others, but the heavy responsibility thrown upon the master, in which the owner might be made to participate, would, as it seems to me, act as a most powerful deterrent against overloading. It might seem, at first sight, that such a plan would be unjustly hard upon the master, by imperilling his certificate, he being unable to attend to the loading of his ship (a duty devolving upon one of the mates), but it would, in reality, be nothing of the sort; on the contrary, he would merely have to see that she was not immersed beyond her declared load-line; and, so far from being placed in an unfair position, he would be afforded a protection which he certainly does not at present enjoy, as, should a greedy owner wish him to proceed with an overloaded ship, he could safely refuse to do so, the owner being held in check by the information which might be laid against him.

There is another and that a very simple means which might be exercised as a check, both against overloading and frauds upon marine insurances, viz., the insertion of a clause in the policy to the effect that, on it being decided by an authorised and competent tribunal appointed to inquire into causes of shipwreck and casualty, that the loss sustained arose from overloading or other preventible cause, the policy should become void. If, as I suppose, the great insurance interests have power to effect this, and would do so, the result would be a protection to life as well as property which certainly does not at present exist.

Boats and Life-Rafts.

One more subject ere I conclude. Perhaps one of the greatest causes of the enormous loss of life at sea mentioned in the first part of my paper, has been the absence of sufficient means for preserving it in case of casualty.

Mr. Gray, in his able paper on the inadequacy of modern legislation to meet the ends sought to be attained in regard to our merchant shipping (a paper with which you are doubtless familiar), pointed out so clearly the insufficiency and comparative inutility of the boats carried by our merchant ships (more especially those carrying passengers) that I need not lengthen a paper already, I fear, too long, by dwelling upon that subject, but take it for granted that the necessity for some auxiliary for saving life is admitted.

A receiver of wreck, in his examination on oath of the masters of vessels or survivors, in cases of casualty at sea, has the horrors of shipwreck in most of its varieties brought very prominently before him, and having, during my official career, been also an amateur salvor and eye-witness, the very natural consequence has been, an endeavour to devise some reliable means for saving life in such cases; and after thinking out all sorts of plans during several years, some experiments in regard to displacement and flotation, nine years ago, led me at last to a practical result in the portable life-raft or boat represented by the diagrams, and the model on the table before you. You will observe that each raft, or half of the raft-boat, forms an open isosceles triangle of 20 feet side by $12\frac{1}{2}$ feet base; that the beams are composed of solid cork, stiffened with light wooden planking; that the centre of the triangle consists of a rope-net flooring; and that, in its portable state, each raft exhibits three beams lying parallel, which might be placed under the bilge of a long-boat, a grating seat on the deck of a ship, or any other convenient out-of-the-way but easily reached place on board.

I will now tell you, as briefly as possible, what has been done to test the soundness and value of the invention, and point out a few of the uses to which it may be applied.

After having perfected my plan, constructed a model, and submitted them to the severest scientific and nautical criticisms I could obtain, finding them to be approved, a raft was built with the assistance of friends, and, in the month of May, 1865, launched at Harwich, and tried off Felixtow, on the Suffolk coast, by the Inspecting-Commander of the Coast-Guard, by order of the Admiralty, in regard to its probable utility as an adjunct to the mortar and rocket aparatus.

The following brief extract from the account of the trial, by a gentleman practically acquainted with the subject, who was present on the occasion, is taken from the *Shipping Gazette* of the 19th May, 1865.

"Some experiments were tried, a few days ago, at Harwich with a life raft, the invention of Mr. Wood, the receiver of wreck there. It is in shape like a letter A, and is firmly built of wood and cork combined. The spaces between the strokes of the letter are filled in with a rope netting. The invention, which promises to be of great value to sailors, in saving life and property, and to the coastguard, in connexion with the mortar and rocket apparatus, has been presented by Mr. Wood to the public. The raft was put together and shoved over the pier, and immediately it was in the water righted itself. It was towed away to a spot off the P tower at Felixtow, when a line was thrown over the tug-boat, from a mortar apparatus on shore, and attached to it a double line, which being passed through a block, the raft was hauled backwards and forwards with ease by those on shore, showing its capabilities as a means of saving life from a vessel stranded and going to pieces on a lee shore. As many as 14 men got on board her at one time, and were landed across a strong tide. Experiments were then made with a view of ascertaining whether it was likely to capsize, and, although 10 men got into one corner of it, they were unable to send it under or turn it over. On the whole, the experiments were highly successful, and Capt. Jackson, R.N., of the coast-guard, will make an official report to the Admiralty on the subject."

I was present at the trial, with a number of nautical men of different classes, who pronounced the raft a success, and the naval officer who tried it, I have reason to believe, made a favourable report, on receipt of which the Admiralty sent another naval officer from a distance to report upon it. This officer admitted to me that the raft would be very useful in cases of emergency, but he did not think that ships would carry such a thing. He also objected to it as going back to first principles, and preferred a boat. A short time after I received a letter from the Admiralty, declining to adopt the invention. I sent the model to the Dublin International Exhibition, where it was much apppoved, and I received a medal and diploma, with a very gratifying letter, from one of the naval jurors, a perfect stranger to me.

I will not weary you with a relation of my numerous visits to town with my model, and fruitless endeavours to get my invention accepted. Suffice it to say, that I succeeded at last, in June, 1867, through the spirited kindness of the secretary to Lloyds' Salvage Association, until then a stranger to me, in getting my invention thoroughly overhauled by a special committee of naval and practical officers attached to that association, when it met with their unanimous approval, and each officer making his official report, the secretary enclosed them in a letter to the Board of Trade, drawing attention to the subject as of national importance.

I have now the satisfaction of seeing in clause 322 of the New Merchant Shipping Bill, instead of a proposed renewal of the present law in regard to boats, which has long been a course of vexation and annoyance to the shipping interest, without securing the desired end, an elastic provision that every sea-going ship shall be provided with efficient boats, rafts, or other appliances for saving life.

I will now take the half of the raft-boat lying before me in its portable state, put it together, and briefly describe some of its uses. You will observe, that in putting it together, no extraneous aid, beyond that of a marline-spike or a large iron nail, is required, each part being complete in itself. First drawing together the ends of the two side beams having the longest tongues, which extends the other ends and spreads the net flooring, I take the beam which has been lying in the centre, and place it at the base; run the iron rod through the meshes at the base of the rope netting, lay it on the shouldered screws running through the base beam; fit the centre longitudinal plank into the grooves made for it; lift the screw stanchions; draw the corners together, also the loose end of the cross brace from right to left; return the stanchions to their places; and, after a few turns of each screw, the raft is constructed. I then run a double life-line through the holes in the stanchions, by which means an open bulwark is made, and it is ready for launching. The net flooring may be tightened or loosened at will, with the aid of a marline-spike inserted in the hollow-headed side-screws. You see that the details are practically so simple that they could not well be misunderstood by the most ordinary intelligence.

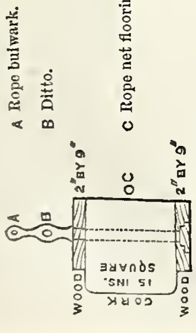
Supposing the second raft to have been put together at the same time as the first, and the vessel to be in the worst possible condition, lying like a log upon the water, with spars and boats gone, you will observe that, as they are made flush underneath, there would be no difficulty in pushing them overboard, and, when overboard, there are strong and simple means at the base of each for connecting them, so that they may be speedily converted into a wave-line two-masted lug-sail raft-boat, not only fit for sailing, but capable of being rowed without difficulty. You have now, to say the least, a skeleton boat, which can neither be capsized nor swamped; a means of making conspicuous signals of distress, and the power of progression and safe conveyance of about 50 persons, with cask, provisions, and water, either to the shore or to the fair-way of vessels. Further, should its flotation be insufficient for the number of persons it might in certain cases of emergency be required to carry, the power of increasing it speedily and without difficulty by means of water casks, or any spare spars or wood at hand, will, I think, be apparent. Seeing what was effected by one small boat and its judicious management in the case of the *London*, is it too much to suppose that many, if not the greater part of the unfortunate crew and passengers who went down with that vessel might have been saved, had she been supplied with a number of such portable raft-boats proportionate to her size and average complement of persons on board?

We will next view the matter from the coast, say from a life-boat station. Consider the raft with a pair of wheels temporarily attached to its sides as a carriage for the life-boat. A ship is on the sand, and the life-boat goes off to her assistance, but the water is found to be so shoal that she would be beached and lost in attempting to get sufficiently near to be of any service. There is the raft ready to hand, unlash the wheels, launch, and tow it off to windward as near the wreck as possible; then pay away the rope by which it is secured till it reaches the wreck (for it only draws four inches of water), and those on board can draw it to the lee side, jump in without fear of injury, and, casting-off the line, drift to leeward till picked up. Observe that there would be no risk to life in using it as in using a boat, and, however much knocked about and damaged it might become, even to the almost impossible extent of being broken in pieces, each piece would still be an effective life-buoy.

It has been suggested to me that if such rafts of convenient size were kept ready for use on board light-ships—say at the mouth of the Thames, or any other places where dangerous shoals abound, and too distant from the shore for a life-boat to be available in time, they would be on the spot, ready for salvage smacks or steamers to tow to vessels in distress, and very many lives be saved which would otherwise be lost; as I know for a fact that salvors are obliged to look on and see shipwrecked crews within hailing distance, drop exhausted one by one from the rigging, and perish before their eyes, owing to the utter impossibility of their being reached in a boat through the shoal and broken water, on sands, for instance, like the Shipwash, Longsand, and others. Again, is it not probable that, as a means of bringing a whole crew on shore at once, it would in many cases be preferable to the breeches-buoy, which can only bring one at a time, and with these additional advantages,

Section of Beam,

Showing its composition, also depth from upper bulwark line to net flooring.



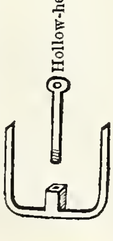
A Rope bulwark.

B Ditto.

C Rope net flooring.

Metal Bands,

Containing nuts to receive hollow-headed side-screws sustaining and confining net flooring rods.



Hollow-headed side-screw.

Hollow-headed Screw Stanchion.

A Ring for bulwark line.

B Ditto.

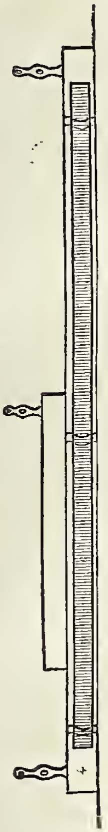
C Shoulder resting on beam.

D Screw passing through do.

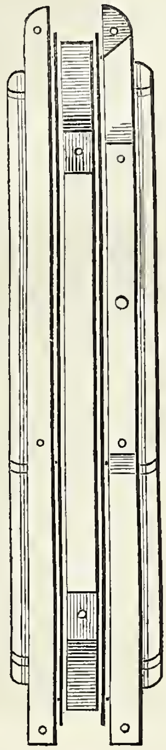
E Nut to receive screw, let in flush on under side of beam.

Shouldered Base Screw.

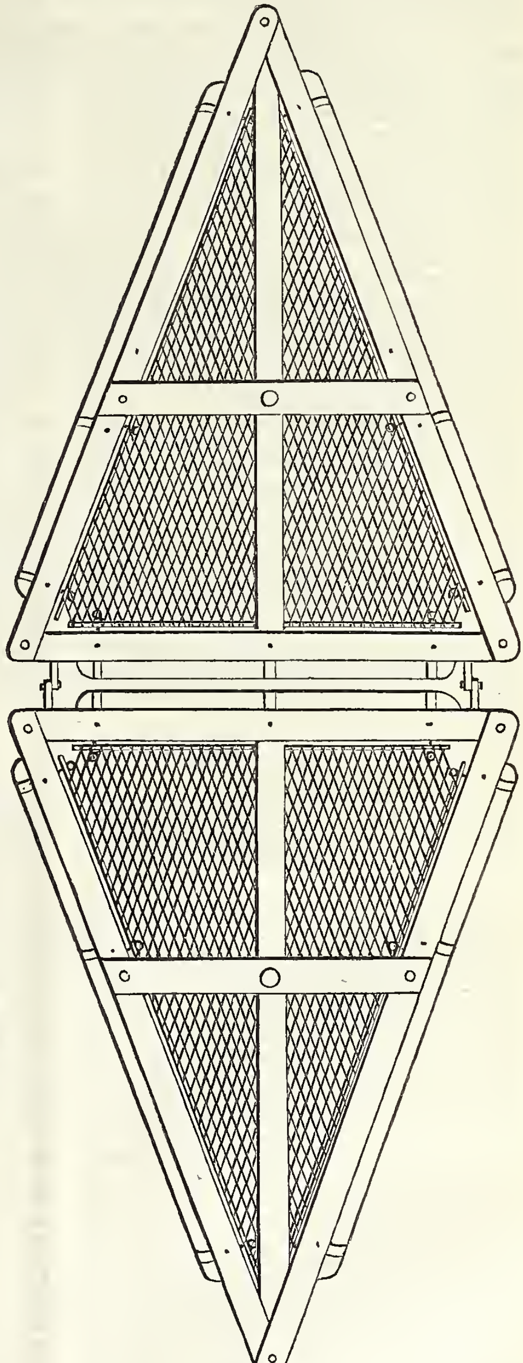
Side View on Deck.



Bird's Eye View on Deck.



Metal Rod sustaining Net Flooring.



Raft Boat.

that women and partially-disabled men could avail themselves of it, and that, requiring no elevation to work it, as the breeches-buoy does, there would be no necessity, in the case of a vessel being dismasted, to draw the people through the water, at the risk of drowning them, as, I fear, does sometimes happen.

Such is my portable life-raft and raft-boat, dedicated from the first as a free gift to the sea-going public, for the purpose of saving life. I have spared no pains to make the gift worthy of acceptance; and all I ask in return is that it may receive a fair trial, in which case I shall look forward with hopeful confidence to its being the means of saving many valuable lives.

Quoting a suggestion of mine, headed "Boats," which will be found at page 72 in the Appendix to the Report of the Committee of the Society for Improving the Condition of our Merchant Seamen, &c., 1867—"I think it would be advisable to collect descriptive particulars of the various auxiliaries which have been invented of late, and selecting those apparently possessing the greatest merit, have them exercised in competition in heavy weather, by disinterested competent persons, at the Goodwin Sands, or any other suitable spot or spots, when a selection of the best might be made, with a view to its compulsory adoption, with the necessary boats."

I was glad to learn, a few weeks since, that the Council of this Society, acting on a suggestion of Mr. Gray, the Assistant-Secretary to the Marine Department of the Board of Trade, had determined on a step which cannot fail to prove of value, though apparently with reference to boats only, viz., to appoint a special committee of inquiry as to what qualities should be deemed essential in a good ship's life-boat, and, on certain conditions, to offer a medal for that which might be considered the best.

I will leave now what I have advanced to consideration and discussion, in the hope that my somewhat anxious labour, during a very limited leisure, in regard to the several matters treated may be productive of good results.

DISCUSSION.

At the conclusion of the paper, Mr. Wood exhibited a model of his raft on the scale of an inch to a foot, which would occupy on board ship when stowed about 3 ft. 6 in. by 20 ft., and the probable cost of which would be about £25.

Admiral Sir E. Belcher thoroughly agreed with the principle of a raft, having carried out the same idea 30 years ago. He said he made it a point in nearly all the ships he commanded from 1830 to 1833 to practise his men and officers in constructing from the spars on board ship such rafts as could not only be made available for floating, but would also carry sail; and a sketch of one of these rafts he happened to have with him, representing a raft made from the spars of a frigate. In a 61-gun frigate he found the two spare topmasts would form the two keels as it were, and the topsail yards the outrigger spars of a raft which would give a lifting power of 7,780 lbs., or over three tons, 12 inches over the water line, so that when the cross spars were fitted, and a sail added, he could get almost any speed out of it, and it would conveniently carry 50 men. In the late Arctic expedition it was found that the hermetically sealed cases of provisions could be made available in constructing a raft, each of them giving a power of flotation of about 123 lbs. He had intended reading a paper himself on this subject, showing the importance in the mercantile navy of carrying their provisions on deck in this way. There was always a difficulty about carrying water on a raft, but he had found that by the use of portable soup, done up in the form of sausages, there was less necessity for drinking than when salt meat was used, and another valuable expedient was that adopted by Bligh in his unfortunate expedition, when he made his men jump overboard and so absorb moisture through the pores of the skin. In 1830, he had had a conclusive proof that a raft in the shape suggested by Mr. Wood was capable of standing the strongest surf on the coast of Africa. When he was off the mouth of the Gambia in that year he engaged to erect a flag-staff on St. Mary's Island to assist vessels coming in; but in towing out the boat containing the materials she was driven inside the surf and was supposed at first to be lost, much to the chagrin of the Governor. However, he set to work, anchored his ship in five fathoms, and taking two barges for the sides of the triangle, he, with a top mast and some other spars, built just such a raft as had been described as a breakwater, and veering the barges in, put some spars across them, and by this means got the boat out of the surf and managed to erect the flag-staff; thus proving by actual experience what a raft of that shape could do. Beyond the question of saving life, the paper seemed to deal with the whole arrangement of the merchant service, particularly as to providing seamen. He must say that all the experience he had had of seamen from the merchant service, which was rather considerable, had not led him to such a low estimate of them or their education as seemed to be entertained by the author of the paper; and one man, who had been for some time bow-man in his gig, was now commander of a Cunard steamer; so that his education could not have been very defective. Some years ago, in connection with Mr. Adderley Sleigh, when the question of floating breakwaters was much mooted, he had proposed something very similar to Mr. Wood's raft, to be worked by steam, but having four wheels, two guiding wheels and two broad wheels behind, which would run easily over the sand, which would also act as paddles when the machine was afloat. He was quite satisfied, from having discussed the matter with engineers, that it was quite possible to have steam rafts which could go to sea, over any flats or sands, and which would make much better weather of it than a life-boat.

Mr. Thomas Gray (Board of Trade) said they ought to feel indebted to Mr. Wood for the labour he had bestowed on his paper, although he did not consider that the title was properly applicable to the whole subject-matter of it. However, in a meeting of that character, he took it they did not want to discuss what particular form of life-boat was best, or whether food should be carried in any particular manner—they rather ought to consider what should be the scope and aim of legislation in connection with the whole subject, leaving minor details to be settled by practical men out of doors. The first part of the paper referred to the scarcity of seamen, or rather the scarcity of British seamen, whose place had to be supplied by foreigners. He for one did not believe that they had suffered in any way from this scarcity, although doubtless they would have done so had they been unwise enough to exclude foreigners from their ships when the coasting and foreign trade of the empire was thrown open. It then became necessary to call in the assistance of foreign seamen, and that necessity still existed. With regard to parish apprentices and training ships, he might say that the sight of a ship like the *Chichester* always awoke in him feelings of the liveliest pleasure, inasmuch as he knew it was the means of reclaiming numbers of boys from a life of idleness and crime. But there was another side to the question, and a very important one. They did not want to man the British mercantile marine with paupers or street Arabs. From a philanthropic point of view it was wise to do what they could with these boys, but it was neither wise nor just to the shipowner to put any pressure on him to employ these lads in preference to the ordinary and better stuff that British seamen were made of. The British seaman, as they knew him, came from the sea-coast and agricultural districts. The class of street Arabs, though not lacking intelligence—sometimes even evincing rather too much—often showed a deficiency in physical power and stamina. He did not

know that he could offer any useful observations on the subject of floating wreck, but the next topic, that of deck-loading, was of considerable importance. Mr. Wood proposed that no dead weight of any description should be allowed, that no animal or other cargo should be carried on a steamer's bridge, &c. Now, to interfere with the loading of a ship was to interfere with the business of a shipowner, and if you did that at all, it would only be logical to do so entirely. Again, by making such a provision you would virtually shut up certain classes of trade altogether. As one instance with which he was familiar, he might mention the steamers that plied from Glasgow round the Hebrides and Orkneys and to Wick. They were really steam omnibuses. They touched at one place perhaps, and took in a few bags of periwinkles; at another a few bags of meal and a sheep or two; then at another island they would deposit the sheep to graze, and exchange the meal for salt fish, and so on through the whole journey. If these steamers could not carry cargo on deck their trade would be stopped altogether. Again, if such a law were made, it would easily be defeated. They would only have to put an awning deck above, which would be kept clear, and then they would carry even more than at present on the deck, and so perhaps render the boats more unsafe than they are alleged to be at present. He did not think government ought to interfere in any way in the carrying or stowing of cargo, which must be understood and performed better by the shipowner than by any government agent. With regard to overloading and load lines, the object with which keels carrying coals were first marked, was purely a fiscal one. The vessel was loaded down to a certain line, and nails were then driven in at the stem and stern to show how much cargo she was to carry; she was taxed for that amount, and was not allowed to carry more. In the same way the registration of tonnage was required purely for fiscal purposes. A register ton simply meant 100 cubic feet of internal space, and the object of fixing it was to apportion the light dues to be paid by each vessel. It had nothing whatever to do with the carrying capacity or the load-line. The formula given by Mr. Moorsom, as quoted in the paper, was only offered as a rough-and ready method, as stated by that gentleman, because some owners were unwilling to take the trouble of making the necessary deductions alluded to. With regard to a load line, all he could say was that, in 1853, the Board of Trade consulted a number of practical persons throughout the country on this subject, and the result was they could not get any two persons to agree as to the method of calculating such a load line; but Mr. Wood now proposed that there should be two, according to the quality of the cargo, which would greatly increase the difficulty. There would be immediate complications if the vessel carried a cargo partly composed of one kind of goods and partly of another, and the load line must vary according to the proportions. The real remedy appeared to him to be this, that the government, instead of interfering in any way with the loading, should see that on both stem and stern the correct draught of water was placed. A record would then be kept of the draught of water of all ships going to sea, and it would rest with the parties interested to see whether any ship went to sea properly loaded or not. The proposal, that the collector of customs should detain a master's certificate because his vessel was overloaded appeared specially objectionable, as it made the captain suffer for the fault of the owner. With regard to lifeboats and rafts, he considered they were exceedingly necessary, but he feared British shipowners would never be persuaded to carry a raft instead of a boat (though in a big ship it might be carried as well), because the one could be used for ordinary purposes and the other could not. The last thing to be done, therefore, was to provide such a boat as should be available both for ordinary purposes and also for saving life in case of accident. The matter under discussion was but one part, and that a small one, of a very large question. Prevention, it was well known, was better than cure, and prevention in some shape must be looked to; the only question was how it could be applied. Some people wished to prevent loss of life by inspections, certificates, and government interference, whilst another mode was to abolish government interference altogether, and to leave the owner responsible for his own acts, and to make him pay in the event of culpable neglect, or any abuse of the power entrusted to him. Take the case of railways; he did not believe that if a Board of Trade official were to inspect every line of railway daily, sit on every engine and watch it, be at every signal post, and smell every man's breath to make sure he was not drunk, there would be so few accidents as under the present system, by which heavy damages were given against railway companies in case of accidents. Let a shipowner do his business and mind his business, and let the underwriters and government do the same. Let ships be lost and cargoes be lost, so long as underwriters are too sordid or too lazy to refuse payment of doubtful and fraudulent cases. But if the shipowner puts the country to expense, or causes or contributes to the death of a citizen, let him have justice without mercy. It was precisely the same with the owner of a mine. He had just been talking to the owner of a large mine in the north, who told him he had just had a boiler blown up. He inquired how that came to happen, and he said he did not know; the overlooker inspected it every week, the under overlooker every day, and it was also insured in the Boiler Association, on whose behalf it was also inspected regularly. It had been inspected and repaired only three days before it blew up, and the inspector congratulated him on having so good a boiler. Again, all the men had lamps, which were inspected by men in his own employment, who were responsible. If all this were done by a goverument inspector it would not be done so well, and the responsibility would be shifted from the right shoulders to the wrong ones. The evil of modern legislation had been that it was, to a great extent, sensational. When the *Cricket* blew up, everybody said what a horrible thing it was, and that explosions must be prevented, and the consequence wa that legislation was undertaken in a panic, and that was the basis of the Steam Navigation Act, and of parts of the Shipping Act, and he was afraid to say how long the system would be perpetuated. People had a superstitious idea that because a ship had been inspected she must be safe; if they could only get over that superstition and apply the proper remedy, he believed many difficulties would be removed, and there would soon be a diminution in the loss of life at sea. He confined himself to the question of loss of life, because, of course, property must look after itself. He could hardly do better than conclude by quoting a passage from Herbert Spencer—"Ever since society has existed, disappointment has been preaching put not your trust in legislation, and yet our trust in legislation is scarcely diminished. We have long since ceased to coerce men for their spiritual good, though we have not yet ceased to coerce them for their temporal good, not seeing that the one is as useless and unwarrantable as the other."

Mr. Lambton Young (Royal Humane Society) desired to say a word or two on the paragraph in the paper which alluded to the Society having offered a medal for the best model of a ship's life-boat. During last autumn he had accompanied the channel fleet on their cruise to Gibraltar, and on passing Cape Finisterre on their return in a heavy gale, one of the davits of the port cutter was sprung, and seven men were ordered out to try and secure the boat. The ship began to roll so, however, that they were ordered in; five came in, but two poor fellows clung on, and a heavy wave swept them overboard. There were immediately plenty of volunteers to go after them, but the captain very wisely would not allow a boat to put off, as she would inevitably have been swamped. Now, if there had been proper life-boats, very likely those two men would have been saved, whereas one sank quite close to

the vessel, and the other clung to a life-buoy, to perish, undoubtedly, after a short interval. Several times on the homeward voyage he had noticed the difficulty there was in lowering boats from the quarter in heavy weather, and on more than one occasion they were of opinion that the boats had been smashed by the ship dropping upon them as it were, there being a hollow in that part of the hull of a ship under which the boats got. He would, therefore, venture to suggest whether the Society could not entertain the question of having davits for lowering boats amidships, which he believed could easily be arranged in the case of the large ironclads; they might, if necessary, be shifting davits, and be only used when it was necessary to lower a boat in a heavy sea. He also noticed that the number of boats in the *Northumberland*, which was the vessel he was on, were not adequate to carry the crew, which he thought was a great mistake, especially as in an iron ship there was not sufficient dunnage for making a raft.

Mr. Hyde Clarke, D.C.L., said it must be a great gratification to the Council that their efforts in the direction of improving ships' lifeboats had been so well appreciated, and the suggestion just made as to the davits amidships would receive consideration. The paper of Mr. Wood was very valuable and comprehensive, and, in connection with the earlier part of it, he might mention that the subject of naval drill had not been forgotten by the Council of the Society. Last year a committee was appointed to consider the introduction of military drill into schools, when it was suggested that, in a maritime nation like England, naval drill was certainly not less important; but in the course of inquiries which had been made on the subject, it was found that one great impediment to its introduction was the cost of the necessary material. It might be said that the guardians should provide these matters, but the ratepayers were already very heavily taxed, and were very apt to consider this sort of thing as a luxury rather than a necessity. Surely, however, it was part of the national defences to habituate the population to a seafaring life; and he thought the government might, at a very small expense, do a great deal to aid this movement, both by distributing old stores, which were often sacrificed for almost nothing, and by providing naval instructors, who might be selected from the pensioners. He did not like to differ in any way from one who had studied these matters so closely as Mr. Gray, who had laid down some very important principles with regard to the limits of government interference with which he cordially agreed, having taken a part in the first campaign of resistance to the Board of Trade inspection of steam boats, which was successful for the time, though not eventually, and also in a similar resistance to the principle of railway inspection, which was carried under motives of panic; but he could not go with him in what he had said with regard to the expediency of drawing a portion of our mercantile marine from pauper children. It did not at all follow that all paupers were necessarily of the street Arab class, for many of the children found in the union and district schools were not habitual paupers, and did not belong hereditarily to that class, but had been brought into that position by misfortune, such as the death of one or both of their parents. Many of them possessed what he might call thoroughly independent hearts, and were equal to any other members of the working class, and he could see no objection to recruiting the merchant service from such sources, and it certainly seemed desirable to give such boys an opportunity of benefiting both their country and themselves. No doubt Mr. Gray was right with regard to the street Arabs; any one who visited the schools in which they were placed must have been struck by the evident want of stamina they evinced, many of them requiring great care even to render them fit for any employment whatever; but in such cases it appeared to him that there would be a kind of natural selection, which would prevent any unfit subjects entering the navy. He thought it a great pity that, while the standard of food for seamen had been raised, the standard of education had not been also put higher, for by so doing there could be no doubt that in very many cases they would prevent loss of life.

Mr. Stephenson (Lloyds) said this subject seemed to divide itself naturally into two parts—the saving of life before a vessel was lost, and afterwards, and he believed the first was by far the most important. He wished he could agree with Mr. Gray in thinking that human life would be pretty safe if left in the hands of shipowners, but he feared this was far from being the case. He had just prepared a table relating to one particular class of trade, which said more upon the subject of overloading than any theory could do. It showed the number of Baltic steamers lost in the year 1869. Twenty-one were lost entirely, and in a great number of instances the whole of the crew were lost; but the remarkable part of it was that sixteen were lost in three months, between September 2nd and November 17th. The reason for this was, that just at that time of year, before the Baltic ports were closed for the winter, there was a rush to fill the steamers, and everyone was overloaded. One vessel from Sunderland to Cronstadt, with registered tonnage 872, and horse-power 140, took a cargo of 1,594 tons of pig and bar iron; and another, of 511 tons register, horse-power 80, took 803 tons of railway iron, and a general cargo. In the face of such facts as these, could they trust shipowners not to overload their vessels? What was the remedy? He agreed with Mr. Gray that no inspection in the world would be of much use. He did not believe any Board of Trade official or representative of Lloyds could say, absolutely, that a vessel was properly loaded and fit to go to sea; and if he were qualified to do it, it would be a mischievous thing, because if a vessel were overloaded, she could not be seaworthy, and if not seaworthy her insurance was forfeited. A heavier penalty than the forfeiture of the insurance could not be put upon an owner, but this would require the fact to be proved, and this brought him to the real point of the question. They should know, whenever a vessel started from a port, whether she was fit or not to go to sea. Let them only know it; he did not want anybody to express their belief that she ought not to go, or to tell a captain he ought not to take her, or anything of that sort. Only let it be put on record in the public papers, or in any other way, that such and such a vessel, of 850 tons say, had gone to sea with 1,500 tons of iron in her, and they (speaking for insurers whom he represented) would take upon themselves the infliction of the necessary penalty. He did think the legislature might go so far as to require some such record as this to be kept of the fact, that a vessel had gone to sea with such and such a cargo on board, when it could be easily known whether or not she was likely to arrive at her journey's end. If this were done, the rest would take care of itself. He would urge this kind of operation much more earnestly than the construction of life-boats, or rafts, or anything of that kind. The loss of life was attributable chiefly to the state in which vessels were sent to sea. If time permitted, he might go into many details as to the construction of vessels, their loading, the class of iron of which they were built, and a thousand other things, but he believed the real secret lay in preventing a ship being lost, not in saving lives after she was wrecked.

Admiral Ommaney said he had come there for the purpose of hearing what could be said as to the cause of the loss of life at sea, and he believed the last speaker had pointed out the gist of the whole matter. On looking over the wreck register of that day, he found that during the last 10 years 500 ships had been lost from unseaworthiness. That was a state of facts which could be cured somehow or other; and another strong fact was, that out of the total loss of colliers, a most terrible amount arose from sheer negligence, for one-third of the whole number took place in broad daylight, and in fine weather.

A great many laws had been made, but the evil was that nobody saw them carried out; for instance, laws were made for regulating ships' lights, but still ships were allowed to go about with very imperfect lights. Half the accidents which occurred he believed were either from a bad look-out or some negligence of the laws which had been established to prevent collisions. He thought, therefore, that, instead of turning their attention to making new laws or provisions, they should see that those already made were thoroughly carried out. With regard to training seamen and educating boys for the mercantile marine, there was one point which persons should always bear in mind. It was no use trying to make sailors out of boys who had not a natural inclination for it. He did not wish to say anything against reformatory institutions, but he thought in a great many cases boys from these institutions got to a certain point, and then did not like the sea, and they would, therefore, never make good seamen. With regard to raising the standard of education of British seamen, they must never forget that what was wanted was to make a man a really good seaman. Mr. Gray had, as he understood, suggested that there should be a change in the tribunal for trying cases connected with disasters at sea; and he certainly believed, if these cases came before a jury, there would not be the same laxity shown as there was now in many cases where there had been lamentable loss of life through evident negligence. The carrying of cargo, &c., on deck was a very important point, for he had noticed on one or two occasions, when he had been unfortunate enough to take a passage in merchant vessels, that the deck was loaded with jute, no tarpaulin over it, whilst sparks from the funnel were flying about in all directions, and all sorts of things were covering the deck from one end to the other; whilst on looking at the table put up by the Board of Trade, to regulate the number of passengers to be carried, he found there were about double the number on board, which, of course, caused great inconvenience to everybody, and he was quite sure if any accident had happened there could scarcely have been a life saved, owing to the confusion which would have inevitably ensued.

Mr. Lloyd Wise could not speak from any practical experience of ship-building, but one or two points occurred to him, which he took the liberty of suggesting. With regard to what had been said about interfering with the business of a shipowner, he did not see that the regulation of how deck-loads should be carried was any more interference than the regulations which were now made with regard to the number of passengers in an omnibus or any other public conveyance. He therefore thought the way the cargo was carried on deck might be regulated according to the load-line of the vessel, the class of vessel, of course, being taken into consideration. He had himself noticed steamers coming up the river so heavily laden on deck with cattle, as to cause a very considerable rolling motion, even off Queenhithe on a fine morning, and how much more, then, must they roll at sea. With reference to the raft, he should like Mr. Wood to state whether there were any loose parts likely to be mislaid in the confusion that would arise in case of accident, or any difficulty in getting the various parts together if the sailors happened to be more or less numbed with cold.

Mr. W. M. Venning said a statement had been made by one gentleman to the effect that, if any loss arose from overloading, it would generally fall on the shipowner, but he could not quite agree with that, inasmuch as there were a class of people called underwriters, who acted as a sort of buffer to prevent the loss in such cases falling on the owners. From various causes, they were unable or unwilling to interfere properly in such cases, owing to the very defective organisation that existed amongst them, and the great competition which made underwriters exceedingly anxious to acquire a character for being very particular in their settlements. The consequence was that very little real supervision was exercised in the payment of losses. These losses, as had been said, very often arose from overloading and unseaworthiness. Of course, there were black sheep in every class, and there were good owners and bad owners; but he was sorry to say the latter class were very numerous. He believed they frequently let their ships go out overloaded, because at the present low premium it was comparatively easy to cover her for a few extra hundreds, so as to secure themselves in any event. If the ship arrived they got a good freight, and if she was lost they got their profit out of the underwriters. However, he was glad to say that there was more supervision now than there was a year ago, and he had no doubt that a year hence there would be still more. He would not detain the meeting longer, or he might give various particulars to corroborate what he had said. He held in his hand the particulars of a vessel which put back to Liverpool only ten days ago, in which he would not have gone to sea if anyone had given him £20,000. He saw the captain of her, but he must not say what his opinion about her was, as, in the ordinary phrase, he had his topsails on board. She was built of steel, had been out to the Southern States, and had since been lengthened 20 ft. He gave the particulars of some parts of her construction, which he thought much too light, and, in fact, in several parts, as, for instance, just at the turn of the bridge, he saw evident signs of her being violently strained, although she had been only 10 days at sea, and she had to put back again. Another ship, very similar to her, had also been similarly lengthened; and when vessels were sent to sea in such a state, there was no wonder that accidents occurred. He did not say there ought to be government supervision, but, certainly, unless there was supervision of some sort, the state of affairs would be a positive disgrace to a maritime nation.

Mr. Stirling Lacon said he had been urging for some years the evils of over legislation, and he had therefore heard with infinite satisfaction the remarks of Mr. Gray, almost every word of which he thoroughly endorsed; and he was only sorry that the department of which that gentleman was so distinguished a member, did not carry his principles into practice. The old Merchant Shipping Act contained 578 clauses, and he was sorry to say that the Consolidation Act about to be laid on the table of the House of Commons, contained between 700 and 800 clauses. The former Act passed through Committee at one morning sitting, and he only hoped that the new Act would not meet with the like treatment.

Mr. Robert Smith suggested that a clause should be introduced into the Merchant Shipping Act, directing every captain to carry a life-belt for each of the crew and passengers, instead of only two life-buoys, as at present. The only object of the present provision could be that there should be some ready means of saving life in the case of a man falling overboard, for in case of wreck on a lee-shore something much more complete was required. By such a clause as he suggested he believed many thousands of lives would be saved, and he might add that this provision had been adopted in the American Marine Act.

Mr. Wood, in replying to the various observations which had been made, said that, only a few moments being left to him, he could of necessity say but little in reply to the various speakers, and must, therefore, content himself with a few passing remarks. The difference between his raft and that described by Admiral Belcher was this, that the latter required to be made on board, and, as he had pointed out, it often happened that there were no spars, &c., available for such a purpose, particularly on iron vessels, whilst the one he proposed was always ready to hand; again, unlike a solid raft, persons could not be washed off it, and if time were precious, provisions and other necessaries could be pitched into it in any way without risk of losing them. Mr. Gray appeared to doubt the scarcity of English seamen, but he held in his hand statistics, issued by a committee

composed of some very celebrated shipowners, which plainly showed there was a great increase in the number of foreign seamen, viz., from 13,200, in 1854, to 31,817, in 1867; in fact, they had increased in proportion to the registered tonnage, whilst the number of British seamen had not. He did not propose to compel shipowners to employ paupers to man their ships, but he thought they would form a valuable auxiliary; and that by training them as sailors a benefit would be conferred on all parties. In some other points Mr. Gray had misconceived him. He did not propose to forbid the carrying of deck loads altogether, as he was perfectly aware that certain classes of cargo could not be carried in any other way; he suggested that it should be regulated, and that the carrying of dead-weight on deck should be absolutely forbidden. He had also clearly stated, as was remarked by Mr. Gray, that load-lines were substituted for purely fiscal purposes. Mr. Young had advocated lifeboats in preference to rafts, and he did not by any means propose to supersede them, but he maintained that there were many cases in which a boat would be capsized or dashed to pieces where a raft would be valuable. Mr. Stephenson's statistics with regard to dead weight were very valuable, and he had in his hand a return from one of the northern ports to the same effect. In reply to Admiral Ommaney, he would say that he did not contemplate driving lads to sea, but only affording facilities to those who felt a desire to do so; and in answer to Mr. Wise, he might say that the only loose part of the raft was an iron bar, which secured the bottom of the netting. It took about twenty minutes to put the raft together at Harwich, and there was no reason why it should take longer on board ship. With regard to life-belts, no doubt it would be a good thing to have a good supply of them, but he would observe that it was in the power of every captain to supply them, at a cost of about 1s. 3d. each, by simply providing canvas bags into which waste corks might be put instead of being thrown away. The only objection was, that these belts, unless great care was taken of them, got broken and useless.

The Chairman, in rising to propose a vote of thanks to Mr. Wood for his able and comprehensive paper, said he must add a remark or two on points which had not yet been touched upon. In the first place, it was fixing an improper stigma on any human being to say that, because he was born in low circumstances, he was therefore to be considered and treated as a pauper during his whole career. The object of society and of legislation should be to lift up these castaways and restore them to their proper station, and thus save the expense which must fall upon the State, and which doubled and reduplicated that namely required to prevent the consequences of their falling into idleness and crime. The very best school, and that which had been productive of the best results in this direction, was that sharp and severe discipline and that close supervision which was possible at sea, but which was almost impossible on shore. No training or preparation on land would ever make good seamen, any more than you could ever get good technical education outside of a workshop. If it was desired that boys should be taken from the streets before they were allowed to become worse than useless members of society, it would be necessary to give an inducement to those who were to employ them, by giving them their labour free, and making their obedience certain. If that obedience were insecure—if the boys were permitted in any way to set their apprenticeship at defiance, people would decline to engage them. But where proper conditions were observed, it had been proved over and over again, that these boys did make good seamen, and *pro tanto* the streets were relieved from vagabonds, and the reproach was removed of having mainly foreigners to man our merchant vessels. He should like to hear from any practical seaman whether their experience pointed to floating wreck as being in any considerable degree the cause of accident; his own impression being that it was not so. One cause of loss adverted to in the paper was the parting of ground tackle, and this was not at all to be wondered at when they considered the principle on which cables were made. The practice of engineers in making cables to support heavy strains, as in the case of suspension bridges, was to make them three times as strong at the saddle of the bridge as in the middle of the span, whereas in ships' cables, every link that was given out in order to have a long scope to secure the ship in a heavy seaway, added to the weakness of the cable. They were not made scientifically strong, and he hoped this matter would receive speedy attention. With regard to legislation, he confessed himself to be of opinion that legislation in these matters was the worst possible fallacy applied in the worst possible way. What a man could not do for himself legislation should be very slow to do for him. If underwriters would insist on proper care being taken, on pain of refusing to insure, we should not be able to speak of the greed of insurers; and if shipowners, on the other hand, would consider as well the lives of the crew, and the credit to be obtained by properly conducting freights to port, as the gain to be made of any particular cargo, they would cease to hear of the greed of shipowners. If captains were given the proper responsibility which ought to attach to them, and if they had to report to the Lloyd's agent when they left port that they considered the ship properly loaded, and fit for sea, and if underwriters refused to insure unless such a certificate were given, then the proper test would be applied as to the sea-worthiness for each particular voyage. Laws, whatever they might do, would utterly fail to reach all descriptions of ships under all possible circumstances. With regard to the sufficiency of boats on board of men-of war, he believed the two gallant admirals who were present would bear him out, in replying to Mr. Young, that the naval authorities well understood what boats were required, and he did not believe there was an instance of loss of life from such a cause. All the men were thoroughly disciplined, and each one knew what to do in case of disaster, and, as had been said by Admiral Sir Edward Belcher, there were plenty of appliances on board of any man-of-war for the construction of a raft, whether the vessel were built of iron or wood. With regard to the steel vessel mentioned by Mr. Venning, he might inform him that, according to the figures he had given, considering the material of which the vessel was made, she was much stronger than any iron ship now afloat in the merchant service; and the straining which he had observed probably arose from the great length of the ship in proportion to her breadth of beam, and the elasticity of the material. She was quite strong enough, but the material was elastic, and sufficient provision had not been made to meet that elasticity.

The vote of thanks was then put and carried unanimously, and, having been briefly acknowledged, the meeting separated.

THE PRESS ON THE EDUCATIONAL CONFERENCE.

The *Times*, in a leader referring to the Educational Conference at the Society of Arts, says that "the result, perhaps, indicates that there is good reason to hope for a practical agreement among moderate men; but it seems to indicate also the necessity of compromise, if this desirable end is to be attained."

In reference to the proposal to appoint an Education Minister, the *Times* thinks "some such central agency would probably be beneficial." It points out the significant fact, that though the chairman referred to the 'religious difficulty' only to dismiss it, and one or two other speakers treated it as a matter only interesting to "enthusiasts and doctrinaires, this question consumes nearly half the reports of the speeches made. The *Times* evidently doubts the feasiblity of introducing any unsectarian

system of religious training which will satisfy all denominations. With reference to government grants, it thinks that the policy of the code will now be reversed, and the rule will be "to help those who will not help themselves," but at the same time it believes "there is a growing disinclination to render education gratuitous."

The *Pall Mall Gazette* thinks the conference "may, on the whole, be considered one of good augury." As to the teaching of "unsectarian religion," it feels "a certain difficulty in understanding what kind of religion that would be from which all sectarian views had been eliminated," and quotes a certain fable of Æsop's about the two wives of an unlucky husband, one old, the other young, the elder of whom plucked out his white hairs, while the other eradicated all the black ones. "The result was eminently unsectarian, but not quite satisfactory to either." It thinks that the question is not so much what dogmas are to be taught, as the degree in which we can safely entrust the business of education to the clergy of the different denominations; but at the same time it expresses a hope that "when a satisfactory system is fairly in operation, there can be no insuperable difficulty in providing that secular subjects of learning will be thoroughly taught, while the clergy may have sufficient opportunities of administering instruction to members of their own sects, without being entrusted with the actual management of the schools.

THE EDUCATION QUESTION IN PARLIAMENT.

The following is the brief paragraph in the Queen's speech relating to this subject:—

"We are further directed by Her Majesty to state that many other subjects of public importance appear to demand your care, and among these especially to inform you that a Bill has been prepared for the enlargement, on a comprehensive scale, of the means of National Education."

In the debate on the address, the mover in the House of Lords, the Marquis of Huntly, said that the time had arrived for the introduction of an efficient measure for the education of the people, and, though not acquainted with the government scheme, he trusted that it would prove a solution of the many difficulties which surrounded the question. While bearing his humble testimony to the valuable services rendered by the clergy in promoting the education of the labouring classes, he was bound to add that the country required a thoroughly national system, such as would root out ignorance and reach even the vagrant classes. He hoped the forthcoming measure would tend to improve the condition of the country, elevate the morals of the people, and diminish crime.

Lord Cairns said—"I rejoice to think that subject is one upon which, though we may differ as to the means, we can entertain no difference of opinion as to the desirability of the end to be attained, and I am willing to express a sanguine hope that, the same object being in the minds of both sides of the House, the session may not pass over without the passing of a large and comprehensive measure for the improvement of education."

Captain Egerton, the mover of the address in the Lower House, said that though there were differences of opinion on the matter, one thing had been decided by the voice of the nation—that the children should be educated. He thought that, on closer examination, the religious difficulty might be found to be not so great a one as was generally supposed. He felt sure that few, if any, of the earnest men who had taken part in the discussions which had been held all over the country wished to exclude religion from education; and he thought it would be hard if, when the measure was discussed, means should not be found for arriving at a settlement.

Sir Charles Dilke, the seconder, said the announcement upon the subject of education in her Majesty's speech had been received with much pleasure by the House, but he believed that announcement had been largely interpreted, and, read by the light of the words of the right hon. gentleman the Vice-President of the Committee of Council, used in his recent speech at Bradford, in which he said that no religious difficulty would be allowed to stand in the way of education, he believed that those words expressed not only the feeling of the government, but also the general feeling of the country. He merely expressed the opinion shared by many hon. members on that side of the House, when he asserted that the constituencies had made up their minds to require the adoption of some system of compulsory attendance, and would be ready to make great sacrifices in order to secure a good system, and would be prepared not only to give up religious teaching in the schools, but also to pay the increased cost of the new system out of their own pocket.

The speeches of Lord Granville, Mr. Gladstone, and Mr. Disraeli were almost entirely directed to the Irish question, and the subject of education was not referred to.

The Right Hon. W. E. Forster gave notice that on Thursday week, the 17th inst., he would move for leave to bring in "a Bill to provide for primary and elementary education in England and Wales."

CORRESPONDENCE.

A NEW HOUSE FOR THE SOCIETY.

Sir,—The letter of "Cosmos," in last week's *Journal*, has raised a question of the greatest importance to the future welfare of the Society of Arts, at least, so it seems to me. I was not aware, till I saw that letter, that the Society possessed no funded property, or that its income depended entirely upon the subscriptions of the members. Such, however, being the case, it follows naturally that the larger the number of members, the greater the means for promoting the objects for which the Society was founded. In seeking new members the Society offers certain advantages in return for the subscription asked for. These include the privilege of attending valuable and interesting lectures and meetings, the use of a library, and an opportunity of studying the books therein; and it was on the faith of these statements that I joined it last year. In common, however, with others, I find that the Society is unable to fulfil its promises. I received some weeks back, from the Secretary, tickets to admit myself and friends to the Cantor lectures of Mr. Norman Lockyer, on "The Spectroscope;" and on the night of the first lecture I went to the Society's house with some ladies, at about a quarter to eight, to find, however, the staircase crowded with two streams of persons, one trying to get up, and the other struggling to get down, because the lecture-hall was already over-full. The next time I was a quarter of an hour earlier, but with a like result; and, as I cannot afford to waste an hour on the steps outside the Society's house, in order to get a place inside, I refrained from going to the third lecture. I have, more than once or twice, wanted to consult the library, but the library itself is used as a sort of exhibition room for models and pictures, and though it is, no doubt, desirable to have exhibitions, it is scarcely fair to do so at the expense of the utility of the Society in other ways. The reading-room is partly an office and partly a reference-room, so that quiet study is out of the question. I joined the Society not from a purely philanthropic motive, but from a desire to avail myself of the advantages it offered, content, however, if a portion of my subscription went towards the general good. I feel somewhat that the Society had no right to ask for my membership, if it could not accommodate me. I have no doubt that the number of members might be considerably increased i the Society took some means to afford them accommodation. This, it seems to me, it can never do in its present house. The new one, suggested by "Cosmos," becomes,

therefore, an imperative necessity in justice to the present members, if they are looked to to continue their subscriptions. I have very little doubt that, looking to what the Society has done in the past, and the energy with which the Council is working in the present, the appeal suggested, if made, would be responded to.—I am, &c.,

A New Member.

GENERAL NOTES.

Mineral Production in the Province of Cagliari.—The following statistics of the mineral production in 1867, of the province of Cagliari have recently been published by the Chamber of Commerce of that province, and tend to show a steady increase in mining industry in this part of the island of Sardinia. In 1865, the total quantity of ore raised amounted to 220,524 metrical quintals, to the value of 3,850,237 francs; in 1866, to 359,996 quintals, to the value of 4,516,775 francs; whilst in 1867, the total quantity of ore raised was 532,853 quintals, amounting in value to 6,607,985 francs (£264,320) showing an increase of 172,857 quintals, and 2,091,210 francs, on the produce of the previous year.

Water Supply of London.—Dr. Letheby in his report says, the chemical composition of the metropolitan water has not fluctuated to any considerable extent; for that derived from the Thames and the Lea has contained from 21 to 23 grains of solid matter per imperial gallon during the winter months, when the rainfall is the greatest, and from 17 to 17·5 grains per gallon in the summer, when it is least, the average for the whole year being about 19·3 grains per gallon, of which about 14·2 grains are calcareous salts, giving that degree of hardness to the water, the hardness being reduced to about 3·8 degrees by boiling the water for a quarter of an hour. The proportion of common salt in the water does not exceed 1·8 grains per gallon, and the organic matter, as estimated by the oxygen required to oxidise it, is not above two-thirds of a grain per gallon. The nitrogeneous matter also is remarkably small, ammonia being in the proportion of only one part to about 35,000,000 parts of water, and the nitrogen, as nitrates, &c., as one to 630,000 parts. The water supplied to the public is for the most part clear and colourless; on one occasion, however, during the year, it was slightly turbid in the case of the Grand Junction water; on two occasions with the Southwark and Vauxhall water; on four with the Lambeth; and on six with the Chelsea. The daily supply of water to the metropolis has ranged from 91,578,341 gallons per day, in the month of January last, to 110,094,058 gallons in the month of July, the average for the whole year being rather more than 99 millions of gallons per day, or 31·2 gallons per head of the population. The daily supply to Paris averaged 24·6 gallons per head of the population; but this includes the water supplied to the public fountains, &c. The number of houses supplied daily by the water companies of London is about 463,000. Rather more than half of the water is obtained from the River Thames at Hampton, and the rest is from the Lea, and from springs and wells in the chalk. The filtering of the water is generally very effective. I have remarked that, except in special cases, water of moderate hardness, like that supplied to the metropolis, to Paris, and Vienna is always preferred, and is best suited for domestic purposes, because of its being brighter to the eye and more agreeable to the taste. So satisfied, indeed, were the French authorities on this head, that they passed by the soft waters of the sandy plains near Paris, and went far away to the chalk hills of Champagne, where they found a water which is even harder that that supplied to London. One important consideration which strongly influenced them in their decision was the fact that more conscripts are rejected in the soft-water districts, on account of imperfect development and stunted growth, than in the hard; and they conclude that calcareous matter in water is essential to the formation of tissues. In this country, also, it is remarkable that, wherever soft water is supplied to the people, the mortality is large, even when allowance is made for the birth-rate of the place. Glasgow, for example, as well as Preston, Dundee, Sheffield, Plymouth, Manchester, Bradford, &c., which are all supplied with water of less than 4 degrees of hardness, have a mortality which ranges from 26 to 34 per 1,000, while at Birmingham, Bristol, Sunderland, Newcastle-on-Tyne, Wakefield, Dover, Norwich, Croydon, Worcester, Derby, and other places, where the waters are hard, the mortality is considerably less; in fact, it may be said that in towns supplied with water of more than 10 degrees of hardness, the average mortality is about 22 per 1,000, while in those supplied with softer water it is about 26 per 1,000. It may well be, as the late Professor Johnston observed, that "the bright sparkling hard waters which gush out in frequent springs from our chalk and other limestone rocks are relished to drink, not merely because they are grateful to the eye, but because there is something exhilarating in the excess of carbonic acid they contain and give off; and because the lime they hold in solution removes acid matters from the stomach, and thus acts as a grateful medicine to the system. To abandon the use of such a water, and to drink daily in its stead one entirely free from mineral matter, so far from improving the health, may injure it. The water of a country may determine the diet of its inhabitants. The soft water of the lakes of Scotland may have had much to do with the use of brown meal; and but for the calcareous waters of Ireland the potato could not have become a national food. Looking at the plain teachings of all this, and considering the excellent quality of the water supplied to this metropolis, it would be folly, in my opinion, to change it for a soft water. On the other hand, it is quite possible to have an excess of calcareous and other saline matters, as is the case with the well waters of this city, where the proportion ranges from 48 to 120 grains per gallon. Dr. Letheby concludes with a report of the sanitary work done in the city during the year.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. Sir Bartle Frere, "On the Runn of Cutch and Neighbouring Region."
British Architects, 8.
Medical, 8.
London Inst., 4.
Law Amendment Society, 8. Mr. Joseph Brown, Q.C., "On the Evils of Unlimited Liability for Accidents, in the case of Masters and Railway Companies, with an Argument for Limited Liability."

Tues ...Civil Engineers, 8. 1. Discussion, "Railway Expenditure and Income." 2. Mr. A. R. Terry, "The Mhowkee-Mullee Viaduct, G.I.P. Railway." 3. Mr. E. W. Stoney, "The Pennair Bridge, Madras Railway."
Statistical, 8. Mr. Ernest Seyd, "On International Coinage, and the Variations of the Foreign Exchanges during recent Years."
Pathological, 8.
Anthropological, 8.
Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."

Wed ...Society of Arts, 8. Mr. Thos. Plummer, "On Emigration."
R. Society of Literature, 8½.

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. Scott, "On the Tree-ferns of British Sikkim."
London Inst., 7½.
Zoological, 4.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Royal Inst., 3. Prof. Odling, "Chemistry of Vegetable Products."
Social Science Assoc., 8. M. Corr-Vander-Maeren, "On the Results of Government Management of Railways in Belgium."

Fri ......Philological, 8½.
Royal Inst., 8. Mr. Kingdon Clifford, "Theories of the Physical Forces."

Sat ......Royal Inst., 3. Prof. Max Müller, "Science of Religion."

Journal of the Society of Arts.

FRIDAY, FEBRUARY 18, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

February 23.—"On the Utilization of Town Sewage." By Wm. Hope, Esq., V.C. On this evening Professor Marshall, F.R.C.S., F.R.S., will preside.

March 2.—"On the Causes and Consequences of High Charges for Passengers by Railway, and the Advantages to be expected from an adoption of Low Fares." By G. W. Jones, Esq.

March 9.—"On Tramways in Streets." By W. Bridges Adams, Esq. On this evening Chas. Hutton Gregory, Esq., will preside.

March 16.—"On Surface Decoration." By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

March 30.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

PREMIUMS FOR PERFUMES.

The following Premiums have been placed at the disposal of the Council, for the term of seven years, by Septimus Piesse, Ph.D., F.C.S.:—

1. A Premium of £5, for one pound of Otto of Bergamot, of the value of 16s. or more in the London market, being the produce of plants *(Citrus bergamia)* grown in Australia, New Zealand, Natal, any of the British West India Islands, or any other British Colony or Dependency.

2. A Premium of £5, for one ounce of Otto of Roses, of the value of 20s. or more in the London market, being the produce of any variety of roses grown together in one plantation in Australia, New Zealand, Natal, any of the British West India Islands, or any other British Colony or Dependency.

3. A Premium of £10, for a canister of Enflowered Butter or Fat, so scented with any kind or sort of flower, either by infusion or enfleurage, or by means of these processes jointly, of the weight of 3 lbs. or more, and of the value of 6s. per lb. in London. The said butter or fat to be enflowered or infused with flowers grown for the purpose in Australia, New Zealand, Natal, any of the British West India Islands, or any other British Colony or Dependency.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

INDIA COMMITTEE.

The adjourned Conference on the subject of a Gold Currency for India was held on Friday, January 21st, W. S. Fitzwilliam, Esq., late member of the Supreme Legislative Council of India, in the chair.

(Continued from page 238.)

Col. Smith said the great difficulty in dealing with the question of the gold currency for India arises from the variety of opinions upon several difficult points, which are fundamental in the consideration of the question. The best way of illustrating and inquiring into these differences would, perhaps, be by explaining how it is that the results declared by some differ from those arrived at by others, possessed of eminent abilities, who had given their attention to the subject. He would first notice the remarks made by Mr. Rowland Hamilton, because his conclusions vary to the largest extent from those which he believed to be the truth. Mr. Hamilton arrives at the result that "the fairest equivalent of 10 rupees, taking all circumstances into consideration, is about 117 grs. of gold, British standard, and if the sovereign (123·274 grs.) were taken at all, 10 rupees 8 annas would be the nearest simple fraction at which it could be introduced, with a fair chance of its remaining in the country." The causes giving rise to this opinion are:—1st. That Mr. Hamilton compares and equates the sovereign, not with the actual past, but with the supposed future value of silver, after the change shall have been accomplished. 2nd. By his making the comparison of value according to the ratio in the London market, which is very different from that in India. Mr. Hamilton's result correctly represents what the sovereign would be worth hereafter, in rupees, if the latter were coined in London at a seignorage of 2·1 per cent. out of silver costing 60d. per ounce standard; but it by no means represents the true relative values in India, if the past value of rupees be compared with the present, and still less with the future value of gold coins struck at the mint without charge. The first of these two peculiarities in Mr. Hamilton's system makes a difference against the rupees of $2\frac{1}{3}$ per cent., for the average value of silver in the London market, during the 15 years ending with December, 1867, is 61·37 pence per ounce, instead of 60 pence, which he assumes. And the second peculiarity makes a difference of $2\frac{3}{4}$ per cent. more, because, while gold is of the same value in India as in England, silver is by $2\frac{3}{4}$ per cent. more. These two differences together make the 5 per cent., or 8 annas, which Mr. Hamilton would add to the 10 rupees to make them equivalent to the value of the sovereign. Now, it may be considered the special duty of a meeting like the present to discuss and decide such fundamental principles as those above referred to, and he remarked that no progress can be hoped for towards the settlement of the question till this has been done. He would, therefore, inquire what the values really are which have to be compared together, and made equal to one another. The object is to substitute a new standard of value composed of gold for the former one composed of silver. If, instead of a standard of value, the government proposed to substitute a new standard of length, the course adopted would be to collect all the previously existing measures, to compare them with one another and any existing authorised standard, and then to define, as nearly as possible in the new standard, the average length of the measures previously in use. It was in that way that the existing standard measures of Great Britain were defined, the yard, for instance, being declared to be

$\frac{36}{39}$ 8ths of a pendulum vibrating seconds in the latitude of London. Now, the question to be decided is whether, at the time of determining the precise definition of the new standard, anything more than the actual dimensions of the previous measures ought to be taken into consideration. With very great deference he must say he thought nothing whatever ought. If such a thing could possibly have been predicted as that all the measures previously in use in England would, subsequently to, and in consequence of the alteration, shrink to one-half their former dimensions, in his opinion, it would have been of no consequence, and it would not, and ought not, to have made the slightest difference in the definition of the new standard. If, on the other hand, it were certain that, immediately after the changes, and in consequence of it, the seconds pendulum would be diminished precisely one inch in length, that circumstance ought to be, and no doubt would have been allowed for. The truth he believed to be that, previous to a change of standard of value, it is the duty of the State, first, to make the most careful inquiry into the precise commercial worth of the existing standards and measures of value, carrying the inquiry back so far as they may consider to be practically useful and just; and, secondly, to carefully adjust thereto, with as much precision as possible, the commercial dimensions o the new standard and measure of value, taking into account the effect of the change upon the latter; and having done this, to abolish the former, and establish the latter for the future. To carry out these views, in regard to the proposed measure for India, demands a very careful inquiry into the past value of silver, and of the present and future value of gold, that is, after its establishment as a legal tender and standard of value. The second principle which Mr. Hamilton adopted, and which very materially affects his results, is that of comparing silver and gold at their London prices. This is not done inadvertently, for Mr. Hamilton distinctly says, that "the best and safest way of arriving at an equivalent in gold for the rupee, was to go to the great markets in the world common to both," and again, "the cost of transmission of either silver or gold bullion does not enhance their permanent value." According to this view, it appears that the relative value of gold and silver bullion ought to be, and must be the same in all parts of the world, for if their prices in Calcutta, Bombay, and, we may add, Lahore, and Peshawar, are to be determined by such markets as London, Paris, and Hamburgh, &c., it would be difficult to name any other places where their relative values should not be so regulated; and the value of silver stated in gold, ought to be the same at a mine in Mexico, where silver alone is produced, as in Melbourne, Victoria, where gold in particular abounds. It appeared to him that, in estimating the relative values of gold and silver in any land, it is incumbent upon us to do so as commodities, on ordinary commercial principles, by endeavouring to discover the maximum value at which each of them can be continously supplied and adding thereto all the expenses necessary to bring them into the market in question. This process of calculation, which would be indispensable to any merchant estimating his prospect of profit by the sale of any commodity, is doubly necessary on the part of a government in deciding upon a change in the measure of value. This opinion does not merely rest upon reasoning and argument. It may be established by unquestionable facts. During the fifteen years, from 1853 to 1867, the latest of which we have accounts, the selling price of gold in the Calcutta market was, on the average, 257·4 annas per tola (180 grains) pure. These 257·4 annas (or 16 rupees, 1 anna, 5 pies) were procured by the delivery at the mint (according to Mr. Hamilton's ratio of 183·78 grains per rupee) of 2956·561 grains of Indian standard silver, equivalent to 6·10401 ounces of silver of the English standard, and, according to this average rate, the 123·274 grains of standard gold contained in a sovereign were exchanged for 3·8320 ounces of English standard silver. The average market price of silver in London prevailing throughout the same fifteen years was 61·3375 pence per ounce. Hence the sovereign, which in London exchanged regularly for ($\frac{240}{61\cdot3375}$) 3·9127 ounces of silver, in India exchanged during the same period for only 3·8320 ounces, or 2·062 per cent. less; so that gold was cheaper, or silver dearer in India than in England during the above-named period by more than 2 per cent. The difference would have been more, and would probably amount to about 2¾ per cent., were it not that a good deal of gold was sent out to the Indian market from England, and in such cases the price realised in India is encumbered with very nearly the same charges for gold as for silver. As he had elsewhere remarked, this will be put a stop to, and the price of gold in the Indian market will be reduced whenever telegraphic communication is established between Australia and India, and there is a sure market for gold at a fixed price in the latter country. It appeared to him that the paramount duty of the government in effecting a change of the standard is to take care that after the proposed alteration, merchants and the public shall have exactly the same cost in procuring the new as they had in providing the old currency. Hence every expense, up to the very delivery of the currency by the treasury or mint, ought in strict justice to be calculated; and it would surely be unjust to enact by law that, because the ratio of values between gold and silver is 15½ to 1 in Paris and the leading European mints, a debtor in India, where the true ratio is less than 15 to 1, should be acquitted of his obligation of 31,000 rupees in silver by a payment of 2,000 gold coins of equal weight, which he could procure for less than 30,000 rupees? He would respectfully venture to offer the opinion that, in every country, in order to estimate the value of its currency composed of coins stamped from any metal, it is necessary to calculate every cost whatsoever of bringing the required metal to the mint, and charge the same upon the currency delivered in exchange for it. If this be fairly done in regard to the cost of silver and gold in the Indian markets of Calcutta, Madras, and Bombay, it will be found that the ratio of value is 14·94 to one at present, and not 15·15, the ratio adopted by Mr. Hendriks, or even a higher ratio, has been supposed. He would only further remark on the subject of Mr. Hamilton's views that, whereas the government of India, long before the discovery of the gold mines in Australia, namely in 1835, fixed the ratio of gold to silver as 15 to 1, the figure now proposed by Mr. Hamilton would actually increase that ratio and make it no less than 15·7 to one. Although there was much to admire in Mr. Hendriks' able treatment of the subject, he was, nevertheless, compelled to dissent from some of his conclusions, because the ratio of silver to gold which he had calculated was not applicable now, though much nearer the truth than that of Mr. Hamilton. Mr. Hendriks had adopted the ratio fixed by the government of India previous to 1835, long before the gold discoveries in Australia, since which time the comparative value of gold had much declined. By the memorandum which he had drawn up from the most authentic information, which would be recorded together with this discussion, but which he must ask them, in the meantime, to take for granted, they would find that the value of the sovereign was even now rather below than above that of 10 rupees, and would certainly be below on the establishment of telegraphic communication with Australia. This, however, would remove the difficulty in the way of Mr. Hendriks' proposal, as it filled up the gap which he thought required bridging over; and, such being the case, he (Colonel Smith) felt there could be no objection to that part of it which established a legal tender for 10 rupees of the same current value as the British sovereign, although he himself thought it better to wait for the action of the British government in respect to joining the European Monetary Convention, till which time a sovereign of full intrinsic value would be of much

greater use, both for remittances to England and internal commerce, and would be more easily recognised and pass into circulation. So far, he and Mr. Hendriks were quite in accord, namely, that the gold coin equivalent for 10 rupees should be of the current value of the British sovereign. But he was not of opinion that it was necessary or even desirable to limit the period of the "double standard," or that it would be expedient to enact that, within any brief period, gold should be demandable to an unlimited extent. As his views regarding this particular case of the double standard might perhaps require explanation, he would observe that, what was spoken of as a double standard in India, on the introduction of a gold currency, would not be so in fact, in the objectionable sense of the term. Properly speaking, a double standard can hardly be said to exist when there is only one commodity by which the currency can be procured. There may be a dozen "legal tenders" for the pound sterling, but so long as none of them can be procured except upon payment of the full weight of gold, there is only one standard. In India, if the standard were changed, and the currency were only procurable by the delivery of gold, there would be only one standard, and the silver coins would represent gold. The well-known evil of a double standard is that, as fluctuations in the value of the metals occur, the cheaper metals drive out the dearer; and this happens because either may be used, at the option of the public, to make coins, or, as the Chancellor of the Exchequer very happily termed it, because it is an "alternative" standard. But if government refuse to coin silver for individuals, or put an extra tax upon it, silver cannot drive out gold, neither could the gold drive out the silver, provided the quantity of metal in the gold coins were not so much reduced as to create the risk of their becoming cheaper to obtain than silver coins of the same nominal value. He had remarked just before that the sovereign would be somewhat cheaper to procure than 10 rupees if it were coined for nothing, that is, its current value might be less than that of 10 rupees formerly was, but its intrinsic value would be 2 per cent. more than 10 rupees, because that proportion of the value of the rupees consisted of seignorage, and it is the intrinsic value which decides what part of the currency shall go abroad. In regard to trade with England, the protection of the rupees would be much more than 2 per cent., for, while the sovereign would always be worth 240 pence in London, 10 rupees, when sent for remittance, would not fetch more than 225 pence. There would, therefore, be no danger of the gold driving out the silver coins, always supposing that the intrinsic value of the former was greater than that of the latter, according to their denominations; and though the gold would leave the country for remittances and return to it, both might continue legal tender without further risk than than that of the gradual absorption of the silver currency by internal commerce (in spite of the protection of two per cent.), which would be met and obviated as it occurred, by the issue of new rupees or token coins, as suggested by Mr. Hendriks and himself. Thus the restriction to five years for the currency of the double legal tender was uncalled for. On the other hand, he thought it would not be safe to enact that, at the end of that time, gold only should be legal tender for large sums, as it would be difficult to say how long it would take for so vast a country to be sufficiently stocked with gold coins to make that a safe and just measure. All that is necessary, Colonel Smith thought, is that sovereigns, or coins equivalent in current value, should be coined, and declared legal tender for ten rupees, but not demandable, all existing contracts up to the date of the enactment being payable in silver or gold, at the option of the debtor, and all future contracts the same for the present, unless there were a stipulation to the contrary. The remarks now made applied to the first, second, third, and fifth of Mr. Hendriks' proposals. In regard to the fourth, sixth, and seventh, he was of opinion that no legislation was necessary. The government might decline to coin silver as at present for private individuals, and would do so on their own account, either from silver bullion purchased for the purpose, or out of standard rupees, the new coins being of the precise legal weight and fineness of the present currency, or, if thought more desirable, tokens, to which latter only the regulation limiting their legal tender ought to apply. There would be no object in hurrying this measure, for the present standard rupees would continue of the same value as at present, and might remain for any length of time, till gradually superseded by gold coins. Of the last, or seventh, of Mr. Hendriks' proposals, Colonel Smith expressed his approval, though he was much more anxious, at this juncture, to secure the opportunity, while we have it, of introducing the ten-rupee gold coin equivalent with the sovereign, and he feared that if too much were attempted the time would be wasted in the discussion of many subjects, and might end without the desired result being accomplished. He agreed with Mr. Campbell, that as regards the mere introduction of a gold currency there is no great urgency, because, in his opinion, a gold currency was pretty sure to be established without any effort on the part of the State or individuals, the only thing likely to prevent it being the abandonment by the leading European nations, now following that system, of the "double standard." So long as that continued to exist to any great extent in Europe, silver could not fall much below its present price, and that being so, the present Indian mint regulations would probably lead to gold establishing itself on the terms proposed by the government of India, namely, the exchange of the value of 121·2 grains of standard gold* for 10 rupees. In all this there is no urgency, nor, indeed, any need for effort of any kind. The urgency and the effort were needed to guide the movement to a right result, and take care that the gold currency be not wrongly established. It needs no effort or care to stand by and see your house tumble down about your ears, but it might need effort, and it would be wise, to prop it up and keep it in its place. Gold will not spontaneously take the place of silver on the same level, that is, on an equality of value, just as solid bodies will not change their positions and roll on level ground. When gold coins take the place of rupees, they will do so because they are cheaper, that is, of less value, and the government revenue and private debts will become depreciated to the extent of that cheapness. He had elsewhere stated the opinion that it was useless to attempt to establish a gold currency without stopping the coinage of silver, and that statement would appear inconsistent with what he now said as to its spontaneous introduction. He must, therefore, point out the difference between the two cases, and explain that the difficulty of introduction applies to the case of equality of value. He had occasion to remark, at the last conference, that the regulation of the government of India, fixing the value of the sovereign at $10\frac{1}{4}$ rupees, would have the effect of injuring the revenue to the extent of at least a million of pounds sterling per annum. That regulation, which was founded upon a misapprehension of the true relative values of gold and silver would, no doubt, be abandoned; but the measure which he understood was to be substituted for it was nearly as unsatisfactory, namely, that of coining gold 10-rupee pieces, containing 120 grains standard gold, with 1 per cent. seignorage. This corresponds with a payment of about 10 rupees 2 annas 9 pies for the sovereign; and though this is nearer the truth, it would still be $1\frac{3}{4}$ per cent. too high as compared with the previous value of rupees, and would make a difference and loss in the purchasing power of the Indian revenues of, probably, £600,000 or £700,000 per annum. But this is not the most objectionable feature of the arrangement; the consequence of it would be the establishment of a vexatious

* 120 grains standard, plus 1 per cent. seignorage.

and irritating fraction in the factor of exchange from the Indian into the British currency, and the impossibility of their being brought into harmony while it continued. The argument in favour of the measure just referred to, he believed to be that it was merely the continuance of the existing system, for the Indian mints have always, since 1835, been authorised to stamp gold coins in this ratio. But the fact is that, in 1835, the regulation was a mistaken one, as it authorised the coining 15-rupee pieces, which were worth much more than the value assigned to them, and, consequently, they were never called for. And now that the circumstances are wholly changed, and the time is close at hand when these same coins will be as much below as they were formerly above their nominal value, the first mistake is pleaded as a necessity for a second, it being apparently overlooked, that whereas the first mistake was harmless and inoperative, the second may revolutionise all the values in India. The 10 and 15 rupee gold pieces of 120 and 180 grains would probably be sufficiently cheap soon to be largely introduced into circulation, if they were received by the government in payment of revenue; and they would become established in the currency without being made legal tender, just as rupees had been years ago in Ceylon. The government would then be obliged to legalise them, and would thus lose the opportunity of preventing the decline in the value of their revenues, and establishing their currency on a par with that of England. That gold is coming into the country and establishing itself there without the advantage of legal recognition, is evident from the increasing imports. From 1853 to 1857, the gold imported was at the rate of $1\frac{1}{2}$ millions of pounds sterling per annum; from 1858 to 1862, 4 millions; and from 1862 to 1868, 7 millions per annum. During the last ten years, the imports exceeded 56 millions of pounds sterling in value; in the preceding ten years, only $13\frac{1}{2}$ millions—in all cases after deducting exports. It had been stated in the course of this conference that new dies had lately been sent out to India. In his (Col. Smith's) opinion, if nothing else be done, the opportunity ought not to be lost to alter the weight of the 10 and 15 rupee pieces, so as to adapt them, when gold has reached its limit, to the real value the rupees have always hitherto held, and this would be effected by increasing the weight of the 15-rupee piece from 180 grains to 183·075 grains, and that of the 10-rupee piece from 120 grains to 122·05 grains, with 1 per cent. seignorage. These weights and seignorage would produce a current value corresponding with that of the British sovereign, which might be substituted for them at any time, either in its present form, or as altered to suit the International Convention. It is important to add that, if the 10 and 15 rupee pieces be not increased in valuo, not only will the purchasing power of the currency be lowered, and all contracts and the revenue be prejudiced thereby, but considerable risk will be incurred of tho eventual loss of the silver coins. The gold coins now authorised to be stamped by the Indian mints may very soon be cheaper than rupees, and the latter will find their way into the markets of Central Asia, China, Burmah, &c. If this were hereafter to begin to disclose itself, great distress and injury to trade might occur before a remedy could be applied; and the fact would occasion well-founded regret that the authorities cannot now see any reason to induce them to make tho required change. A good deal of righteous feeling existed, he thought, to the effect that it would be a sin for the government to interfere and prejudice existing contracts. To this he answered true; but the change ought to be made without prejudicing contracts; and when the opportunity is offered to them of preventing contracts being prejudiced by their own want of care, is there not a greater sin in remaining passive? It was also thought that there were many serious obstacles to be overcome in adopting a measure which would apparently unsettle all the existing assessments; but he was of opinion that these would disappear on close examination, and the necessary measures found to be as simple as they are important and indispensable. It might be useful to add that the abandonment of the "double standard," and the adoption of a single standard of gold by the leading States of Europe, which seems to be not an improbable event, would open the way for a large and uncertain reduction in the worth of silver, and in the value of our revenues and contracts founded thereon. Should this ever take place, it would prevent the spontaneous establishment of a gold currency in India, even at the sacrifice hinted above; and whether it occur or not, no progress can be made in the establishment of a gold currency on a par with the existing silver currency of India, except by the adoption of the former as a legal tender, and the exclusion of the latter from the mints on the part of individuals.

Mr. Rowland Hamilton regretted that he had not the advantage of hearing in detail the remarks of Mr. Hendriks and Colonel Smith, but would venture to submit a few observations. He fully agreed with Dr. Boycott and Mr. Campbell, that it is impossible by mere force of law to introduce a new standard coinage, and silver does, and for long must, satisfy so large a proportion of the wants of India, that it would be most unwise and injurious to take any premature steps to demonetise or reduce it to a token currency; and with the latter speaker also, as he understood him, in ascribing the failure of former attempts to introduce a gold coinage to the fact that too large a weight of gold had been fixed upon. No doubt, in such cases, the State's stamp on the coin simply has the effect of declaring it to be worth less than the bullion contained in it will fetch in the open market, and of course owners will not bring their metal to be so disparaged. But Mr. Campbell seems inclined to repeat the error he has himself pointed out. If gold has, as Professor Jevons argues, declined 30 or 40 per cent. as compared with commodities generally, certainly silver has declined with it *pari passu;* and, as to future contingencies, we know the worst about gold, but we know little of silver, beyond the fact that rich ore is in vast abundance on the western coast of America, and a slight decline in gold would probably turn attention to it, while a fall in the price of quicksilver, or the discovery of any better method of separating silver from the ore, might at any time greatly reduce the cost of its production. Of course, on the assumption that silver will rise sufficiently, a sovereign would be given for 10 rupees, or, for that matter, for five rupees; but, if silver is to fall, we cannot look back to the past, but, in timely anticipation of the future, should endeavour to impose gold to prevent a heavy depreciation in our standard, now expressed only in silver. There is no precedent for changing a standard by law, nor does there seem any reason to credit the French or United States with the exercise of peculiar forethought in monetary legislation. The idea of a double standard was that it insured stability, whereas the fact is that if two standards are offered, whichever is the cheaper will constantly be preferred; for if there are two ways of discharging a debt, the payer will take the cheapest, and it is at his option to choose which form of legal tender he will offer. In the two countries referred to, both a gold and a silver standard had long since been legally established, but, until within the last 20 years, gold had practically no place in their currency. Subsequently, from causes altogether external to either, silver became dearer; the standard was thus, as Mr. Dadabhai Naroji urges, unquestionably raised, and every debtor had to pay in a medium which had become more costly. The hardship, up to a certain point, was irremediable, but the rise was stopped by tho alternative afforded by the gold standard. When that became tho cheaper, debtors chose it, and creditors had to accept it on the conditions the law had ordained for legal tender of value in that metal. Both governments may deserve credit for promptly meeting

new emergencies as they arose, but it was a necessity far beyond any legal control which supplied the motive-power by which silver was drawn to Asia, and gold brought to supply the deficiency. The movement, substantially the same in both countries, illustrates the way in which a double or alternative standard works, but we have no reason, as regards India, to expect external causes to bring about in the same way the change desired. If silver remains at its present value as compared with gold, a law making sovereigns a legal tender at 10 rupees would simply be a dead letter; but a law to enable a man to demand a sovereign, when its cost was more than the 10 rupees which his debtor had engaged to pay, would be altogether monstrous. The difficulty in India is, that all existing obligations had reference to a definite silver standard, and government can only present an alternative which will be voluntarily accepted. If too great a weight of gold is fixed upon, it will either never be brought into the country at all, or, if introduced by any exceptional emergency of commerce, will quickly flow out again and disappear. If too low a weight is fixed upon, creditors would be injuriously affected, by having to accept the legal tender offered by their debtors in an inferior currency. The effect would be the introduction of a stipulation into all contracts for payment in one metal or the other, as, the law notwithstanding, the standards would not practically be recognised as identical. If, by a fortunate exercise of foresight, a true equivalent is fixed upon in accordance with the respective values of the metals in the open market, gold may be largely introduced, for it is in so many ways more convenient, especially for all the larger operations of trade, that debtors will often be able to afford to tender it on terms slightly over its intrinsic relative value. Of course, if we could predict that silver was to rise or fall materially, the task would be simple, and the operation worked out in France and the United States, or the converse of it, could very easily be provided for. As we cannot exercise such prevision, the task is one of more delicacy and difficulty. As regards the mode in which equivalents of the two metals should be calculated, Colonel Smith has fairly stated the points of difference. The Colonel considers, in the first place, that the average value of the current rupee for a reasonable time past should be taken, and established by legal enactment. His (Mr. Hamilton's) argument is, that we must look to the future; for our only practicable course is to carry on, without any forcible break, the representation in gold of the "purchasing power" hitherto legally vested solely in silver. On the question of justice to existing interests in changing the standard at all, it seems to him that creditors have no right to complain that the standard which they accepted has declined in value, from causes over which neither they, nor their debtors, nor the government, had any control; they inevitably took the risk of some fluctuation, for nothing the world contains has the quality of a perfect stability. But government has not only the right, but the duty, imposed on it of looking beyond the letter, to the reason of the law. If the means used to express and convey value or "purchasing power" seem likely to fail, it should endeavour to supersede them by other and better means, if it can, but it is not under any obligation to attempt the hopeless task of remedying byegone and partial hardships. Colonel Smith seems to assume that a rupee may, in some way, be taken at 2s.; and, in his very useful book, sometimes transfers, apparently as a matter of course in his calculations, rupees into sterling money at that rate. Of course, if 1 rupee = 2s., 10 rupees = 20s., or £1, but whether the rupee is really worth 1s. 6d., or 2s., or 2s. 6d., depends altogether on the fluctuating price of silver as measured in gold. At 5s. per ounce, British standard, the quantity of silver required to make a rupee is worth about 1s. 10¾d., and the rupee itself about halfpenny less. In the same way the allegation that the sovereign can be introduced from Australia to India without bearing transit charges seems taken to prove that it would be sent if valued at ten rupees. But, with silver at 5s. per ounce, British standard, £100 will buy enough silver to make 1,053 rupees, or even allowing for transit charges, fully 1,030 rupees, which correspond to 10 rupees, 8 annas, and 6 pies, and 10 rupees and 5 annas respectively for the sovereign. The other point of difference is as regards the cost of transport, which he (Mr. Hamilton) maintains should not be included in calculating the equivalents; they may fall on one side or the other. The well-known economic maxim, that costs of transit as well as cost of production constitute value in the market is fully admitted. But what is the market for bullion? Nothing less than the whole civilised commercial world, and the transit charges for moving this common medium of exchange from one part of this great common market to another cannot be held to add permanently to value. Still less can interest or any other accidental charge be added. All these are a tax on the importer who brings the bullion to the mint, or rather on the trade generally for the time being, but it makes no difference to the subsequent holder, and possible exporter, of the coin, whether such charges were at their maximum or their minimum, or altogether avoided. Unquestionably, the metal which can be introduced with the least cost will, *cæteris paribus*, be preferred by importers, and as far as gold can be transmitted at a less cost than silver, it forms a more perfect common measure of value; but if, instead of taking the equivalents as shown in the great markets common to both, the lesser charges on the one metal are made up for by an addition to the weight required of the other, the difference which constitutes the sole motive power on which we can rely for effecting the change desired, is directly counteracted. Assuming, for the sake of illustration, that gold costs 1 per cent. and silver 2 per cent. to introduce, if the difference of 1 per cent. be added to the weight of gold equivalent, in the common markets of the world, to a given weight of silver, there remains no more inducement to bring in the one rather than the other. But should the course of exchange turn, and bullion be exported, there is not only 1 per cent. economy in charges, but 1 per cent. in weight in favour of using gold, which would inevitably flow out with a far stronger impetus than it came in. The comparative weights in fact would not be taken with a level beam, but when one side was hard down and the other high in the air; but as the weights may be reversed in the respective scales, the results are simply self-contradictory. He had never doubted that our supplies of gold would be drawn from Australia direct; on the contrary, based his hopes of the possibility of introducing a gold currency at all on such terms as would admit of its retention in India, on the slight advantages to be derived from resorting to that country. His fear rather was that these differences might prove too small and inadequate, for there is no reason to assume that they will continue to be as large as at present. The charge of 2 per cent. now made on silver from England to India rested merely on the will of one great company. Competition might, and most likely would, reduce it materially; and it is certainly within the limits of probability that silver may come from the east to India on quite as favourable terms as gold from Australia. Lastly, the very fact of joining Australia and India commercially by a common gold standard, would tend to throw the cost of transmission on India. Thus, taking Sydney, where the export is in sovereigns, as showing the working of international exchange most simply, we find a premium of 1¼ per cent., for a bill payable in London 60 days after sight, would, according to the rates current in 1869, cover the cost of shipping coin; that is, importers of British goods requiring to remit to England for goods sold in Australia, found it very much the same thing whether they sent their sovereigns home at their own cost, or paid the bank that premium for such a bill; either way, directly

or indirectly, the cost of sending home sovereigns fell upon them. But the year's quotations show this rate barely touched, and the premium even pared down to ½ per cent. premium, especially during the season for shipping their other great staple, wool. Now, if our heavy excess of exports from India come, however indirectly, into the account, this premium will be certainly lost entirely. To follow the natural course of the transaction, bills on London would be sold in Sydney, the proceeds of which would pay for the gold sent to India; but any urgency in the sale of such bills would lead to a decline in the rate obtained to par, or even to a discount. The compensation, as far as the banker is concerned, is readily found in the rate of exchange in India, but the rate in India equally effects gold and silver, and the difference in cost of transit would thus be pared down to the very narrowest margin. The reply to this argument is, no doubt, that all these consequences can be provided against by legislative enactment. He can only express his conviction that it will be found impossible thus to alter the existing standard, either by rendering it artificially scarce, by imposing an excessive seignorage or by any other means, and that the attempt to do so would be unjust, impolitic, and demoralising. With him the practical question of difficulty was the estimate of the future value of silver as measured in gold. As far as his information went, he was inclined to think 5s. per ounce British standard was as high a rate as could be expected, and this gave an equivalent of 15·7165 silver to 1 gold; nearly 117 grains troy standard, or 107·236 pure gold for 10 rupees; and 10 rupees, 8 annas, 7 pies for the sovereign. Silver at present was in steady demand for Europe, at about 5s. 0½d. per oz. British standard; but the probable future extent and cost of production of of silver was a point to which the special attention of the Indian home government might well be directed. They would have more ample means than any private individual of overcoming any difficulties that there might be in obtaining full information from the various remote quarters, which were or which might become sources of supply, and according to the estimate formed the equivalent rates must be fixed and determined. He considered the advantages of a gold currency quite sufficient to command the best attention that government could bestow upon the subject, and the fact that large quantities of gold, mostly in 10 oz. bars, were sent to India, was a sufficient proof that the country was quite ready to accept an alternative standard, if offered to them on suitable terms. This must necessarily be the first step. The substitution of gold for silver can only be effected when the former is fully recognised as a standard, and accepted as such throughout the Indian empire. These bars had been sold largely during the past year at 16 rupees 8 annas, to 16 rupees, 11 annas, 3 pies per tola of 180 grains troy fine gold, equivalent to $109\frac{10}{11}$ to 107·765 grains pure (or 119·007 to 117·562 standard) for 10 rupees; and 10 rupees, 5 annas, 9 pice to 10 rupees, 7 annas, 9½ pice for the sovereign, which proves how closely gold is received according to its relative market value when presented in suitable form. If made legal tender, and its utility thus more widely extended, there seems no reason to doubt that it would be freely received at its full relative value, at first in commercial circles, and, as it became known, in remoter districts. The calculations of Mr. Hendriks were simply based on the proportion of 15 to 1 fixed by the (ineffective) Act of 1835, corrected for difference in seignorage, and had no bearing on the relative values in the open market. The new gold coins proposed did not conform in weight either to the gramme or the grain troy, and were thus but a partial remedy for the inconveniences of existing metric systems. The rupee is the "tola" weight common to all India. If standards were exact, mere differences in weight were adjusted by a sum in simple arithmetic, which was no appreciable difficulty in the larger operations of commerce. The social advantages of a common coinage would no doubt be great and increasing, and in every way worthy of consideration, and it may be better to adopt even a faulty system than remain isolated; but still, apart from the difficulty of adjusting existing standards, unless the fallacy of a double standard be definitely abandoned, and further, the necessity of securing identity both as to weight and seignorage of standard coins; of keeping up and replacing such coins when reduced by wear and tear; and of duly regulating the issue of the subsidiary token currency; is not merely recognised theoretically, but provided for in a definite and adequate manner by international treaty—England will be far better "left out in the cold" than involved in the wrangling and confusion that will inevitably arise if these essential requisites are practically neglected.

(*To be continued.*)

ELEVENTH ORDINARY MEETING.

Wednesday, February 16th, 1870; Sir George Grey, K.C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Carson, James Alexander, La Belle Sauvage-yard, Ludgate-hill, E.C.
Casey, James, 25, Philpot-lane, E.C.
Constable, William H., Magdalen-street, Cambridge.
Donville, William Henry, 15, Gloucester-crescent, Hyde-park, W.
Franchi, Giovanni, 15, Myddelton-street, E.C.
Kerr, James, 54, King William-street, E.C.
Le Riche, E. W., Warwick-house, 6, Warwick-court, Gray's-inn, W.C.
Newton, Marcus Bourne, Wharf No. 4, inside Great Northern Goods Station, King's-cross, N.
Soares, Augusto, 40, Seething-lane, E.C., and The Poplars, Alridge, Essex.
Verity, George, 31-33, King-street, Covent-garden, W.C.
Verity, John, 31-33, King-street, Covent-garden, W.C.
Weale, Solomon, 27, Clifton-gardens, Maida-hill, W.

The following candidates were balloted for, and duly elected members of the Society:—

Ashcroft, George, C.E., Cairo, Egypt.
Jones, G. W., 25, Essex-street, Strand, W.C.
Rogers, William, 13, Finsbury-pavement, E.C.

AND AS HONORARY CORRESPONDING MEMBER.

Soubeiran, Dr. J. L., Société Imperiale d'Acclimatation, Paris.

The Paper read was—

ON EMIGRATION.

By Thomas Plummer, Esq. (late of British North America).

The theories of political economists upon the causes of overgrown population have not as yet furnished us with the practical means of relief; but as surplus and unemployed labour has been too often a source of political danger, it is no exaggeration to say that emigration may be regarded as the antidote to a possible catastrophe. The unemployed may be ranged under two heads, the organised and the disorganised. The trades' unions, we learn from their monthly reports, have branches in most of the towns of Great Britain, and that the trade in each branch, during every month in 1869, is reported as "bad," "very bad," "dull," or "declining." Without staying to discuss the cause of this depressed state of trade, I will simply notice the fact that the Society of Ironworkers alone paid, during the last three years, £300,000, to provide for their sick and to keep their unemployed from destitution or the workhouse. And,

when you consider that the whole of this vast sum was raised by the members of one society, the majority of whom were only half-employed, and that the combined societies number 800,000 hardy men, an idea may be formed of an organisation sufficient to command the serious attention of our wise men, especially when it is known that the whole body firmly believe that not only capitalists are antagonistic to the interests of the working man, but that England, the richest country in the world, is bound to procure remunerative employment for all her labouring classes. Leaving the trades' unions, and turning to non-union men—the disorganised labour—in vain we seek for improvement, for during the whole of last year one-half of the working men of the metropolis worked only half-time, and these looked with envy on their fellows who were fortunate enough to make anything like full-time; consequently, now winter has set in, we have our hearts pierced with the deep wail of misery, and hear of Englishmen dying of starvation without a murmur bravely, and this is sad enough to make strong men weep. The surplus population is still further augmented by improvements in agricultural machinery, which adds one in five of the farm labourers per annum to the surplus labour in our great centres of industry. If we dive deeper into the subject, we find that our population increases at the rate of a thousand a day, and that within the last ten years our marvellous commercial prosperity has been accompanied by a growing surplus population, and a poor-rate increased by one-half. In 1801, our foreign trade amounted to £30,000,000, and the poor-rates of the same year to only £2,000,000. Our foreign trade in 1868, was £179,000,000, and our poor-rates, £11,472,843. Thus, paradoxical as it may seem, we have had with an enormous increase of national wealth a corresponding increase of poverty and distress. If the Chancellor of the Exchequer says the nation is growing very rich, because he has £50,000,000 in his hands of the savings of the people, the parochial authorities say the nation is growing very poor, for they have on hand a million of paupers, with a million more on the verge of destitution. These two forces, the organised and disorganised surplus labour, though separate, have the same tendency to create anxiety, if not positive trouble in the future, and the energies of our wisest statesmen will be taxed to the utmost to prevent their influence becoming overwhelming. The true policy is to grapple with the danger at once, and, while preventing the development of a social evil, utilise surplus labour, relieve the poor, and promote the prosperity of the whole empire.

Before, however, discussing the question in relation to the government dealing with the matter, I will notice the appliances already in operation for removing England's surplus population. Thank God, England's children never need prompting to generous deeds. The same divine element, active benevolence, guides alike the peasant and the Queen, the mechanic and the merchant-prince. As soon as the distressed condition of working men became known, Englishmen of all grades formed different societies for one and the same object. The City merchants, always in the front rank of every good work, subscribed liberally, and started an emigration society, which has sent many families, and is about to send many more, to mend their condition in other lands; the Duke of Manchester started, or at least graciously became the president of, another society, which proposed to combine colonisation with emigration, and which is calculated to do an amount of good to the working and other classes of a very permanent character; the working man also started his society for the consolidation of the British Empire, which has since been amalgamated with another, and is known as the Emigration League. Other societies have also been started, and, with the exception of the Emigrant and Colonist Aid, they have been so industrious of late that they have created a sort of emigration epidemic, and during the last few weeks everybody has been wanting everybody to send everybody else to the colonies. All these societies mean well, but their proceedings have been accompanied with so much that is confusing, that it is impossible to tell whether the societies want to aid the government, or get the government to aid them; nor can I understand what practical means they suggest for benefiting the emigrant while relieving London of its surplus population. Those of us who have spent many years in the colonies, and are known as experienced emigrants, while acknowledging that great good may have been done by these societies, are bound to declare, at the risk of giving offence to gentlemen of large hearts and benevolent purposes, that most of the machinery set in operation is not only defective, but altogether inadequate to the work intended to be accomplished. The motto of one of these societies was, "Emigration for the consolidation of the British Empire," and a most excellent motto too; but suppose a ship-load of mechanics is sent at hap-hazard to Canada, the chances are that most of them would find their way across the frontier, and in that case the society would be promoting the consolidation of the United States of America. Be this as it may, it cannot be denied that all the machinery now in operation is simply sending out unemployed mechanics to the cities and towns of our colonies; but unless great care be taken—and this great care is not taken at present—this practice simply gets rid of a surplus in one place to create a surplus in another. During the year 1869, we find that 33,921 emigrants were sent to Canada from this country, and 203,001 to the United States. It is fair to presume that 10,000 of this 203,001 reached Canada as their ultimate destination. This gives us nearly 44,000 emigrants to Canada in the year 1869. Australia absorbed only 14,901, and all other places only 6,234. To supplement this natural flow of emigration, we are establishing powerful organisations, which may be described as forcing-pumps to increase the stream, without having any means at work for utilising the labour, or any idea whether we shall benefit the mechanic we send out, or the place to which we send him. We all know that success depends on a right application of knowledge, and, if we reflect, we must know that in no country in the world can legitimate labour be put into a hot-bed and forced like a cucumber or mushroom. In order to be healthy, the flow of immigration must be natural, and labour must be regulated as at home, by supply and demand. Of all undertakings, one of the most difficult is to convince those who have not studied the subject of their ignorance of what is doing and what is really wanted in the colonies. In vain we tell them theories may be beautiful in Old England, and yet would be found totally impracticable in any new country. We tell them, in order to save emigrants from fearful trials, it is necessary to have an accurate knowledge of the demand for workmen at the place where they are sending them; in their impotence they go to the government, and the government is unable to give them the information they seek, for how is it possible, in the present state of things, for a government to tell where tailors, shoemakers, or painters are wanted, and where they would prove to be only a glut in the market? The *Toronto Globe* recently published a paragraph headed "Distressed Emigrants in Canada." "There must be something wrong," says the editor, "and it shows a grave defect in emigrational arrangements to invite people to Ontario, and then to leave them in a destitute state." The case alluded to is that of twelve emigrant families being left in London, Ontario, in a destitute condition. Cases of this kind often occur, and those of us who have employed large numbers of mechanics in Ontario can pledge our words that it often happens, on the arrival of first-class mechanics, that they have to get their bread, not by their own trade, but by sawing and cutting cord-wood, and doing any rough job that comes to hand, which materially checks their energies. The same might be said of the United States. It was only the other day

that Father Hyacinthe was taken from his repose to lecture for the relief of the unemployed Frenchmen of New York. These facts are not stated to dishearten the friends of the emigration movement, but rather to induce them to extend the basis of their operations, and adopt a more practical and comprehensive plan. What I propose is, to ensure that the emigrant shall be a true pioneer, and thus successfully combine emigration with colonisation. Mere emigration exhausts labour, while colonisation would create a demand for labour which England in a thousand years could not supply. Our chairman, a short time ago, most wisely said, "Don't amalgamate existing societies, but multiply them;" and I say, combine colonisation with emigration, and then if you had ten distinct societies, by wise management, they would, in a few years, not only become self-sustaining, but their labours would result in an annual increase to the revenue. The first step towards successful colonisation is the selection of the most eligible districts at the disposal of the colonial governments. On this question a number of different interests clash; one person, writing to the *Daily News*, says, it would be foolish to attempt to colonise in the forests of Canada, when the United States have such eligible prairies ready for the plough; and, he might have added, where it is often difficult to find timber enough for a log hut and farm buildings, and impossible to find sufficient to fence the land. Another, writing to the *Times*, says, do not take your emigrant out and set him down in the uncleared lands of Canada, the pampas of South America, or the wastes of Australia, when there is such capital land in Monte Video. These recommendations must be taken for what they are worth. Eligible districts are to be found in most of our colonies, as well as in the United States and Monte Video, but as there has been so much said against the forests of Upper Canada, it would be well to consider for a moment the characteristics of that colony. If large districts could be chosen in Upper Canada for colonisation near the lakes, or on the banks of a navigable river, forest land, with only a comparatively small quantity of cleared, instead of being an objection, would be a great advantage. The forests of Canada have always been one of the best sources of revenue to the emigrant; one of the most profitable trades has been the exportation of red and white pine timber, masts, staves, and deals to Great Britain, and for many years there has been a steadily increasing trade in sawn lumber between Canada and the United States. The products of the forest exported during the year 1852 were valued at £1,351,713 9s. 7d. Hemlock is used as a substitute for oak-bark for tanning, and the planks made from it are used for planking roads; the red and white cedars are plentiful, and are used for fencing; the larch is of the finest quality, and is invaluable for railway ties. Of the hard woods, considerable quantities of elm are exported; the ash and black ash are abundant, and fetch a good price for railway purposes; while the maple tree is the pet of the forest. It makes the best of fuel, and from its sap is made an excellent sugar to sweeten the emigrants' life. Other varieties of maple, curled and bird's-eye, make excellent furniture. Then there are the beech, birch, butternut, and black walnut, all invaluable for cabinet wares. As for oak, it is second only to the British, and has long formed a very important article of export. Then, again, in the process of forming a settlement, the wood is thrown into heaps and burned, and from the ashes quantities of potash and pearl-ash are manufactured and exported, their price often going a long way towards enabling the settler to meet the first cost of his land. In 1852, potash and pearl-ash were exported to the value of £232,004. Most of our colonies are eligible for new settlements, and ought to be held as precious, and looked upon with pride, and made conducive to the well-being of the whole British people. Whether we look to Canada, the Cape, Natal, or Australasia, we have millions of acres of first-class land lying idle. It is true most of it has passed from the hands of the imperial to the colonial government; nevertheless, it is the property of the empire, and some of it is in the midst of grand and beautiful scenery, with water communication, great mill power, and with soil that requires only to be scratched with the harrow for the first wheat sowing to give back to the sower a hundredfold. The problem for us is, to hit upon a plan which shall bring the surplus labour of England to these favoured tracts, and place the emigrant in such circumstances that his second position shall not be, as in too many cases it unfortunately is, worse than his first, but that he shall have means for utilising the resources of his adopted country, and so become a contented citizen and a support to the empire.

We know many districts of great promise, but will describe only two, and those far from being the best. One of these districts is nearer to the sea-coast than London is to Brighton. At the seaboard a thriving city has just started into life, at a point, too, which at no distant day will be situated on one of the great highways of nations. A rapid river running far away into the interior connects this eligible district with the young city, the intervening space, principally woodland, being less than 50 miles. The timber is magnificent, and, with the facilities of the river, a lumber trade could be carried on with profit. Here, where the present settlers do not know what to do with their sheep's wool for lack of manufacturers—here, where the fisheries are not worked and are inexhaustible—here, where the climate is like England, wet weather included—land could be had at the upset price of 4s. 2d. per acre; and if a large, well-organised, benevolent emigration society applied for it, by giving a guarantee to establish a large settlement, no doubt a free grant would be made by the colonial government, in consideration of developing the resources of the country and creating trade, and thus adding to the revenue through an increased indirect taxation.

Another eligible district, which is already surveyed, and which, I have every reason to believe, the Canadian government would willingly make a few grants to a well-organised emigration society, is a place called Sault St. Marie, situated between Lake Superior and Lake Huron. The river St. Marie, 39 miles long, through which Lake Superior discharges itself, would give any amount of water-power; and the large quantity of water which surrounds the district equalises the temperature, and it is neither so cold in winter or hot in summer as in many other parts; on one side is Lake Superior, which is 1,750 miles in circuit, with an area of 40,000 square miles. On the other side is Lake Huron, which is 578 feet above the sea, and is 250 miles long, 220 broad, with a depth of 900 feet. The country near Lake Superior is bold and rocky, and contains inexhaustible mineral wealth, in iron and copper. The Bonce copper mines are here, and here too is the American boundary line; and the Americans, knowing the resources of this part of their territory, have constructed a ship canal on their side of Sault St. Marie, between the two lakes, to overcome an interruption of a mile and a half in the navigation of the river, and as soon as the land becomes partially settled, the Canadian government will construct a canal on their territory. The soil is good, abounding with the sugar maple and other timber, which, with the advantage of good water-power, is invaluable; in fact, Sault St. Marie might become a depôt for lumber, as the shores of Lake Superior, except in Michigan and Wisconsin on the south, and the Hudson's Bay and a small portion of the territories of the mining companies on the north, are covered with the original forests. The water communication cannot be surpassed. The whole traffic passing Lake Superior, coming from the north-west provinces, must pass this spot. The discovery of the size of Lake Nipegon, which is really the sixth American lake, and the head of the St. Lawrence is a great geological fact; this will ultimately bring even more traffic this way, and make Sault St. Marie a most important point.

From this point you can go to Chicago by water; and, in fact, all the copper ore raised is taken down to be smelted at Cleaveland, where the coal of Ohio is used for the purpose. The approach from England is easy, namely, by steamers, and then on by railway to Collingwood, on Lake Huron, from which steamers constantly run through the Sault St. Marie Canal into Lake Superior. The fisheries here, too, are not worked, and are also inexhaustive, and the place is altogether most eligible for colonisation.

We have now arrived at the question of the practicability of self-sustaining emigration. After a long residence in our colonies, my experience in buying, selling, and settling land assures me that this is possible. My plan has long been studied, and, although it bears a resemblance to the Emigrant and Colonists' Aid Corporation, it is broader in its basis, and the plan itself is purely of a benevolent character. One thing, however, is certain, if my plan, with a borrowed capital, to be repaid with interest in twelve years, can be made to succeed, then that excellent corporation must become eminently successful.

I now proceed to describe my scheme, as it might be carried out on a large and comprehensive basis, not that I should prefer a gigantic experiment to one of smaller dimensions, but I think my meaning would be more clear if put before you in a large plan. Suppose, then, we borrowed a million of money from the government or our excellent Chairman, to be repaid with simple interest in twelve years, on condition that it is to be employed in sending 40,000 people out to our colonies, preparing for their reception on their arrival, providing them with the necessaries of life until they can support themselves, and by developing the resources of the colonised country, shall make the whole scheme equally advantageous to the emigrant, the colonial, and the imperial government. With this million of money I would establish ten distinct settlements in our colonies of 130,000 acres each, and set apart £100,000 for the administration of each settlement, and administer this capital sum in such a way as to colonise the district, and have the capital sum recouped. The passage money for 1,000 families, averaging four statute adults per family, at £8 per head, would amount to £32,000; and I would set apart for each family food and implements to the value of £40, to be dispensed to them at regular periods during the first twelve months. This would form a charge of £40,000. I would also place at the disposal of each family 100 acres of land, reserving 30,000 acres for purposes I will presently describe. The working expenses for the 12 years I put at the balance of £28,000. So much for the expenditure; and now I come to the reimbursement. The interest upon £100,000 for 12 years at 3½ per cent. amounts to £42,000; but inasmuch as I should require repayments from each family, to commence with the end of the second year, the actual charge on account of interest would amount only to £25,000. The interest then will bring the capital sum up to £125,000, and this sum must be got out of the 1,000 families in the course of the 12 years. While, therefore, I would let each family have its 100 acres free of charge for the first 12 months, and give them the £40 worth of implements, food, and other necessaries into the bargain. at the end of the second and third year, I would require £5 from each family; at the end of the fourth and fifth years, I should require £10 per family; at the end of the sixth and seventh years, £12; at the end of the eighth, ninth, tenth, and eleventh years, I should require £14; and at the close of the last year, £15, as a final payment. This would give us £125 for each 100 acres in exchange for the freehold, and produce the necessary £125,000. I have yet 30,000 acres of land left. I would devote 7,000 of them to roads, churches, schools, &c., and set apart 2,000 of them for town sites, villages, and business sites, at £15 per acre, which would yield £30,000. This would still leave 21,000 acres, to be sold at the rate of 30s. an acre, and realising £31,500. These reserved lots would naturally fall into the hands of the best settlers and most successful colonists. These repayments of £125,000, the proceeds from town sites of £30,000, and the £31,500 arising from the sale of reserved lots, amount altogether to £186,500, and yield a profit for the local treasury, or to make good deficits of £57,500. This repeated in ten districts gives the following gross result:—

Expenses.

Passage-money for 10,000 families, averaging four statute adults per family, at £8 per head	£320,000
Advances of £40 to each family on account of implements, subsistence, &c.	400,000
Balance for working expenses for 12 years	280,000
Total	£1,000,000

Reimbursment.

By 10,000 families, of £1,000,000, with 3½ per cent. per annum simple interest, during 12 years		£1,250,000
1st year	*nil*	
2nd „ £5 per family	£50,000	
3rd „ £5 „	50,000	
4th „ £10 „	100,000	
5th „ £10 „	100,000	
6th „ £12 „	120,000	
7th „ £12 „	120,000	
8th „ £14 „	140,000	
9th „ £14 „	140,000	
10th „ £14 „	140,000	
11th „ £14 „	140,000	
12th „ £15 „	150,000	
		£1,250,000

Results.

Cost of 100 acres for each family, being the repayment of advances and interest, £125 per family, 10,000 families		£1,250,000
70,000 acres for roads, schools, churches, &c.	*nil*	
20,000 acres for town sites, villages, and business sites, at £15 per acre	£300,000	
Reserve of 210,000 acres, at 30s. per acre	£315,000	
		£1,865,000
Profit		£575,000

These calculations are made on the basis that the colonial government would make a free grant of land, but although the grant will be free, the colonial government will not be losers, and will, in fact, receive ample compensation in the shape of taxation upon 1,000 families in each district. Taking direct and indirect taxation, we may estimate that the colonial treasury will be a gainer to the extent of £2 per adult, and presuming that the families would number four adults on an average, this would give £8,000 to the colonial treasury per annum, almost immediately, in exchange for what before was wild and unprofitable land. I have already set apart £28,000 in each district for the working expenses during the twelve years; this would give us nearly £2,341 each year, and out of this I propose to give the manager of the estate some £400 a-year, and two clerks to assist him at £100 each, leaving an ample margin for contingencies.

The question may be asked as to whether any instances can be given of a result such as I have pictured, of having been brought about. The answer is that several experiments have been made, more or less resembling my plan. I will mention one. The experience of an eminent colonist, who is now living in London, furnishes a case in point. Twenty years ago, shortly after the establishment of British rule in Port Natal, Mr. Bergtheil found himself in possession of 15,000 acres of mother earth, but the old lady, though attractive ni

primæval beauty, with her lap full of riches, had never been disturbed by the hand of man. The wealth was there, but of no value, as the power was lacking to bring it forth. There was much land, but no hands, so Mr. Bergtheil came to Europe, where little land is to spare, but, alas! idle hands are too abundant. In Germany, he selected 47 families, numbering in all 247 souls. Now mark. The whole of these he carried out to Natal, located them on his own property, and built stores, to provide them with the necessaries of life, until they could provide for themselves. And what were the results? At the end of six months after their arrival in the colony, the head of each family possessed a house and garden well-stocked with vegetables, and, things continuing to prosper, they soon found themselves in possession of a freehold farm, and on the road to independence. Nor is this all. Two towns sprang up as if by magic, uniting trade, commerce, and agriculture, and thus in a short time creating out of a wilderness a little world, inhabited by a happy and prosperous people. Surely it will not be offensive to say that the gentleman who accomplished such a work has done more substantial good for this world of ours than the disorganised efforts of all our new-born emigration societies put together. It would be far better for the aggrandisement of any colony, and for the glory of any parent country, to give their best lands to such a man, with money to boot, than to sell it at a high price to unprincipled speculators.

Perhaps it may be in the minds of some that the result I have pictured must have followed the exertions of the emigrant in numberless isolated cases of which we have no account; but those cases of spontaneous emigration which have come under my observation have proved to me that the difference between the lot of the ordinary emigrant and those who may be sent out in connection with a good, well-considered plan is immense; and all those who have been accustomed to survey land in the wilderness, have often been struck with the fearful isolation of the pioneer settler, and the desolate appearance of his little log hut. Far away from human habitation, month after month, the never-varying thud of the axe is heard falling on the trunk of tree after tree, telling the tale that one brave man alone is driving back the forest, and claiming, by the right of conquest, foot by foot, a farm on which he and his family, at no distant day, are destined to become independent. The little patch of clearing already made nerves his arm, and when he rests, as the sun shines brightly on his Indian corn ready to be gathered, he calls his wife and they talk over the blessed guarantee of bare subsistence for the future, and instead of desponding over its scantiness, it becomes the source of bright dreams of a good house, a farm-yard, well-filled granaries, horses, cows, and poultry, and all the luxuries and comforts of an affluent civilised life. Another instance, showing the hardships which the ordinary emigrant has to undergo, may be taken from my own experience. A few years ago I bought, from a pioneer settler, a piece of land. The settler was a native of London, and joined the army in 1812. Soon afterwards his regiment was ordered to Canada, and up to this time he had never seen a wheat-field. He received for his services in the army government land scrip for 200 acres, but for a long time his title was of little value, the estate being lost in the midst of a dense forest, and when, after much trouble, it was found, he bravely took possession, and commenced a new life, with an axe, spade, hoe, gun, bag of nails, a few potatoes, and a pocket full of Indian corn. How he lived for the first year no one but himself could tell. Still, after many years of lonely, unassisted toil, he found himself a rich man in the midst of a thriving settlement, and the small piece of land I purchased of him I sold to the present Postmaster General of Upper Canada for £1,750. After such instances of individual hardship, followed by success, in the wilderness, who will be bold enough to say that success will not attend combined effort conducted on the principles of co-operation? History furnishes us with precedents which put the question beyond a doubt. It was the co-operation of persecuted men, assisted by God's free gift of the spirit of religious liberty, which sent the Pilgrim Fathers to the shores of New England, and helped them to assist in laying the foundation for a people whose present greatness and prospects of future grandeur have not been surpassed since the world was made. It was the co-operative principle which carried the Mormons, independently of their false theology, so many hundred miles across the wilderness to Salt Lake, and after settling at Utah, it was co-operation alone which enabled them to perform the wonderful task of turning a barren soil into a fruitful garden. And I may add that the successful emigration of 1,000 Waldenses to Rosario Oriental is an instance of the good results which follow combination and system. These poor, persecuted fellows were sent out through the contributions of a few friends in England, Scotland, Holland, and Prussia, and, although the sum raised did not amount to more than £4,000, it sufficed to place them on the road to independence. It is true, when they arrived at their destination, they were environed by hostile natives, and pounced upon by speculative land-sharks, still they did not hesitate to give their bonds to four times the value of their land; nevertheless, by combined action they have, besides conciliating their foes, paid every dollar demanded of them, and are now living in the midst of a thriving colony. If we are told that it was religious enthusiasm and fanaticism which united these people, and enabled them to accomplish such results, I answer—Go to our chambers of commerce, our merchants' offices, and our city markets, and you will find men as determined of purpose, and who are bound together as closely for one object as much by mammon as by godliness. It is, therefore, unnecessary to inquire whether mammon or godliness would be most effectual in binding together a number of men, with their wives, their sons, and their daughters to form a colony. So, if it be asked what security you have that the loan contracted in behalf of the emigrant would be repaid the answer is, the certain prospect of worldly gain, his natural love of offspring, and his knowledge of certain removal from his holding if he neglects to meet his liabilities. To doubt the fulfilment of the engagement is to libel the national character. It is said that, in 1852 and 1853, the Highland and Island Society of Scotland sent out a number of emigrants to Victoria and South Australia, on the promise of repayment of the expenses of the passage, and that the amount recovered did not amount to five per cent. of the expense. In my opinion this failure could be found in one of the following causes:—The emigrants cannot have been settled on the land, or, if placed, they must have been left to shift for themselves; the district must have been so ill-chosen and so badly managed that the emigrants had not the slightest chance of substantial benefit; or lastly, which I cannot believe, Scotchmen are more dishonest and less thrifty than the poor ignorant people of the Basque provinces, for we have been assured that only a small per-centage of 40,000 of these people, carried out by one house alone to Monte Video, failed within the given period to repay their passage money. And why did the small per-centage fail? The reason is a good one. The poor fellows did not understand any mechanical trade, neither were they settled on the land; they were sent out without any definite plan for their well-being, and left to earn their living as porters and messengers. Behold these poor honest fellows doomed to toil on for years, perhaps for life, like beasts of burden, and compare their condition with that of a thousand families, numbering 4,000 souls, all bound together for one common object, centralising and utilising their labour to create out of a part of this beautiful earth a little kingdom of their own. It is true hard work for a time would be their portion, rough places would have to be made plain and crooked straight,

but God would be their capitalist, and would pay them liberally. Nor would they lack incentives to toil cheerfully. New associations would arouse latent energies. One would say to his neighbour "Come and see what progress I am making in my clearing;" another would want a cow-shed or stable built. "A bee," which is a municipal law in a new colony, would be summoned, many hands would make short work of it, and the last nail would be driven home with "God speed you, neighbour." The co-operative store and general post-office near the banks of the river, on the site for the town, would be the centre of general attraction. Men of forethought would secure building lots, knowing that four thousand people would soon want boots, clothes, hats, ironmongery, shoes and harness for their horses, mills to saw their lumber and to grind their corn. Business places would soon appear, where men, if they liked, might work at their trade, and for a time receive for their labour the produce of the land. Nor would the customs of Old England be forgotten; one would say, "This is St. Crispin's day;" another, "This is the birthday of my sister—come to our holding, for there will be great merrymaking;" and young men and maidens would meet, and dance, and sing, and there would be marrying and giving in marriage; and land would rise in value, and schools would be established, and churches would appear, and God's name would be praised in a new world. The chairman shall put the finishing touch to this picture. Yes, Sir George Grey—in whom it may be truly said that all the characteristics of a high-born Englishman dwell in an eminent degree, courage, deep thought, probity, and careful utterance, unhesitatingly declares, as the late governor of a British colony, that "the land that has been cultivated by poor mechanics has resulted in placing them in a state of independence, and that their children in the first generation have become lawyers, merchants, members of assembly, orators, and distinguished in every walk of life." This picture is not an imagined landscape in the moon; it is a true representation of the wealth-creating power of colonisation. In order further to illustrate this, I beg leave to present to the Society of Arts two pictures, from which a volume of knowledge may be gathered by only a cursory examination. To place my pictures in a proper position, we must trace 75 years of past history, and here we are, on the 16th February, 1795, in North America, standing on the margin of a beautiful ice-bound bay, stretching for a mile towards the south to a long sand bank, against which Lake Ontario is beating with angry wave. We try to look northward, but the view is broken by interminable snow-clad forests; the sun shines brightly, and the cold crisp air gives elasticity to mind and body, inspiring us with interest in the lonely scene; hungry wolves are howling, and timid deer are flying behind the tangled brushwood skirting the forest to the west. We now discover footmarks in the snow, and here are indications of the work of man; these rude sheds are the wigwams of two families of Missessauga Indians. All around is desolation; the nearest point of civilization is nearly 200 miles eastward; the west and north have hitherto been in possession of the red-skins. We enter a wigwam, and find the Indians not marked with war-paint, but with trouble. They have just seen the face of civilized man, and know that, when the snow is melted and the earth is hardened by the sun, their hunting-grounds are lost to them for ever. They appear to be listening to their chief, whom we may imagine is fortelling their destiny, in the language of Longfellow:—

> Gitche Manito, the Mighty,
> Said this to me in a vision—
> "I beheld, too, in that vision,
> All the secrets of the future,
> Of the distant days that shall be.
> I beheld the westward marches
> Of the unknown, crowded nations.
> All the land was full of people,
> Restless, struggling, toiling, striving,
> Speaking many tongues, yet feeling
> But one heart-beat in their bosoms.
> In the woodlands rang their axes,
> Smoked their towns in all the valleys,
> Over all the lakes and rivers
> Rushed their great canoes of thunder.
> Then a darker, drearier vision
> Passed before me, vague and cloud-like;
> I beheld our nations scattered,
> All forgetful of my counsels,
> Weakened, warring with each other;
> Saw the remnants of our people
> Sweeping westward, wild and woful,
> Like the cloud-rack of a tempest,
> Like the withered leaves of autumn."

The second picture is sketched after a lapse of sixty years. We are standing upon the same spot. The scene is changed; the year is 1855, and we are in the heart of Toronto, a beautiful city with 50,000 inhabitants; we look westward and where the deer fled from the wolves we find long lines of splendid stores, with plate-glass windows, filled with the richest merchandise of Europe, and the ground on which they are built is worth £100 per foot frontage. Where the forest stood, we see broad streets stretching far away, intersecting each other at right angles, having splendid houses and pleasant villas; besides two colleges, two cathedrals, 24 churches, a provincial asylum, and a handsome post-office. Many of the buildings are fine specimens of architecture, and would be an ornament to any city in Europe. A map of Upper Canada is placed in our hands; we trace the country 100 miles towards the east, and find towns and villages have sprung up; we turn to the north, with the same result; towards the west we find that for 100 miles dense forests have been cut down to clear the way for a great empire. Going still further west, we arrive at Hamilton, a beautiful city with sixteen churches, several substantial banks, a large number of manufactories, a splendid central school, and many merchant princes who are proud of their surroundings. Following the same track, we arrive at the thriving town of Brandford, with its nine churches, handsome town-hall, market-house, school-house, newspaper offices, and all the accompaniments of growth and prosperity. Beyond this, we at last come to the beautiful city of London, with its 12,000 inhabitants, splendid houses, and pretty villas, and these have sprung up in the wilderness within twenty-five years. Time will not permit us to pursue the journey; we throw aside the map, and gaze towards the south, on Lake Ontario. The vision of the Indian chief is realised —the white-man's steam-ships and gunboats are in sight,

> "Smoke their towns in all the valleys,
> Over all the lakes and rivers
> Rush their great canoes of thunder."

I have presented these two pictures, in order to show that if such a grand transformation has come to pass from emigration, the result more of accident than organisation, how much more easily and more surely might other wild districts be transformed, if attacked upon a system suggested by the trials of the pioneer of sixty years ago. It is true, we find that the districts which produced such wonderful results were wisely selected, either at the head of a lake, the margin of a stream, the banks of a navigable river, or on the great highway coming from and leading to some place of importance; still, let the same thing be done on any uncleared land, and villages, towns, and cities are sure to be created by the settlement and cultivation of the soil. England, we are told, is the great workshop of the world, but she has been depending too much upon her workshop, and the result is the manufacturing of two classes, the extreme rich and the extreme poor; whereas the breaking up of new land in our colonies has produced new worlds, distributing even-handed prosperity to millions of people. What is the secret of the prosperity of the United States of America, which is leading that great republic on to be the most powerful people in the world? Just this—they have long known how to dig inexhaustible resources out of their interminable land. Hence their desire to connect by a railway the Atlantic

with the Pacific, and so open out and utilise regions which until lately were unexplored. The contractors of that railway were alive to their interest when they accepted strips of land along their line in part payment for their work, knowing that England's folly would soon send them plenty of hands to turn their land into gold.

It is true, our government might find it difficult, at this political crisis, to make emigration a State question; still, ignoring will not crush the social monster pauperism, which threatens the stability of the present order of things, and obscures the future with a gloom which cannot be pierced by the most far-seeing. Political economists may tell us that the functions of a good government are, to watch the movements, and discover the secrets of foreign states, to honour the genius that can invent the most deadly weapons of war, to raise bulwarks to protect the land, and to ascertain even to a scruple the weight of taxation a nation can bear. Granting these are all necessary to meet the exigencies of the times, still, in my humble opinion, a good government, as a faithful steward of the Queen and people, is also bound to make the most of the empire committed to it. If one part of the dominion is over-populated, and the wealth-creating power of labour is perishing from lack of use, it is the duty of that steward to help to send that surplus labour to other parts of its dominions, to raise new towns, build new factories, create new trades, and establish a new commerce, so that every Briton should have bread enough to eat during the life God has given him. I know that my plan of colonisation will be assailed, like all progressive schemes, by a host of different interests, but the foes to be most dreaded are those now raising the cry "Behold the exodus of the people; the glory of Britain is departing." The cry is false; it is the children only who are going, and they seek new homes in the same dominion. Britain, our beloved Britain, will continue to wax strong in her old age, and, by the blessing of God, the glory of the mother of the empires will be as indestructable as the everlasting hills.

DISCUSSION.

Mr. Edward Jenkins, while confessing his obligation to the author of the paper for the general ability which it displayed, and for the poetic spirit with which he had imbued the subject, said he could not but deprecate a good deal of what was said at the outset. In discussing a great question of this sort, it was not a dignified attitude for anyone to assume to depreciate in any way the efforts of other persons who were pursuing the same end, and he must say the first few paragraphs of the very able paper they had listened to depended for their application on a misapprehension of facts, for which he did not see that there was any excuse. The author had referred to the efforts of various societies, of some of which both the Chairman and he (Mr. Jenkins), as well as many other gentlemen present, were members, and, as it seemed to him, he had failed to investigate the principles upon which these societies were working. The Working Man's Emigration Society, which had united with the Emigration League, was somewhat animadverted upon, at all events by implication, and was supposed to be asking government assistance to transport labour from this country to empty labour fields in the colonies; and then followed a grotesque picture of hot-beds of labour to be created in the colonies for the purpose of absorbing the surplus home population. He must say that this was a most unfair representation of the principles and aims of the National Emigration League, which could not really be better expressed than by the latter part of Mr. Plummer's paper; supposing only the element of private speculation which had been imported into it to be got rid of, and which, he believed, would only lead to the most disastrous failure. What the League proposed was simply to strip Mr. Plummer's scheme of the private element, and to ask government to do that which he proposed should be done by a private company; and it appeared to him that any one who looked at the scheme as it had been laid before them that evening must be convinced of its impracticability. They were asked, as he understood, to suppose that a million sterling should be procured either from the home government or from private individuals, for the purpose of exporting 10,000 families, and placing them on land to be granted free by the colonies, in order that private speculators might, in twelve years, acquire a very large profit by the speculation. When, however, he considered the rest of the paper, and saw how ably it was worked out, he thought it afforded a sound basis upon which they could go to government, which alone had the power of organisation and the requisite funds at disposal for such an enterprise, with some hope of success. At the same time he had no wish to interfere with the efforts of chivalrous gentlemen who liked to spend their own means in this way. There were, in his opinion, two main points to be kept constantly in view. First of all, what it was they wanted to do; and, secondly, the best way of doing it. They did not want simply to export 10,000 families from England; even such a number taken from the dense masses of the metropolis would produce but very little good; they must assist some hundreds of thousands of families to emigrate, if they wished to create that condition of social relations in this country which would enable the labourer to hope to receive proper remuneration for what he did. Taking it for granted, then, that the amount of distress was so great as to require so large a removal of the population, it became evident at once that if you multiplied the estimates given in the paper in the requisite proportion, in order to meet the demand which would be made upon any exchequer for such a purpose, private enterprise must wholly fail. The principle, therefore, of the Emigration League was to ask the government to assist in carrying on such a system of colonisation; for, considering the admirable arguments which had been put forward in general, he maintained that it would be advantageous to deport labour from this country even were we never repaid directly the cost of carriage, on account of the trade which would eventually spring up. He was afraid, however, that such a fanciful and somewhat speculative theory would not suit the ideas of the present generation, which liked to have ready returns for money invested, and, therefore, a plan similar in its nature to that so well sketched by Mr. Plummer was proposed by the League. He thought that if government advanced the funds in co-operation with the colonial government, it would be able not only to get back from the emigrant the amount advanced, but he would go so far as to say that they might hope in the course of years to repay the colonies themselves for the value of the land which they gave the emigrant; for he was one of those who were inclined to believe that it was false economy for the colonies to give away their lands. In conclusion, he would say there was a great difference between exporting labour to supply a labour market, and exporting settlers for colonisation, and that difference the National Emigration League were trying to impress upon the country. In the first place they urged upon the government that if there was an excess of labour here, and room for labour in the colonies, and they were told by such gentlemen as Mr. Dixon, the Canadian Emigration agent, that there was a demand for at least 20,000 men to supply the labour market there, that it would be the cheapest thing in the end, as tending to relieve the rates, for government to advance the money to export that amount of labour. But that was not colonisation. It simply meant paying the passage money of these people, and employment was to be found for them when they arrived. It was, at all events, part of the business of the government to ascertain where there were these openings, and to give such information to intending emigrants.

That information had been withheld by our own government, although it had been supplied freely by the government of the United States, at every consulate, both here and in the colonies. But secondly and principally, they urged that a land settlement, properly projected and carried out, and especially a settlement of families, would meet the objections which had been alluded to by Mr. Plummer, of the rapid transfer to the United States of persons who went out to Canada, and simply waited there for employment. When a man was surrounded by his family, and so situated that he would have to traverse some hundreds of miles of forest before he got to any labour market at all, there was not much danger of his running away.

Mr. Margetts thought the only objection to the plan proposed in the paper was, that the wishes of the emigrant did not seem to be sufficiently consulted. An intelligent emigrant wanted first of all to know what was the best place to go to, and considering first the English colonies, he would generally put aside Australia and New Zealand as too far off, while Canada would appear objectionable on account of its interminable forests, which presented a great obstable to the majority of English emigrants, who had been used to a town life, and who did not like the idea of having so much clearing work to do before the land was available for farming purposes. The only place, therefore, that could compete with the United States was British Columbia, and what was known as the Fertile Belt, where there was an immense quantity of open land suitable for cultivation by men who had been accustomed to towns, and very often these men made the best emigrants, as they were not deficient in intelligence. British Columbia, however, was difficult of access, and men therefore very naturally went in large numbers to the United States. He had some friends in Kansas, who wrote to him saying there was abundance of land to be had at four dollars an acre, or about 16s. 6d., which was considerably below the cost suggested by Mr. Plummer in Canada, while there were other advantages on the score of climate, which were not without influence. He believed that if English emigrants were to be persuaded to go to Canada and British Columbia, it would be necessary first of all to improve the railway communication, failing which they would still flock to the United States, as they had done hitherto.

Mr. Bergtheil said he should not have intruded himself upon the meeting had not his name and his little colony in Natal been brought so prominently forward. He believed that what had especially contributed to his success was that he started with the idea—having been once an emigrant himself—What must I do to induce people to emigrate? He never dealt with the poor German people whom he took out as he was sorry to say at most emigration meetings poor men were constantly dealt with. He heard them constantly spoken of in the same way as one would speak of a bale of surplus goods which was only in the way in a store, instead of bearing in mind that they had human wants and feelings, that when a man was asked to leave his home, however wretched that home might be, his feelings must be consulted, and it must be explained to him how much his position will be improved. He was the last to depreciate the advantages of any particular colony, whether Canada, Australia, Natal, or the Cape; they all had their advantages and disadvantages; but the first thing was to set before the persons you wanted to emigrate the advantages they would obtain by so doing, and the second, and equally important consideration was, what arrangements you could make so that the colonies might feel, when the emigrants arrived, that however poor and destitute they might have been at home, when they arrived there they would be a source of strength and not of weakness. They could not do better than follow the guidance of nature. When bees swarmed they went from one hive to another, everything being done in order and under proper control and system. On the other hand, a tree shed its seed, and you saw nothing of it again until it sprouted up as a shrub or a tree. In those two ways should emigration be carried on; colonisation being like the swarming of a bee-hive, while individual voluntary emigration was typified by the example of the tree. He did not think it was correct to say that the Home Government did not afford information, as he believed they were very willing to supply all they had, but no colony could stand the sudden influx of a vast number of poor people having no means of subsistence, and it was wrong to put them to the trial. The workhouses in England might be bad, and he believed the workhouse system was the cause of a great deal of the evil, because poverty was treated as a crime, but in the colonies there was not even that resource. The society of which the Chairman was a member was asking for charitable assistance to send destitute men to Canada and other colonies, and he had so much confidence in Sir George Grey's knowledge of the subject that he knew this would not be done except under proper arrangements, or else he should be tempted to say—Pause! and do not send out these people until you know what they are to do when they get there. He himself had the honour to belong to the Emigration League, and also to the Emigrants' Aid Society, and he did not believe Mr. Plummer intended to say a word in depreciation of those societies. A foreigner was once asked what he liked best in England, when he replied, "The inscription which he saw on the front of nearly all public buildings—'Supported by voluntary contributions.'" And it was perfectly true the charity of Englishmen was always ready and open, but charity could not remedy this evil; it was too large, and therefore the next question was, would government do it. He had every confidence in the good wishes of the government, but he knew what emigration was, and so did they. It would be a troublesome piece of work, and they would not undertake it until, like the telegraphs, they saw there would be a profit to be made out of it. Then they would come forward and take it in hand. They must, therefore, do what they could to help themselves, and show the practicability of the system, and then he had no doubt that government would complete the work. As regarded his own little colony, perhaps a little youthful vanity had had something to do with it. Having all this land, he said to himself that he might as well bring some one to settle upon it, and then, at all events, whatever happened, these people would never forget him, and he should be leaving some little monument, at any rate, behind him. And so it turned out, for the little village bore his name to this day. Whether he became rich or poor, that village would still stand, and its first inhabitants and their children would never forget their founder. No one who had money to spare could do better than follow the same plan. Let him take out a few poor families, settle them on the land, supply them with necessaries for a short time, and treat them well, and he need not fear that his outlay would be repaid; but to think that an emigrant could be sent abroad to shift for himself how he could, and then expect him to send money home, was a little too much for human nature. He believed if the million sterling which had been spoken of were placed in the hands of the worthy Chairman, he would soon find the means of spending it wisely and profitably.

Mr. Frederick Young said he was very glad to see some ladies amongst the audience, for he was convinced that this was pre-eminently a lady's question, and if once the ladies would take it up, the men would soon follow them. He was also a member of the Emigration League, and therefore, while thanking Mr. Plummer for his valuable paper, he must enter his protest against the harsh terms in which the efforts of those who had been

endeavouring to diffuse the views of the League had been spoken of. He felt assured that whatever action the government would ultimately take in this matter would depend upon the feelings with which it was entertained hy the British public. And if any argument were needed to support the views which had been promulgated from the first hy the Emigration League, it was supplied by Mr. Plummer's paper, which had proved that a system of colonisation might be a great commercial success. But, inasmuch as there were a great many questions which would have to be cleared up hefore that success was assured, he considered that these risks were such as should not be thrown upon any private individuals, hut should be horne by the nation or the government, of course taking on the other hand any profit which might accrue. Large sums of money had been spoken of, and a million sterling certainly was a large sum, but he concluded that a much larger sum than that, five, or perhaps, ten times the amount, would be required for a perfect system of colonisation; and even such a sum would, he believed, be wisely expended in such a way. A question had just been asked in the House of Commons on the subject of the increase of pauperism in the metropolis—and the same thing was going on all over the country—to which Mr. Goschen replied that it was perfectly true the workhouses had heen overcrowded for the last three years, but that he hoped during the present year there would be an addition of some 4,000 heds in the workhouses of the metropolis, and of 3,000 in the next year. No doubt many gentlemen present were as well able to judge what that meant, as he was; it certainly meant the expenditure of a very large sum of money in addition to what was expended now, and it appeared to him there was no greater difficulty in spending money on a well considered plan of colonisation, than in providing increased workhouse accommodation in London, Manchester, Sheffield, and other large towns; for in the former case the sums spent, though large, would be saved to the ratepayers in other ways, instead of tending to increase the demoralisation and pauperism of the country. In conclusion, he would merely say, as he had always said, that while they had the divine command to people and replenish the earth, the same command which told them to increase and multiply did not tell them to keep in one particular spot while there were vast regions uncultivated and unpeopled.

Mr. Whalley, M.P., said he was not able from experience or reflection to say much on the subject of emigration, and how far the suggestions offered by Mr. Plummer could be carried out, but he felt sure that the result of the action of the societies recently established, and for which the country were mainly indebted to tho Chairman, would be to bring about better relations between the colonies and the government. He could only say, in conclusion, that he should be prepared to do everything which lay in his power to support these views in tho House of Commons. It appeared to him that amongst all other inducements to persons to assist emigrants from this country, there should be somo assurance that the relations between the colonies and the mother country should in no degree be relaxed. But, on the other hand, whatever might be necessary, this country would be willing to do in order to maintain unimpaired and unbroken tho fabric of the British Empire throughout tho world.

Mr. Briggs did not think there was any Englishman worthy of tho name who would not sympathise with the objects which had been brought beforo them that evening, and which were so well put forward by the various emigration societies which had been referred to. At the same time, it appeared they would not be able to prevail upon the government to tax tho people of this country for the purpose of sending people away to Canada, inasmuch as it was quite clear, from the official returns, that nine-tenths of tho emigrants who went thero passed on to the United States, and, therefore, it seemed preposterous to expect the taxpayers of England to pay for sending people to a place where our goods were barred out by a hostile tariff. With regard to what had been said about the Americans making the most of their land, that was well illustrated by the course of their legislation. During the last year they had carved out of the wilderness 60,000 of acres, and settled down 60,000 families in the course of one year, which would represent the population of a city of 250,000 or 300,000 people. With regard to the experiments which had been carried on in Natal, he thought it very strange, considering the number who had gone there, that they had not increased to a much greater extent than they had, and there must be some reason to account for this. With regard to government assistance, he feared they would never get it until a great outcry was made.

Mr. Torrens said he had listened with very great pleasure, and with a great deal of profit and instruction, to the paper which had been read that evening. He had emigrated to South Australia at a very early period of his life, and at a very early stage of that colony's history. He had been there two years when he had the pleasure of seeing Sir George Grey land as third governor. He had seen the forests disappearing, and the plains, which at one time gave but a very scanty subsistance to the savage tribes, converted into beautiful homesteads and farms, the tillers of which were, in almost all cases, the proprietors. He agreed with what had been said, that perhaps the most honourable and useful work to which a man could devote his life would be the promotion of systematic colonisation. In fact, he believed this was almost the only direction in which charity could be exercised without leaving behind it any residuum whatever of evil results. He spoke with some personal experience, for, in 1838, it was his lot to travel through Ireland, it being then in contemplation to introduce the poor-law in that country, and his ohject was to oppose its introduction. He wished tbo landlords of Ireland to clear their estates of the surplus population, who were living in a state of semi-starvation, by sending them out to Australia; and, although he did not succeed in that, yet he was enabled to send away three shiploads of the lower classes of the Irish, the most ignorant, common labourers, and before he left Australia it was a great delight to him to visit and see these people, who, if they had remained in Ireland, would most of them either have died in the famine, or would have been still living in a state of hopeless indigence, but were now the proprietors some of them of large estates worth £20,000 or £30,000. He had seen them all, except a few who gave way to drunkenness, prosper greatly, and amongst that large numher he did not believe there was a single instance in which a man did not become the proprietor of a considerable farm in a very few years. That was the result of systematic colonisation on what was then known as the Wakefield system. It was important to observe that they had now the nuclei of civilised societies already estahlished upon which to found a system of colonisation both in North America and in Australia, which were quite sufficient to absorb almost any amount of the surplus lahouring population. To give one instance. A great deal had been said of the advantage of emigration to Canada. He had never been in Canada, and he would say that one of tho most pleasant features of those meetings was, that thero was none of that colonial rivalry which might possibly be expected to arise amongst people who had interests in differont parts of the world; but they wero confined to the great question which interested people in England, how their poorer neighbours were to bo assisted to settle in tho colonies. Now, South Australia was a great wheat-growing country, and tho wages there for a common labourer were about 6s. a-day, whilst miners earned about 12s. The consequence was that the employment of capital was very much limited, because capital could not bo

profitably employed in a country where wages were at the rate of 6s. or 7s. a-day, and where the interest on money was 12 or 14 per cent. But if the sending out of emigrant labour in sufficient quantity brought down wages to 4s. or 5s. a-day, at which rates the workmen would still be in a most admirable position, because food was not more than half the price it was in England, there would be an inexhaustible source of wealth in the copper, lead, and silver mines of that country which now could not be touched at all. At the present rate of wages they could only profitably work copper mines which contained over 15 per cent. of copper ore, which any gentleman who was conversant at all with metals would be aware was an extraordinarily high per-centage. He believed there was ample scope there for that amount of labour which required to be sent out of this country in order to place the industrious classes who remained behind in a condition worthy of civilised beings. He quite agreed with the views which had been put forward, and thought that it was impossible for private charity to carry out such a great enterprise. It was only by the aid of government that this work could be acccomplished. He believed that the most economical thing that the guardians of the poor could do would be to raise money, as they were now enabled to do by the aid of government, for the purpose of emigration. Thirty-five pounds would suffice to carry out an emigrant family, and the interest and sinking-fund upon that amount, allowing it to be lent at the same terms that it was lent to Irish landlords for improving their estates, would not amount to more than 40s. a year.

Mr. Plummer said, in reply—The great inducement which decided me to appear before the Society of Arts, was the knowledge of meeting with gentlemen of hard brain, whose disinterestedness would enable them to winnow one of the most important subjects of the day; and if I have been fortunate enough to lay this subject before you in a way to induce you to think deeply upon it, great good will have been done, and my object will have been gained. The materials I have submitted for discussion have only been touched upon by Mr. Torrens, Mr. Whalley, and others who have had practical knowledge of our colonies. Mr. Jenkins, my first opponent, in stating that my scheme advocated private speculation, and that it was connected with a vested interest, made a mistake, for it is purely benevolent, and I merely show what can be done with a £1,000,000 borrowed capital. Really I should shrink from continuing to discuss the question with gentlemen who know nothing of practical emigration and colonisation. In such a discussion, I should simply hold up facts to be attacked by suppositions; but I should be glad to hold a public discussion with any number of experienced emigrants or accredited colonists. Mr. Jenkins says Canada can take 20,000 emigrants this year. That is true, but the emigrants required are common labourers, who are wanted for railway purposes. A correspondent of the *Daily News*, of the 11th inst., writing something like an official communication, says Canada will want, in 1870, 24,000 able-bodied persons, but 15,000 must be common labourers, 7,000 domestic servants, and only 2,000 mechanics; and then, fearing that he held out delusive hopes, he goes on to say that even this small number of mechanics had better not leave England unless they are willing to try their hand in a new line, and become labourers, for labourers and not mechanics succeed there. The question has been asked—Are mechanics fit for, and if so, are they willing to commence colonising? Surely no one can doubt that British workmen hold, by inheritance, the same element that is leading the Anglo-Saxon race on to encircle the earth. Take them from the enervating influence of close rooms and overcrowded neighbourhoods, and the depressing influence of no work and a dark future, and place them in a new world, with a fair chance in the battle of life, new aspirations and proclivities will appear, and they will not belie their origin, but claim the uttermost parts of the earth for their possession. I have already shown, by Mr. Bergtheil's weavers in Natal, Sir George Grey's description of workmen in another colony, and by many instances in Canada, that mechanics make the best settlers and farmers. There are thousands of unemployed mechanics in this country who would only be too glad to join any well-organised scheme of colonisation if they could see the least chance to better their condition, and to such who are willing and have the courage, and to such only, I say, "Go; before you forests will tremble and fall, and deserts will become fruitful."

The Chairman, in proposing a vote of thanks to Mr. Plummer, said it was gratifying to find that both Mr. Plummer and Mr. Jenkins were members of the Emigration League, and any little differences they had they would be able to settle between them hereafter. It appeared to him that there were two main considerations to be attended to. In the first place they had to consider what would induce a large body of men to leave their homes in England, and the result of that would be, that a large body of persons would be endeavouring to find out what could be done in order to keep men in England, so that on both sides a benefit would be derived. To say that nothing precisely of the same kind as was now proposed had ever been done before, was really to advance no objection; because what was said was this, that large countries had been founded, free of expense to the mother country, principally by individual enterprise. For instance, South Australia, of which Mr. Torrens had spoken so eloquently, with the exception of a very few thousand pounds, had repaid all the cost to which the parent country had been put. Victoria had never cost a single sixpence, and the settlement of Canterbury was also founded entirely without cost. Otago never cost England a shilling; and the Scotchmen who established themselves there, when they wanted the presence of a few troops, in order to avert threatened disturbances amongst the miners, paid for those troops themselves, and gave extra allowances to both men and officers. Therefore, what was proposed had, in another form, already been repeatedly done; and he might further say this, that, before machinery attained its present perfection, you might as well have said to a person in possession of the improved tools which then existed, that you could not make such machinery because it had never before been done. In the colonies which were already founded, in the railways in these colonies, and in the steam and telegraphic communication which now existed with all parts of the world, a machinery existed which would enable them to found new settlements in those already existing upon a plan which had never before been adopted, and which was certain of success. It was incredible that men who had had the energy and sagacity to achieve what had already been done in the world, should now falter at the last moment when they were really entering for the first time upon a path of greatness, surpassing anything which Great Britain or the world had yet seen.

Mr. Hyde Clarke writes :—I beg to call the attention of the friends of emigration to one resource for reproductive emigration which I have advocated for many years, and that is the imposition of a tax (of say £1 per head on each adult) on new immigrants, the proceeds to be applied as a fund for assisted emigration to such colony. If a man is put in the position to acquire a competent livelihood, it is but fair he should pay compensation, so as to enable others of his fellow-countrymen to profit by the same advantages, and to promote the population of the colony in which he is. It is to be remembered that the want of federation is, with regard to emigration as to other measures, injurious to the colonies, injurious to the mother country, and to the empire at large. With regard to emigration, it impedes arrangements for the repayment of advances, and the contribution and distribution of lands for the general advantage.

PROCEEDINGS OF INSTITUTIONS.

Aldershot Local Board.—The result of the elementary examination of the soldiers and their children at Aldershot, by the Local Board of Education in connection with the Society of Arts, has been published to the troops at the camp for general instruction. Nine soldiers and fifty-two children from the camp were examined, out of whom thirty-seven obtained certificates. Twenty-four prizes were awarded to the candidates who stood first and second on the list for either subject of examination. In the final examinations last year, six soldiers were examined, all of whom succeeded in obtaining a certificate. In an order of the day issued recently, it was stated that the Lieutenant-General had much pleasure in notifying to the division the expression of his Royal Highness the Commander-in-Chief's satisfaction at the success of the military candidates at the above examination. "It is gratifying to observe that the emulation for distinction at these annual examinations is on the increase, and it reflects credit, not only on the candidates themselves, but upon the expansive course of instruction obtained in the army schools by adults, as well as soldiers' children, desirous of improving themselves."

ON THE TESTING OF PETROLEUM SPIRIT.

By F. Crace Calvert, F.R.S., F.C.S., &c.

Having read with much interest of late several papers on the Petroleum Act of 1868, and on the uncertainty of getting good results when testing the "flashing point" of petroleum spirit (especially the papers published by Dr. Paul, in the *Chemical News*, and a pamphlet by Mr. Norman Tate, Liverpool), I deemed it my duty to make a series of experiments, with the hope of throwing some light on the subject, the more so, that the defect of the Act of 1868 is, that no length of time is specified for raising the petroleum spirit from natural temperatures to its flashing point. Thus, the Act states:—"The outer vessel shall be filled with cold, or nearly cold water. A small flame shall be applied at the bottom of the outer vessel, and the thermometer shall be inserted into the oil, so that the bulb shall be immersed about one and a-half inches beneath the surface." What is understood by a "small flame" appears to me a difficult question. Whether it shall be such as to require 15, 20, or 30 minutes to raise the petroleum spirit from natural temperatures to its flashing point, say 98° or 105°F., the Act does not state.

The following experiments, made with six samples of petroleum spirit, placed in my hands by the magistrates of Manchester, will show how important the above question is with reference to the testing of petroleum spirit, and the absolute necessity, for the safety of the public, as well as for the interests of those who deal in the article, that the Act should define the exact space of time that should be employed in the testing of any sample of petroleum spirit:—

Sample of petroleum at 52°F.	Time 15 minutes.	Time 20 minutes.	Time 30 minutes.
No. 1	96°F.	98°F.	102°F.
„ 2	92°	99°	101°
„ 3	90°	98°	101°
„ 4	94°	96°	104°
„ 5	96°	98°	110°
„ 6	95°	99°	108°

These results clearly show the influence of time in raising six samples of petroleum spirit from 52°F. to their flashing points. Thus, when fifteen or twenty minutes are employed, the whole of the six samples tested could not be called "petroleum," according to the Act of 1868; the owner would be liable to a penalty and the loss of the fluids; whilst, if the time employed to heat the liquid is half-an-hour, they would all be considered petroleums, their flashing points being above 100°F.

Therefore, there can be no doubt that, according to the time employed so are the results altered; the longer an operator is in completing his test, the higher will be the flashing point of the spirit. This is probably due to the fact that the most volatile products gradually escape in the atmosphere, and are never in sufficient quantity to produce a flash when a taper, as described in the Act, is passed within a quarter of an inch from the surface of the spirit. I am, therefore, of opinion that, as the Act has been made to protect the public against fire and explosions resulting from the employment of too-highly inflammable hydro-carbons, the chemist or person called upon to test liquids of this class should raise the temperature of the fluids as quickly as possible (of course employing the apparatus described in the Act), otherwise they favour the vendor and manufacturer to the detriment of the consumer.

The next series of experiments were made with a view of corroborating a statement made by Mr. Norman Tate, viz., if two thermometers are placed into the petroleum spirit, one, as indicated in the Act, one and a-half inches below the surface of the liquid, the other being only half an inch below the surface, a difference of several degrees will be noticed between them at the time the vapours will flash, and I am happy to say the following results confirm Mr. Tate's interesting observations:—

	Flashed at		Flashed at	
No. 4	94°F.	1½ inches	99°	½ an inch
„ 5	94°	„	98°	„
„ 6	95°	„	99°	„

This curious and unusual fact of a fluid having a much higher temperature near the surface than it has an inch below what may be considered the centre of the bulk of the fluid, is due, in my opinion, to this, that petroleum, not being a homogeneous liquid, but a mixture of several hydro-carbons, the highest products being first expelled, the heat arises towards the surface, and in this way the difference in temperature referred to is produced.

It is with a view of overcoming this practical difficulty that a series of experiments were instituted, in which the operations were conducted in the usual way, with this exception, that the liquid was kept in a constant state of agitation (except at the time when a flame was passed over to observe the flashing point) by the thermometer, and the results obtained were as follows:—

No. 1 did not flash at	102°F.
„ 2 flashed at	99°
„ 3 „	98°
„ 5 „	98°
„ 6 „	104°

These experiments appear to me to confirm the explanation above given, as to the cause which produced the difference of the two thermometers, placed at unequal depths in the fluids under examination; for it will be observed that the flashing-points of the hydro-carbons are raised several degrees; in my opinion, this fact is due to the agitation having facilitated the gradual escape of the most volatile products; the flash will not occur until a sufficient quantity of the more dense vapours have been volatilised and collected on the liquid to be tested.

I believe many of the anomalies above described are principally owing to the difficulty, notwithstanding any amount of care that may be bestowed on the operation, in raising the temperature of the petroleum spirit from natural temperatures in a certain time, say fifteen, twenty, or thirty minutes, to their flashing-points; and as the true flashing-points of the fluids depend entirely on

the time employed in raising its temperature, I would propose the following method, which will enable every operator, in any part of the United Kingdom, to determine the flashing-point of a petroleum with certainty, and feel satisfied that another manipulator will obtain similar results.

The process consists in heating water to 10 degrees above the flashing-point of the spirit (approximately tested) in the outer vessel, such as described in the Act, removing the flame, and then placing the can in the water, filling it at once carefully with the petroleum spirit. The thermometer should then be placed with the bulb half an inch below the surface of the spirit, and the flashing-point then ascertained in the usual manner.

The following are the results I obtained with the same six samples of petroleum which I employed in my previous experiments:—

	1st Exp.		2nd Exp.
No. 1 flashed at	98° F.	..	99° F.
" 2 "	95°	..	96°
" 3 "	96°	..	97°
" 4 "	96°	..	97°
" 5 "	96·5°	..	97°

I am also of opinion that a gas-flame should be employed in preference to a spirit-lamp, when the test is made in the manner directed by the Act, as greater regularity in rising to the temperature can be secured. I have employed in my experiments, and I advise every one to do the same, the excellent suggestions made by Mr. Norman Tate, viz., a small gas flame, instead of that produced by a match or a taper, for testing the flashing-point of the spirit.

I consider the apparatus proposed by Mr. Miles would tend to give certainty to the trial, which at the present time cannot be satisfactorily performed. From the above experiments, the following conclusions may be drawn, viz., that the Petroleum Act of 1868 does not give sufficient and precise instruction for testing petroleum spirit; therefore it is to be hoped that government will take the matter in hand, and do away with the objections to the present Act, substituting more clearly defined rules and instructions, so as to enable the operator to determine the flashing-point of petroleum spirit with greater accuracy.

EDUCATIONAL NOTES.

The Conference held at the Society of Arts appears to have led the supporters of the Union to reconsider their scheme in some of its details. At an influential meeting held on the 10th instant, a supplementary programme was agreed upon, the principal points of which are, to preserve the present denominational system, giving State aid only to those schools which accept a stringent conscience clause; indirect compulsion, by extending the operation of the Factory and Workshop Acts; to meet the case of neglected districts, the local authorities should be compelled to provide the requisite school accommodation within a given time, either by voluntary contributions or by rates, with the aid in either case of a grant from the State, such persons, however, as contribute to the existing authorised schools of the district being exempted from the school-rate to the extent of their offerings; the national schools not to be free, but the fees for the children of parents who are really too poor to pay should, after due inquiry, be discharged by the local authorities.

There has been considerable activity, during the last fortnight, in various parts of the country in discussing the general question. A meeting of the supporters of the Union has been held at Nottingham, under the presidency of the Mayor, when addresses were delivered by Mr. Powell (secretary of the Union), Lord Denman, Mr. Smith, M.P., and others.

A crowded meeting was held at the Chelsea Vestry Hall, on Tuesday, under the presidency of Mr. C. Buxton, M.P., when resolutions in favour of the Union scheme were passed. Among the speakers were Dr. Barry, Canon Cromwell, the Rev. W. Stanyer, Mr. W. G. Larkins, and Mr. Alexander Redgrave.

An important meeting has also been held in Salisbury, in connexion with the Diocesan Board of Education, at which the Bishop presided, and amongst those present were the Dean of Salisbury, and the Archdeacons of Sarum, Wilts, and Dorset. A resolution was passed in favour of the present system, but agreeing to a conscience clause.

At a Worcester meeting in support of the Union, the chairman, the Rev. Canon Hastings, spoke hopefully as to the government measure.

In Birmingham there has been a working men's meeting in connection with the Union. There has also been a Union meeting at Liverpool, presided over by the Mayor. A deputation attended, consisting of Lord Edward Howard, W. Romaine Callender, Esq., and the Rev. W. Stanyer, M.A. Addresses were given by Mr. Graves, M.P., and Mr. Cross, M.P.

An important meeting of the Union has been held at Oxford, under the presidency of the Duke of Marlborough, who spoke in favour of the present educational system. He argued that there were only about 400,000 children now educationally unprovided for, and that there was a steady increase of the number of scholars under the present scheme. He opposed compulsion, and said the League proposed to deprive us of true religious liberty, giving us in its stead "an uniformity, not of one religion, but of no religion at all."

A meeting has been held at Norwich, under the auspices of the Church Association, in support of the present denominational system. The Bishop presided, and among those present were the Dean of Norwich, Mr. E. Howes, M.P., the Hon. F. Walpole, M.P., Mr. E. Fellowes, M.P., Mr. C. S. Read, M.P., and Archdeacons Hopper and Blakelock. Several lectures have also been given and debates held at the same place, in which the principles of the League and the Union were discussed. The Rev. A. W. Pringle and the Rev. J. Baldwin defended the latter, whilst the former was represented by Mr. G. J. Holyoake.

Lord Robert Montagu, in a recent address at Huntingdon, in opposing the views of the League, said he objected to it because compulsion ran through the whole system. Each locality was to be compelled to build, every father was to be compelled to send his children, and religious persons, of whatever creed, were to be compelled to see their children receive a godless education. He also quoted statistics to show that the existing plan had not failed, as was alleged. The *Standard*, in commenting on his lordship's address, denies that a purely secular system would be "truly national," Most Englishmen (it says) have a prejudice in favour of wearing clothes of some kind, though of varying cut and colour, but if we could imagine the existence of a minority who prefer to dispenso with clothes altogether, we might expect to find them contending, after the fashion of Mr. Dixon and his friends, that nudity is the "truly national" costume.

Turning to tho proceedings of the League, a crowded meeting has been held at Liverpool, under the presidency of the Mayor. Mr. Vernon Harcourt, M.P., moved a resolution expressing confidence in the Right Hon. W. E. Forster, M.P., which was carried.

A conference of working men has been held at Leicester, under the auspices of the League. The ex-mayor, Mr. T. W. Hodges, presided. Mr. Paget and the Rev. D. J. Vaughan were among the speakers. As to compulsion and free schools the meeting was unani-

mous, but they were divided on the question of secular schools.

A League meeting has been held at Manchester, under the presidency of Alderman Rumney. Mr. Mundella moved that no education would be satisfactory which was not unsectarian and compulsory; and Sir John Bowring contrasted our prodigal expenditure on war with our illiberality of means for education, which, he said, would cost but ten millions—probably less than it took to bring the people up in ignorance and punish crime.

The Hon. Auberon Herbert has been addressing meetings at Rochester and Falmouth, in support of the League, when resolutions adopting its system were passed. He held that the Manchester scheme was impossible.

In connexion with the League, a numerous deputation recently had an interview with the Lord Mayor, when Sir Charles Dilke, M.P. (president of the London Branch), called his lordship's attention to the position the League had already assumed. The subscriptions to its funds amounted to nearly £54,000, and its enrolled members were upwards of 10,000. Branches were being formed all over the kingdom; 60 had been already established, and as many more were in course of formation; while upwards of 50 members of Parliament had pronounced in favour of its objects. In the metropolis there were already about 1,000 enrolled members; 14 recognised branches had been formed, and others were in course of formation. Public meetings had also been held in Lambeth, Islington, Marylebone, and Greenwich. He requested the Lord Mayor to grant them the use of the Egyptian Hall. This his lordship agreed to do, though he did not wish to be considered an advocate of the League.

The subject of education has occupied the attention of Convocation. Canon Hopkins presented a numerously-signed gravamen to the Lower House, expressing the opinion that the system commonly known as "denominational" should still, in the main, be continued, as against that commonly known as "unsectarian" or "secular;" and that existing schools might, in many cases, be employed or adapted so as to provide a sufficient education for all children near them, if the principle could be recognised of perfect liberty of distinctive religious teaching combined with perfect liberty of declining it. The memorandum prays "that the Upper House will be pleased to take this subject into their consideration, and adopt such method as may seem best to give expression to the unabated zeal and diligence of the clergy in this matter of education, and also to manifest their readiness in every lawful way to second the efforts of her Majesty's government to extend the advantages of education as widely as possible." The conscience clause having been objected to by various speakers, Bishop Mackenzie (of Nottingham) said the time had arrived when, if the Church of England wished to retain her influence as the educator of the nation, she must be prepared to reverse her past policy. Ultimately the motion was withdrawn, and the appointment of a committee to "inquire and report" was agreed to.

The education question has also been under discussion in Scotland. At Glasgow a numerous and influentially-attended meeting of citizens has been held, at which the Lord Provost presided, and it was unanimously agreed to memorialise government to re-introduce the Scotch Education Bill of last Session, in the form approved by the House of Commons.

At a special meeting of the Town Council of Dundee, it was resolved that a general board of education, to be popularly elected, should be established in Scotland; that all existing schools receiving government aid should be converted into national schools, and should be supported by grants from government and local rates, so that the fees may be fixed so low as to be fairly within the reach of the working classes; that in burghs the municipal electors should elect the school committee annually, and that in all other school districts the school committee should be elected by the heritors and rate-payers; that the Bible should be retained in the national schools, but with a conscience clause; that there should be a compulsory clause, and that provision should be made for the education of children whose parents are unable to pay school fees.

A conference of trades union delegates, representing 20,000 members of Scotch societies, has been held at Edinburgh, when it was agreed to support the views of the Birmingham League.

SCIENCE SCHOOLS.

THE TECHNICAL SCHOOLS, ARTHUR-STREET, CHELSEA.

By George C. T. Bartley.

(*Continued from page* 160.)

The so-called Technical Schools, Chelsea, perhaps afford as good an example of the practical effect of the science system as can be found, both in the working of the schools themselves, and in the history of the teacher who has created them. Mr. A. W. Bickerton was engaged as a cabinetmaker, in the year 1864, in a village called Painswick, near Stroud, in Gloucestershire, having previously served his time as a coach-trimmer. He was therefore an artisan in the strictest sense. In the winter of that year, Mr. M. Pullen, a science teacher, formed classes, under the Science and Art Department, in the neighbourhood of Stroud, and Mr. Bickerton, who had always had considerable taste for the study of scientific subjects, joined one of these classes, in geometrical drawing, and he was rewarded by gaining a first-class prize and a bronze medal at the ensuing May examination.

In the following year, he continued his studies in an enlarged number of subjects, walking to and from Stroud in order to be present at some of the classes. In this way, during the winter, he traversed on foot a distance of no less than 380 miles. His efforts were again successful, as he obtained a first class in magnetism and electricity, a second class in animal physiology, and a third class in vegetable physiology. In 1866, he himself commenced teaching at Birmingham, at the same time prosecuting his own studies so successfully as to gain a Royal Exhibition to the Royal School of Mines, in 1867, a year in which the competition was unusually severe. The number of his successes gained at this examination were as follows:—First-class prize and silver medal in applied mechanics; first-class prizes and two bronze medals, one in geometrical drawing and the other in machine drawing; three other first-class prizes, viz., in building construction, acoustics, light and heat, and inorganic chemistry; seven second-class prizes, viz., in elementary mathematics, in theoretical mechanics, in magnetism, in electricity, in organic chemistry, in geology, in animal physiology, and in physical geography; and three third-class prizes, viz., in zoology, in vegetable physiology, and in steam.

During the two years he has already held this exhibition, he has been actively engaged in London in science teaching during the evening, when his attendance is not required at the Royal School of Mines. It has been often remarked that science classes in London are more difficult to collect and keep together than in any other place, but it is evident, from Mr. Bickerton's success, that the cause must lie more with the teachers than with the taught, and that the artisan class of London is not indifferent to the advantages of instruction. During 1868-9, classes were in active operation in the following places under this teacher, aided by assistants:—

Chelsea, Arthur-street,	with	74	individual pupils.
Hampton	„	28	„
Knightsbridge	„	35	„

Nine Elms	,,	26 individual pupils.	
Wandsworth	,,	60	,,

The Arthur-street school has now been removed to College-street, where a regular science school is being established. The history of the building at Chelsea deserves more than passing notice, as showing forcibly that among a large number of the artisan class the desire for instruction is greater than many persons have any idea of. The premises, which had been originally built for a carriage factory, consisted of a large square block of four walls and a roof, 23 feet wide, 72 long, and 25 high. This uninviting place, which had been used for numerous purposes, amongst others for a dissenting congregation, was taken at a rental of £75 a-year, in order to start a regular school with day and evening science classes. The buildings in their existing state being wholly unfit for the purpose, it was arranged to build rows of seats, each rising one behind the other, as in an amphitheatre, so as to form a lecture or large class room, the seats having tables and regular appliances, for convenience in giving lessons in drawing, and other subjects of instruction. Under part of these raised seats smaller class rooms were formed. The whole of the labour of construction was undertaken by the students in the classes. Carpenters, gasfitters, white-washers, and other artisans came night after night, from six o'clock to eleven, and even later, and worked at the object with as much or greater earnestness than if it had been their daily work. The task took six weeks, and so anxious were they to finish it and begin their classes, that they could hardly be got away each evening without the effectual plan of lowering the gas being resorted to. The large room, as finished, accommodates about 200 students; the material, which was the only outlay on the whole work, costing just £50.

These facts show that a great change has taken plaee in the opinions of artisans since 1861, as shown by a report of one of the inspectors of science schools, in 1868. From this it appears that a workman, who has sinee become a successful teacher, was looked upon with great suspicion by his fellow-workmen, and twitted with being taught at their expense, because he joined one of the science classes then being formed by government aid.

The classes at the Chelsea school are taught in the following subjects, and meet every evening, when they are instructed by Mr. Bickerton and the assistant teachers:—

	Pupils.
Geometrical drawing	107
Machine drawing	123
Building construction	125
Elementary mathematics	31
Theoretical mechanics	31
Applied mechanics	123
Acoustics, light and heat	78
Magnetism and electricity	78
Inorganic ehemistry	74
Geology	66
Animal physiology	55
Vegetable anatomy	8
Physical geography	65
Total number of individual pupils	206

As a further proof of the energy displayed, it is a fact that many of the artisans, who have, it must be remembered, to be up at five o'clock in the morning, frequently work when they get home after their lessons till 12 or 1 o'clock, and not a few cases are known of men becoming foremen at once from their superior qualifications attributable to the advantages they have derived from these classes.

In order to supply apparatus for illustrating the lectures of the school, two youths are permanently employed in making and re-arranging the numerous articles required.

A great effort is being made to form regular day classes in science, but at present this has not been so successful as was hoped, owing to the universal difficulty, the deficiency of elementary instruction. Into this school those only are admitted who can read and write, and who possess a certain amount of rudimentary knowledge. They are here instructed in elementary science, and, to a certain extent, a more advanced course of primary education is carried on, as dictation, writing, arithmetic, &c. It is to be sincerely hoped that this effort to form a strictly science school for those children whose parents are able to spare them from work a year or two after they leave the day schools, will be continued, even if not pecuniarily prosperous for the first year or so. There can be no doubt but that it is a most important feature in the scheme of general education, and will supply a want which will be urgently felt, before many years, in all large towns and districts where the bulk of the population is of the artisan class.

The school is entirely supported by the aid from the Science and Art Department and the fees taken from the pupils, which this session have amounted to more than £40. With the exception of a few prizes, no local aid of any description has been received from the neighbourhood.

Such is the working of this science school, which, although it is peculiar in many details, is similar in principle to those established and in an active state in above five hundred places in England, Wales, Scotland, and Ireland. There can be no doubt, as was remarked by Professor Huxley, at the conference on Technical Education, held at the Society of Arts, two years ago, that the system of the Department of Science and Art is having an important and lasting effect on the state of the scientific education of the working clases throughout the country.

CORRESPONDENCE.

CAPTAIN O'HEA'S PAPER ON "SMALL ARMS."

SIR,—I regret that I was unable to be present at the reading of Captain O'Hea's paper on the progress of invention in small arms, or I should have asked him the question I now beg leave to put—How much, in his estimate, does invention, so far as it has gone, give to offence, and how much to defence? Will charges of cavalry, or of infantry, or the general use of *l'arme blanche*, be any longer practicable?—I am, &c.,

E. CHADWICK.

MEETINGS.

On Friday afternoon, a deputation, comprising Sir Thomas Bazley, M.P.; Mr. Birley, M.P.; Mr. Kay Shuttleworth, M.P.; Mr. R. N. Phillips, M.P.; Mr. R. Shaw, M.P.; Mr. Lawley, M.P.; Mr. Jacob Bright, M.P.; Mr. Mellor, M.P.; Mr. Charley, M.P.; Mr. Cunliffe Brooks, M.P.; Sir Joseph Heron, Dr. Watts, Mr. Rumney, and other gentlemen, met at the house of the Society of Arts, and then waited upon Earl de Grey and Ripon, and Mr. Forster, at the Privy Council-office, to present a memorial, representing the hardships of the new orders in reference to the system of State aid to science classes. Sir Thomas Bazley, M.P., Mr. R. Rumney, Dr. Watts, Mr. K. Shuttleworth, M.P., Mr. Shaw, M.P., Mr. Birley, M.P., and others, addressed Lord de Grey, and the chief points urged were that the changes in the Science Directory, before the year had terminated for which the directions were issued, were not only an inconvenience, but were looked upon by the teachers as a breach of faith by the department. The working of the changes, especially with regard to

teachers, was shown to be a peculiar hardship upon the teachers of small classes; and details of the hardships were given by a reference to instances occurring in the classes connected with Union of Lancashire and Cheshire Mechanics' Institutions. It was stated that whilst one class of teachers might benefit another would lose remuneration by the change. For instance, the teacher of chemistry might gain, but the teacher of mathematics would lose. Earl de Grey and Mr. Forster both replied to the deputation. Earl de Grey said the practice of the department had been to reserve to itself the right of making alterations at any time, and distinct notice of this was given in three distinct places of the Science Directory, and this practice had from time to time been adopted. He was glad to find, from the memorial, that the deputation generally approved of the scheme, and, therefore, if they could lay before him any particular cases of hardship, attention should be directed to them. Mr. Lawton (secretary of the Lancashire and Cheshire Institutes) gave details; as did also Mr. Kay Shuttleworth and others. Mr. Forster said that the action of the Science Department had been taken, not in reference to particular localities, but upon the average result of the schools in the kingdom, and it was believed that generally the change would be beneficial, and any reduction of remuneration in one direction was balanced in another by the increase. In 1866 and last year, similar issues of new minutes were made in February, and the department believed that the masters of classes were working with the knowledge that they were to receive fresh regulations. Of course, these matters were experimental, and they were obliged to feel their way. Finally, Lord de Grey said he would consider the subject carefully.

GENERAL NOTES.

Free Library for Reading.—At a recent meeting held at the Town Hall, Reading, it was decided to accept the offer lately made by the Hon. Auberon Herbert, and to establish a free library.

Rate of Postage. — Mr. Graves gave notice, in the House of Commons, on Tuesday night, that on the 15th of March he would move:—" That in the opinion of that House the rate of inland postage on printed matter should be reduced to one halfpenny for two ounces, and also the postage on newspapers to one halfpenny."

Linen Manufacture.—The return of the factories engaged in flax-spinning, and the weaving of linen fabrics, and of fabrics mixed with linen, in Ireland, also in Great Britain, recently published, shows that there are 148 so occupied in Ireland, and 287 in Great Britain; the total number of spindles being 1,638,008.

South Kensington Museum.—Application has been made by the French Government for plans and statements relating to the organisation of the South Kensington Museum and Schools. Schemes based on the same principle and method have, it is understood, been proposed in New York and Boston.

Exhibition of Italian Paintings. — The Raffaelle Academy of Urbino, with the desire of honouring the memory of the great painter, and to encourage arts, has determined to open an exhibition for Italian artists, inviting each to exhibit an oil painting of not less dimensions than 33 inches in height and 47 inches in breadth, with free choice of subject, provided that it relates to the life of Raffaelle. The prize is a gold medal of the value of 400 lire (£16 sterling), and the successful competitor will be made a member of the academy. The next best works will receive silver or bronze medals, and honourable mentions. All works are to be sent in before the 28th of February, 1871, and are to be accompanied by the usual sealed letter, addressed to the Raffaelle Academy, Pesaro per Urbino.

Increased Consumption of Wine.—The consumption of French wine in Great Britain has increased about eightfold in ten years; the consumption of Spanish wines (chiefly sherries) has more than doubled; there has been a very large increase in the consumption of Portuguese and other foreign wines; but the importation of British colonial wines has almost ceased. The annual expenditure on wine is almost as surprising as the quantity consumed, and furnishes a remarkable illustration of the amount of surplus wealth in this country devoted to purposes of luxurious living. Taking the consumption of French wines to be in the proportion of two-thirds claret and one-third champagne—the estimate of a large London wine merchant—we find the probable expenditure amounted to £12,987,927 in the year 1868.—*Companion to the British Almanac*, 1870.

Railways in the Danubian Provinces.—The Bucharest papers give the following particulars of the railways now in course of construction in the Danubian provinces:—The first line from Bucharest to Giurgevo, which has been constructed by Messrs. Barclay and Co., and opened a few weeks since, the cost of contruction being 193,019 francs, not including the land, which was 179,379 francs for the total length of 67 kils., or 2,677 francs per kilometre, making in all 195,696 francs per kilometre. The second line, from Bucharest to Vizciozova, and from Bucharest to Roman, has been conceded to D. Strousberg and Co., who are authorised to raise 270,000 francs per kilometre in obligation. The third line, conceded to Messrs. Oppenheim, is from Suezana to Roman, Jassy, and Botoschani, part of which line will probably be opened during the present year.

Australian Sugar.—Writing from Sydney, under date December 3rd, the *Times* correspondent says:—"The sugar industry is attracting a great deal of capital to it, and is becoming a great success. Some people are troubling themselves at this early hour with the inquiry, But where will be our market? At present, this problem does not press for solution. These colonies consume annually 80,000 tons of sugar, and this demand will be market sufficient for us for a time. Queensland and New South Wales may work away for many years before they produce this amount, and when they have reached this stage they will find themselves in possession of £2,400,000 they are now in the habit of sending abroad every year. One of our leading firms has announced that it will now be able weekly to place ten tons of colonial sugar at auction."

New British Institution.—The increasing pressure upon the Royal Academy has induced a number of artists to form a committee for the purpose of establishing a new British Institution, which, like its predecessor, will provide artists of merit not within the academic body with means for placing many excellent works before the public, for which space, or at least prominent space, can not be found in the principal exhibition of the year. It will also enable Members and Associates of the Royal Academy to exhibit works they may not desire to reserve for the exhibition at Burlington-house. The following are the principles under which this institution has been founded: — 1. An acting committee of selection and arrangement will be elected by the artists promising contributions, from a list of candidates, to be forwarded by letter. 2. The claims of every contributor's work will be decided on the ground of merit alone. No rights or privileges in the exhibition can therefore be allowed to members of the committee, guarantors, or others. 3. No more than two works by any contributor will be placed, and no greater number will be received. 4. A financial committee will have control over expenditure and receipts. Every right of merit in the exhibition is placed in the hands of the contributors themselves, through the representatives they elect. The first exhibition will take place early in March, at the Gallery, 39, Old Bond-street. Mr. T. J. Gullick is the honorary secretary.

Preserved Fish.—The *Sydney Empire* states that a new export has been added to the list of Australian products, one from West Australia, the manufacture of preserved fish, and the inventor has succeeded in producing an article quite equal to that imported from England and America. Large quantities of preserved fish are annually imported into Sydney, while a full supply of the raw article is to be found along the coast.

Platinising Metals.—Professor Böttger, after many experiments, recommends the following bath for this purpose, which may be made of any strength that is desired, and will keep a long time:—Into a solution of chloride of platinum, carbonate of soda in fine powder is gradually thrown in small quantities, until small bubbles of carbonic acid gas make their appearance. A small quantity of starch sugar is then dissolved in the mixture, and afterwards as much sea-salt as is necessary, in order that the deposited metal may not be of a dark tint, but on the contrary may be bright. In order to platinise small articles, they are placed in a zinc vessel pierced with holes, which is plunged in the bath, heated to about 60° C. They are taken out at the end of a few minutes, washed in water, and dried in sawdust.—*Dingler's Polytechnic Journal.*

Gold in New South Wales.—The following table shows the quantity of gold received by the various escorts in New South Wales, during the first eleven months of 1868 and 1869.

	1868.
Western	122,423 oz.
Southern	76,064 "
Northern	13,688 "
	1869.
Western	1,116,052 oz.
Southern	69,586 "
Northern	12,503 "

The total revenue receipts in New South Wales, from 1st January to 31st of November, 1869, were £623,937 4s. 10d., against £595,716 16s. 7d. for corresponding period of 1868. The population of the colony, at the end of 1868, was estimated at 466,739.

Prince Teck on Art.—At the distribution of prizes to the students of the Art Schools at South Kensington, Prince Teck, addressing the assembly, said:—"As a neighbour of this home of art, and perhaps more so as an admirer, I felt great pleasure, though some shyness, I confess, in accepting the Earl de Grey's proposal that I should distribute the prizes which you have so deservedly won. And now, having fulfilled my promise, I may be allowed to offer my warmest congratulations on the excellent results of study and perseverance evinced by you, and which, I trust, may be an encouragement for the future. The report we have just listened to is a gratifying proof that the study of art is placed within reach of all classes of the people throughout the United Kingdom, and as it is a common ground of sympathy, shared alike by rich and poor, we must feel deeply indebted to those who promote and facilitate it in this country, not merely by opening the doors, in the most generous manner, of this temple of art, as I may call the South Kensington Museum, but by connecting therewith teaching, which is made useful, not to this country only, but to the whole world. As a proof of this, I am glad to learn that French manufacturers, so celebrated for their taste, have purchased some of the designs to which prizes have been awarded on the present occasion. I also rejoice to see that a convention for the interchange of reproductions between foreign museums has been made, and that the schools and museums of England will derive advantage from it. Before I conclude, I feel it to be a duty to allude to the originator of this great work, the promoter of art and science in this country—I mean the late Prince Consort, and it must be a great satisfaction to my excellent friend Mr. Cole, who so ably assisted him, to know how entirely these schools realise the late Prince's wishes."

Glass Manufacture.—At a recent meeting of the Paris Academy of Sciences, M. Feil exhibited specimens of flint glass of great density (Faraday's glass) obtained by a new process, enabling masses of this material to be manufactured, weighing from 25 to 35 kilos., perfectly pure, homogeneous, and free from striæ, and of a density equal to and even greater than that of Faraday. He also showed specimens of imitation precious stones, such as emeralds, sapphires, and white and coloured rubies, as well as a specimen of a deep violet blue, rich in tone, and of a brilliancy surpassing that of the finest amethysts. They are stated to be nearly equal in hardness also. The author, in his communication, states that he uses for the flint glass, aluminates of lime, of lime and baryta, of lead, and of bismuth, &c., and for crown glass, aluminates of magnesia, silicates of magnesia, and of alumina.

Lighting Buoys at Night.—The Netherland Society for the Promotion of Industry offers a gold medal, and an award of three hundred florins, for the most practical means of investing buoys with a lighting power, for service at night, under the following conditions:—The communications must bear a distinctive mark or motto, and be accompanied by a sealed envelope, containing the competitor's name and address, and bearing outside the same mark or motto. The communications, and any other accompanying writing must not be in the competitor's own hand. The successful communication becomes the property of the Society, which reserves to itself the right of publication. The Society takes no responsibility for eventual damage to models or instruments, and reserves the right of not returning them to the competitors. Answers are requested before the 30th of September, 1871, to the address of the General Secretary and Treasurer of the Society, F. W. Van Eeden, Haarlem, the Netherlands.

Sea-Fish Supply.—All facts concerning the supply of our edible fish are really of practical importance, for they bear with equal weight upon the rich and the poor. Admitting, for argument sake, that the annual take of sea-fish, reckoned by tons, is about the same now as it has been for years past, still we must not lose sight of the fact that a vastly increased fleet of smacks, boats, and other craft are required, and employed, too, now-a-days, in order to keep up the requisite supply for the metropolitan and local markets. It is in no way overstating the truth to say that hundreds of very fine trawling smacks now fish the British seas, where, not so many years ago, only a few small and indifferently provided boats were employed. The introduction of steam vessels, railways, and the electric telegraphs has completely altered, and we may say revolutionised, the fish-trade. There is hardly any inland town of the smallest importance in the United Kingdom that does not at this time duly receive its wonted supply of fish. The every-day inflow of fish into Billingsgate-market, vast as it is, is, after all, only an inconsiderable quantity, when compared with the supplies which are distributed over the length and breadth of the land. Spreading the fish landed at the different fishing stations over a greater area of country has been assumed to be one of the reasons, if not the principal, why the prices now charged for fish, as contrasted with those of former times, are so much greater. This may be in some degree true, but can only be so to a limited extent. The supply of sea-fish, if our information be correct, does not keep up to the average of former years; indeed, falls very far short of it, although it is a patent fact that ten times as many vessels and hands are employed in the fisheries, and, of course, there is a much greater extent of ocean fished. It is of no use to beat about the bush, or to endeavour by any line of argument to mask the actual truth; the fact is, although we may be loth to admit it, that edible sea-fish, so absolutely essential to the wants of the people, are becoming scarcer year by year.—*Land and Water.*

Prevention of Rust.—Captain Ross, of the Artillery, has recently taken out a patent for a composition which, applied to the clean surface of iron or other metals, chemically combines with it to form, in the case of iron, a coating of iron itself, but changed in character, and said not to rust or oxydise, even if steeped in water for a week. This discovery has been officially submitted by the inventor to his Excellency the Commander-in-Chief, and the Deputy Adjutant-General Royal Artillery himself experimented on some delicate steel articles, which had been treated with the composition, by putting them in the rain and keeping them out on the wet grass all night, which ordeal they sustained without a speck of rust. The composition is so delicate that it can be applied even to the finest needles and small clock-work wheels. We are informed that watch-springs are not affected by it, and will never rust after its application; nor does it alter, but, if anything, improve, the temper of knife or sword-blades. It turns the surface of steel implements to a whitish-grey colour; is capable, perhaps, of receiving as high a polish as steel itself.

The Silk Trade of Canton.—A correspondent at Canton sends to the *Cincinnati Commercial* an account of a visit he paid to a Chinese silk factory in the former city, which furnishes some interesting details of the present condition of the manufacture, in the country from which all the rest of the world has learnt it. Having found his way, by the help of a guide, into the silk-weaving streets, the correspondent thus pourtrays the scene which presented itself to him:—"All around me was silk—silk, nothing but silk. In small dark houses, little better than hovels, were seen people, chiefly women, dyeing this delicate textile. Outside, in little filthy yards and pig-styes, over the ground where the family swine were wallowing, were placed bamboo poles, whereon were hanging skeins of coloured silk, just from the dye, and glowing with the most vivid hues, as they hung for drying in the sunshine over the loathsome pools below." And then he goes on to describe, with some minuteness, the largest of the weaving-shops which he visited. It was about one hundred feet long by sixteen wide. The walls were of coarse clay blocks, sun-dried, without window or other aperture save at the front, which was entirely open the whole breadth of the building. The floor was formed of trodden clay, uneven and untidy, and down its centre ran an aisle just wide enough to allow one person to pass. On either side of this aisle the looms were ranged as close as they could be placed. These looms, on each of which two or three persons were employed, are described as "plain, common-looking affairs, almost precisely of the same kind, as to appearance and mode of manipulation, as were those upon which our grandmothers in Ohio used to weave the linsey-woolsey for the wear of us Western boys, when even the preacher was almost a stranger to broadcloth. So complex," adds the writer, "were the movements of the men on these simple-looking machines, and so marvellously beautiful were the products resulting therefrom, that I gazed with unbounded amazement upon this work of silk-weaving as it progressed before me." Nearly at one end, and extending right across the room, was a plain board counter, behind which stood the proprietor of the factory, a smooth-faced, richly-clad Chinaman, busy measuring off and packing up the products of his looms. In the warmth of his admiration for the gorgeous colours of the magnificent fabrics thus thrown about "in billowy radiance," the writer grows poetical, and tells us it seemed to his eyes as if the busy Chinaman "were tossing and toying with rainbows."

The Cereal Resources of the United States.—The report of Mr. Ruggles, the delegate from the United States to the International Statistical Congress, held at the Hague, contains some valuable and interesting information relating to the cereal resources of the country which he represented. Notwithstanding the disturbing influence of the war, the productive power has gone on increasing during the last eighteen years, 1850 to 1868 (both inclusive), from 867,393,000 bushels to 1,450,786,000 bushels, or 67 per cent. Should that rate of increase be maintained for the succeeding nineteen years, the product of 1887 will reach 2,422,813,620 bushels. The extent of land under wheat, rye, barley, oats, buckwheat, and Indian corn, or maize, in 1868, was 66,709,000 acres, nearly equalling the cultures of France, Prussia, and the United Kingdom. The population of the United States has been estimated at thirty-nine millions, and the cereal crop was at an average of 36 bushels a-head for the whole; this exceeds the produce of European countries, which averages 16 bushels for each inhabitant. Should the increase of population and this ratio of produce continue, it is reckoned that, in 1900, there would be 3,612,146,000 bushels. The large immigration into the United States of European farmers, and the general employment of agricultural machinery, may expedite such results. The number of reaping machines, in 1866, was estimated at 210,000, and that figure is believed to be far within the number now in use. At the rate of 8 bushels a-head, which is the ordinary human consumption, the quantity wanted for the present population would be 312,000,000 bushels. There would, therefore, remain of the cereal product a residue equal, in round numbers, to 1,112,900,000 imperial bushels. Of this, from 500 to 600 millions of bushels were fed to swine and other animals, and largely reappeared in the form of animal food consumed in the United States, or exported as beef, pork, and bacon, to foreign countries needing additional supplies of food. Large quantities of the cereals, which might also be converted into the same purpose for the use of Europe, are distilled into whisky and other spirituous liquors, and also made into starch and other preparations used in manufactures and industrial arts. The abundant capabilities of the United States to supply not only cereals, but animal food, are equal to any probable increase in the population of Europe within the present century, and may materially affect the future rate of increase in that population. By means of steam, within fifteen or twenty days, these supplies can be transported from New York to the ports of the British Islands, and on the Atlantic coasts of Europe.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. United Service Inst., 8½. Capt. C. E. Webber, "On Military Labour."
Entomological, 7.
Medical, 8.
Asiatic, 3.
Victoria Inst., 8. Rev. Professor Kirk, "On Spontaneous Generation; or, the Problem of Life."
London Inst., 4.

Tues ...R. Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Mr. Alex. Robert Terry, "The Mhowkee-Mullee Viaduct, G.I.P. Railway." 2. Mr. Edward W. Stoney, "Description of the Pennair Bridge, Madras Railway."
Royal Inst., 3. Prof. Humphry, "Architecture of the Human Body."
Ethnological, 8. 1. Mr. C. Monkman, "On Recent Archæological Discoveries in Yorkshire." 2. Dr. Jagor, "On the Natives of Naga, in the Philippine Island."

Wed ...Society of Arts, 8. Mr. William Hope, "On the Utilisation of Town Sewage."
Geological, 8.
Archæological Assoc., 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Philosophical Club, 6.
Royal Inst., 3. Prof. Odling, "Chemistry of Vegetable Products."
London Inst., 7½.

Fri ......Royal Inst., 8. Capt. Wilson, "Ordnance Survey of Sinai."
Quekett Club, 8.

Sat ......Royal Inst., 3. Prof. Max Müller, "Science of Religion."
R. Botanic, 3¾.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 25, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

March 2.—"On the Causes and Consequences of High Charges for Passengers by Railway, and the Advantages to be expected from an adoption of Low Fares." By G. W. Jones, Esq.

March 9.—"On Tramways in Streets." By W. Bridges Adams, Esq. On this evening Chas. Hutton Gregory, Esq., will preside.

March 16.—"On Surface Decoration." By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

March 30.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

INDIA COMMITTEE.

On Friday, March 4th, Sir Frederick Arrow, Deputy Master of the Trinity House, will open a conference on the subject of "The Influence of the Suez Canal on Trade with India." The chair will be taken at Eight o'clock, by Sir Bartle Frere, K.C.B., G.C.S.I. Members and their friends are invited to attend.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at 8 o'clock.

Syllabus.

1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat.

2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel.

3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smithery furnaces; means of arresting combustion; extinction of fires.

4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin oil; measurement of light; photometry.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course are issued with this week's *Journal.*

POPULAR LECTURES ON ECONOMIC SCIENCE.

The Council have lent the use of the Great Room to the Social Science Association, for the delivery, on successive Tuesday evenings, of a course of lectures on branches of economic science which are more immediately connected with questions of present interest. The association has especially desired to select the subjects upon which the greatest and most vital differences of opinion prevail, and upon which general information is loose and inaccurate. It proposes, therefore, to invite to take part in the course, gentlemen who have made certain branches of social science matters of special study, each one selecting a particular topic, that will, however, have a relation to the other lectures of the course, all bearing on the improvement of the condition of the people. Among the gentlemen who have consented to lecture are, Dr. Hodgson, who will open the course, Mr. R. H. Hutton, who will take the subject of "Reciprocity;" Mr. Mundella, M.P., on "Arbitration and Courts of Conciliation," and Mr. Frederick Hill, who will point out the identity of interest between capitalists and labourers. Dr. W. A. Guy, is announced also to give four on the subject of the public health. The introductory lecture will be given on Tuesday next, March 1st. These lectures are open to members of the Social Science Association, and members of the Society of Arts are invited to attend.

LIFE BOATS FOR MERCHANT SHIPS.

The Council offer the Society's Gold Medal for a ship's life-boat, suitable for the mercantile marine. The following are the conditions:—

The boats for which plans or models are submitted should combine, as far as possible, the following requirements:—

1. Buoyancy sufficient to ensure that the boat be manageable when, in addition to the number of persons, and additional dead-weight (if any) she is intended to carry, she is filled by a sea.

2. The fittings or appliances by which such buoyancy is obtained to remain efficient under all circumstances of climate and temperature, as well as under exposure to sun, weather, and salt water.

3. Fitness for ordinary use as a ship's boat.

4. Strength.

5. Durability.

6. Lateral stability, or resistance to upsetting on the broadside.

7. Relief of water to the outside level.

8. Cheapness.

9. Simplicity of structure.

10. Lightness.

Before finally awarding the medal, the Council reserve to themselves the right of requiring selected candidates to build full-sized boats, in order that the same may be practically tested.

Models and plans, to a scale of one inch to a foot, must be legibly signed or otherwise distinctly marked, and sent to the Society of Arts, John-street, Adelphi, on or before the 1st June, 1870.

Each model must be accompanied by a statement, in the form given below, showing, amongst other things, the estimated cost of a 12 ft., 15 ft., 18 ft., and 20 ft. boat, and the number of persons, and additional dead-weight (if any) that each boat of the size named is intended to carry.

Ships' Life Boats.

Model marked____________________

Size.	No. of persons intended to carry.	Dead-weight that may be carried in addition to persons named in column 2.	Cost.	Material of boat.	How is buoyancy obtained, viz., by air-spaces, or by any light solid body.
(1)	(2)	(3)	(4)	(5)	(6)
12 feet..					
15 feet..					
18 feet..					
20 feet..					
*					

* Particulars of any smaller or larger sizes can also be inserted.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

TWELFTH ORDINARY MEETING.

Wednesday, February 23rd, 1870; Professor John Marshall, F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Arkwright, Augustus Peter, M.P., 15, King-street, St. James's, S.W.
Baggallay, T. W., 5, Love-lane, Aldermanbury, E.C.
Bamber, Henry K., 5, Westminster-chambers, Victoria-street, S.W.
Bartlett, Frederick, Dunsbee-house, East Croydon.
Bateman, Arthur H., 41, Seething-lane, E.C.
Boyd, John, 85, Gracechurch-street, E.C.
Brooke, Charles Langley, 7, Gresham-street, E.C.
Denny, Jonathan, Holly Cottage, East-hill, Wandsworth, S.W.
Francis, Henry, 17, Gracechurch-street, E.C.
French, John M., 12, Commercial-st., Whitechapel, E.
Goodyear, Charles, 19, Northumberland-street, Strand, W.C.
Gordon, Alexander, The Brewery, Caledonian-road, N., and 10, Holland-park, Bayswater, W.
Hillel, Jules, 14, Palmerston-buildings, Old Broad-st., E.C.
Holdsworth, John James, 13, John-st., Minories, E.C.
Holloway, George H. Hughenden, 31, Soho-square, W.
Hunt, Horatio Nelson, 2, Montague-place, Russell-sq., W.C.
Latchford, Benjamin, 11, Upper St. Martin's-lane, W.C.
Milner, William, 211–213, Tottenham-court-road, W.
Pollard, Joseph, Highdown, Hitchin.
Tallerman, D., 31, Norton Folgate, N.E.

The following candidates were balloted for, and duly elected members of the Society:—

Apps, Alfred, 433, Strand, W.C.
Bates, Rev. Jonathan, Kirstead, Brooke, near Norwich.
Harcourt, Clarence, 8, Moorgate-street, E.C.
Pitman, Henry Alfred, M.D., 28, Gordon-square, W.C.

The Paper read was—

ON THE USE AND ABUSE OF TOWN SEWAGE.

By William Hope, Esq., V.C.

I was asked last year by a member of the Council of this Society to read a paper on the utilisation of sewage, but declined, because I was unwilling to obtrude my views on a Society with which I have never had any connection; however, on a repetition of the request, accompanied by an assurance that such a paper would be acceptable to many members of the Society, I felt that it was, in some degree, a duty to communicate such special information as I happened to possess in the manner desired. I trust, therefore, that my intrusion here, as a stranger, will be pardoned, in consideration of the motive which brings me.

When a man reads a paper on sewage, he generally thinks it necessary to commence with the camp regulations issued by Moses in the wilderness, just as—with equal justice—old-fashioned books on gunnery always began with an account of the imaginary invention of gunpowder by Roger Bacon and Schwartz. Moses did not invent sewage. It is quite clear that the "Sewage Question" must have begun long before his day, and, in fact, must have first cropped up in the Garden of Eden itself. This is, perhaps, a somewhat prosaic view to take of Paradise, but the practical man is necessarily prosaic, and a careful investigation of this question dispels many prejudices and many illusions, and forces one to admit that, as Adam received a special permission to "eat freely" of every fruit in the garden except one, he must, as a physiological necessity, have been perplexed by the very same question which we are met here, some six thousand years later, to discuss. But no candid man, who is not committed to some sewage—precipitation or earth-closet heresy, can doubt that Adam utilised his sewage and grew his vegetables in the Garden of Eden by means of the same system of irrigation that I practise myself. I do not propose, therefore, to adduce any further proof of the antiquity of sewage irrigation, but rather to confine myself to the agricultural and economical desirability of its practice at the present day.

As, however, no man can conveniently preach a sermon without a text, I will, if you will allow me, read, as texts, two short extracts from the *Times* newspaper. The first is taken from the *Times* of the 7th day of January last, and occurs in the letter of the special correspondent in Egypt. It is as follows:—"The other day, at Sakhara, I saw nine camels passing down from the mummy pits to the banks of the river, laden with nets in which were femora, tibia, and other bony bits of the human form, some two hundred weight in each net, on each side of the camel. Among the pits were people busily engaged

in searching out, sifting, and sorting the bones which almost crust the ground. On inquiry, I learnt that the cargoes with which the camels were laden, would be sent down to Alexandria, and thence be shipped to English manure manufacturers. They make excellent manure, I was told, particularly for swedes and other turnips. The trade is brisk, and has been going on for years, and may go on for many more."

The second text is taken from the *Times* of Thursday, the 10th instant, and is as follows:—"According to returns furnished by the engineers of the Metropolitan Board of Works, the daily average quantity of sewage pumped into the river Thames, at Crossness, was 214,973 cubic metres, and at Barking, 157,091 cubic metres, equivalent to about as many tons by weight."

Truly these two texts teach a startling lesson, and the modern philosopher may say with Shakspere's philosophic Duke, that he

"Finds . . . . . . books in the running brooks."

To be ground into powder, or dissolved in sulphuric acid, as manure, to grow turnips, with which to fatten oxen for an unborn race of sacrilegious beefeaters, would probably have been considered by Pharaoh and his haughty captains a far greater indignity than to be swallowed up by the Red Sea.

"To what base uses we may return, Horatio!"

Probably no one would be found now to assert, as Liebig did, when he wrote his celebrated letters to the Lord Mayor in opposition to my proposals for utilising the sewage of London, north of the Thames, that no land plant could come to maturity, if grown in a medium of insoluble silica, and manured with liquid manure only. The proofs since obtained of the soundness of the principles I then advocated have been so overwhelming, that not even their most obstructive opponents any longer attempt to deny that liquid sewage, in its normal state, has a great and a practical value. By the admission, therefore, of even the most sceptical, the "running brooks," or rather small rivers, described above in the second extract from the *Times*, as being injected into the Thames at Barking and Crossness daily, represent so much hard money wasted. Add to this the interest, at 3¾ per cent. on the five millions laid out in the injecting apparatus, together with the tremendous annual expense of working it, and it must be confessed that this arrangement is the most extravagantly wasteful of which history furnishes any record. We profess to be a hard-headed practical people, and yet, while we ransack every other corner of the globe for animal refuse and remains with which to enrich our land, we go to an enormous expense to throw away the quotidian supply with which nature provides us at home—and this with a constantly increasing surplus of population and deficiency of food staring us in the face. This flagrant defiance of those very principles of political economy which we all profess to be guided by, is probably one of the chief causes of that flood of pauperism which all the machinery of government, even when in the most earnest and energetic hands, seems quite unable to stem.

To remedy this state of things I have now laboured actively, and, I hope, practically, for nearly nine years. During this time I have become painfully aware of the apathy with which this subject is regarded by most people, but I was not aware until lately how little the subject was understood. I had studied it so much myself that I forgot that others had not. Many still talk as if there were some room for doubt as to the value inherent in sewage. But this is susceptible of exact determination, and can be demonstrated as conclusively as a mathematical problem. It is a fact in chemistry that every human being, at a given age, produces yearly a certain average amount of ammonia, phosphoric acid, &c. Further observations are still required to enable us to fix the extreme limit of these productions, but existing knowledge enables us to fix a minimum value, below which, under any ordinary conditions, they cannot fall. There is an unknown, because a variable quantity, in the margin of soapsuds, kitchen waste, liquid manure from stables, offal from slaughter-houses, street washings, and many other matters which find their way into the sewers. But this is a margin which has to be added, not deducted, and therefore does not affect the minimum, but only the maximum, possible cost of the waste now going on in London and most other towns.

Many of the most eminent chemists have conducted lengthened observations and experiments from many different points of view, in order to determine the value of the manurial constituents of this refuse. Anderson, Berzelius, Frankland, Gilbert, Hofmann, Lawes, Letheby, Liebig, Miller, Odling, Thudichum, Vœlcker, Way, Wesarg, and Witt, are only a few of those who have investigated this part of the subject; and, not to weary you with technical details, I may mention that, as the result of an immense amount of work, a rough formula has been pretty well agreed upon among chemists, that the total value of all the constituents of sewage is about one farthing per ton of the liquid for every grain of ammonia per gallon, because it has been found that the value of the other constituents taken together is about one-third of that of the ammonia. Hence the important point in practice is to determine the quantity of ammonia, which gives the unit of value, and the engineer must then come to the aid of the chemist, and furnish him with the total number of tons of sewage in the year, with which to multiply his unit. Probably, if this unit were ascertained during one month in winter, and during another in summer, or during one month in spring or autumn, a sufficiently accurate result would be arrived at for most practical purposes; but it is evident that complete scientific accuracy could only be attained by analyses extending over several years.

It was, therefore, a great disappointment to many besides myself, when a series of samplings and guagings, intended to be exhaustive, of the sewage of the high and middle level sewers of London, which, at the suggestion of Mr. Way, I had caused to be commenced in 1865, before the formation of the Metropolis Sewage Company, were summarily stopped by the company. The results obtained were, nevertheless, very instructive and reliable. The samples were taken every half-hour, night and day continuously, for a period of 203 days; they were mixed together at regular intervals, and repeated analyses were made by Mr. Way and Dr. Odling. The result was, to show an average of about 8 grains of ammonia to the gallon of dry weather sewage, and the following tables show the quantities passing the station during that period, the first showing the dry weather only, the second showing the total.

Unfortunately, there is considerable doubt as to the population represented by this flow, and there are also one or two disturbing causes to be taken into account whose magnitude cannot be defined; but this is certainly a higher per-centage of ammonia, and, therefore, a more favourable analysis than previous observations led one to expect, and it must be remembered that, when the low level sewer is completed, an analysis of its contents may be expected to show a very perceptibly higher percentage of ammonia, owing to the denser population, and the great throng of business men of all classes in the lower parts of the metropolis during the day, many of whom represent a temporary addition to even the total population estimated for, as they reside beyond the metropolitan boundary altogether.

Now the estimated "dry weather" sewage of London north of the Thames is 120,000,000 tons per annum, while that portion of the rainfall which does not escape into the Thames and Lee higher up by the "storm overflows," but reaches Barking, can hardly be less than another sixty to eighty millions of tons. It appears impossible, therefore, to place the manurial value of the stream with which, at a cost of £100,000 or £150,000

METROPOLITAN HIGH AND MIDDLE LEVEL SEWERS.

Fine Weather Sewage Flow from 19th March to 7th October, 1865 (inclusive).—Wick-lane, Old Ford.

	No. of days.	Gallons.	Average per day, in gallons.	
Sundays	25	442,628,000	17,705,000	Daily average for fine weather, 27,431,000 gallons.
Mondays	24	669,057,000	27,877,000	
Tuesdays	24	708,335,000	29,514,000	
Wednesdays	25	754,949,000	30,197,000	
Thursdays	20	589,757,000	29,487,000	
Fridays	22	556,453,000	25,293,000	
Saturdays	24	766,632,000	31,943,000	

Flow of Sewage from 19th March to 7th October, 1865 (inclusive).—Wick-lane, Old Ford.

	No. of days.	High level.	Middle level.	Total high and middle level	Average for each day.	Flow increased by rain.
		gallons.	gallons.	gallons.	gallons.	
Sundays	29	208,484,000	350,032,000	558,516,000	19,259,000	Four days
Mondays	29	334,826,000	569,521,000	904,347,000	31,184,000	Five days
Tuesdays	29	357,749,000	634,942,000	992,691,000	34,230,000	Five days
Wednesdays	29	383,901,000	675,067,000	1,058,968,000	36,516,000	Four days
Thursdays	29	405,064,000	713,244,000	1,118,308,000	38,562,000	Nine days
Fridays	29	423,744,000	739,872,000	1,163,616,000	40,124,000	Seven days
Saturdays	29	341,688,000	619,204,000	960,892,060	33,134,000	Five days
Totals	203	2,455,456,000	4,301,882,000	6,757,538,000	..	..

Average flow per day during the above period, 33,288,000 gallons.

a-year, the Thames is polluted at Barking at less than £1,000,000 per annum, equal to about 8s. 8d. per head of the population. And this we may take as a pretty near approach to the unit of value in estimating the yearly worth of the sewage of a given population. The amount of water in which this is conveyed can only affect in a very minor degree its value as a manure. This should therefore be reckoned per head of the population, irrespective of the water supply.

To regard this chemical value as the practical value of the manure if applied to the land, was stated, in a scientific journal the other day, by an eminent chemist, to be a great mistake, and likely to prove a very ruinous one. In the mouth of a chemist who, in the ordinary routine of his daily business, is perpetually called upon to put a practical money-value, by means of chemical analysis, upon all kinds of artificial manures; this is indeed a strange paradox, and I was at first considerably puzzled by it, but the key to the paradox was in the reasons he gave for the statement. In considering so very wide a question, he had been led, by the fascinating process of deduction, to travel beyond the sphere of his own personal knowledge, and so had fallen into a very natural mistake. One distinguishing peculiarity of sewage as a manure is the ease and convenience with which it can be applied to growing crops. This is, of course, an enormous practical advantage. Instead of waiting until the land has been manured between two crops, it may at once be ploughed up, and another crop put in; a saving of time which will frequently pay the farmer's rent for him. It is only natural that this peculiarity should be widely taken advantage of; hence sewage is more frequently applied to growing crops than to fallow land. The chemist alluded to had probably always seen it so applied, and regarded it solely from that point of view. Consequently, he said that the obligation of applying water to crops at all times of the year, whether they required it or not, would be so onerous to the farmer, that the practical value of the manure contained in the water would be very largely reduced. This I at once admit; but I altogether deny that, where sewage irrigation is properly carried out, there exists any such obligation. In spring and summer there are always some growing crops which will benefit instead of suffering from the application of the water in which the manure is conveyed; it must be at once admitted, therefore, that during half the year the farmer must get the full chemical value of the sewage—and something more, for the power of watering his land whenever he pleases has a very practical additional value. In the other half of the year it is quite true that the water in which it is contained might often do as much harm to some plants as the manure could do good. But why suppose that a shrewd, practical farmer is to be such a fool as to apply sewage to growing crops under such conditions? Clearly, he would turn it over his meadows or fallow land. The vastly greater part of the manure of all kinds, throughout the country is applied precisely at that time of the year, and to fallow land. It would be obvious, therefore, to the very slowest bucolic intellect in the country that this is the proper course to follow with sewage, under the conditions stated.

Of course where sewage irrigation is not properly carried out, and where the area of the land irrigated does not bear a proper proportion to the population manuring it, the full chemical value will not be obtained, because the supply of food will be in excess of the demand of the crops; just as a market-gardening neighbour of mine, who, last autumn, put 40 tons of farm-yard manure, 10 cwt. of guano, and 10 cwt. of bones per acre on to one of his fields, will be disappointed with his results; but the accidental topographical exigencies of particular localities, and the accidental manurial eccentricities of particular market-gardeners, are disturbing causes which in no way require to be taken into account in such calculations. Would my friend, the chemist, say that because my neighbour will most assuredly not get the full value of his guano and bones, therefore any farmer who sends to his laboratory to ascertain the practical money value of any particular manure from its chemical analysis will be grievously misled?

What would the chemist say if I assumed that farmyard manure could only be applied to growing crops, and then asserted that the damage done to the land and crops in carting on the manure was so great that it

counterbalanced the benefit conferred? Surely no test of the practical money value of any manure can be as conclusive and reliable as an accurate analysis of its constituents.

As a matter of actual practice, I am just about to sow 10 acres of onions, which will not receive a drop of sewage while they are growing, the land having been manured quite sufficiently by irrigation while fallow.

But in refutation of the fallacious conclusion deduced from a partial view of the question, and an imperfect knowledge of a branch of it which is not strictly within the province of the chemist, I can fortunately adduce a very high authority, namely, Dumas, who is not only one of the greatest, perhaps the greatest, of living chemists, but is a man eminently distinguished for practical good sense. When he paid his visit to this country, in the early part of last summer, to deliver the inaugural Faraday lecture, he gave up a day to the inspection of the sewage irrigation at Barking and of the Barking outfall, accompanied by the President of the Chemical Society, and several other distinguished members of the profession. He expressed himself as being as much gratified by what he saw of the irrigation, as he was shocked by what he saw of the outfall, and he repeated several times over "Oui, l'eau doit être la charrette de l'engrais," which may be translated freely, "water is the best dung-cart." With such an authority to support me in the "water-carriage" system, I am not afraid of a little adverse criticism.

There is another objection which is sometimes urged to the utilisation of sewage by irrigation, although it is, perhaps, the most groundless of all. I have heard it asserted that it was an utter mistake to convey manure in water, because in the course of a very short journey all the ammonia escaped by evaporation. Such a fallacy is, of course, never advanced by a chemist, as it is chemically impossible; but it is worth a passing notice, because it is clung to with such fond tenacity by some dogmatical laymen. In the first place, in fresh sewage, there is no ammonia present in a free state; and when chemists talk of the amount of ammonia in a gallon of sewage, they mean the amount that can be chemically evolved by analysis. But supposing an artificial ammoniacal liquor were substituted for sewage, and distributed over the fields by irrigation, and that this liquor were really a solution of free ammonia, these dogmatisers would still be mistaken, for water has a greater affinity for ammonia than the atmosphere. If some ammonia is set free at one end of a room, and a basin of water placed at the other end, after a time all, or very nearly all, of the ammonia may be recovered from the water. It is chemically impossible therefore that, even to please the most dogmatic of sewage heretics, the process can be inverted, unless the laws of nature are suspended. Dumas would not recommend a leaking dung-cart, and the ammonia is very securely imprisoned in the one that he recommends.

This being so, there is still, however, the question whether some of those processes to which I have alluded as "sewage-precipitation and earth-closet heresies" are not cheaper and more effectual than irrigation. In reply to this question, I can only say that no other process which I have ever been able to hear of approaches irrigation, either in economy or efficiency. I am quite prepared to admit that some of the precipitation processes may, perhaps, be sufficiently practical for use in places where irrigation is impossible, if, indeed, there are any such places; but the annual cost of the best of them amounts to not less than 30 or 40 per cent. of the total yearly value of the sewage, whereas the annual cost of irrigation works, properly carried out, would not, on an average, exceed 10 or 12 per cent. of such value. While quite ready to admit the possibility of some of these processes proving practically efficient, I wish, however, to guard myself against being supposed to approve of any of them. It is evidently an operation of maximum difficulty, on a large scale, and at a cheap rate, to extract the ammonia and phosphoric acid from the sewage in a form sufficiently insoluble to remain behind when the water is driven off, and yet sufficiently soluble to dissolve as soon as put on the land as manure. As a chemist well said, in the chemical section of the British Association, at the meeting at Exeter, it is worse than if he were asked to extract a grain of wheat from a sack of chaff—it is as if he were asked to extract a cell of yeast from a trough of dough. And I confess that the advocates of the various precipitation processes, with many of whom I have had repeated and lengthened interviews, have always failed to inspire me with much confidence in their systems, for I have invariably found that they were quite unable to answer any of the fundamental questions I put to them, that they displayed an entire absence of exactness in their knowledge of their subject, lost themselves in vague generalities, were unable to explain the chemical action which they believed was set up by their own process, and invariably believed that their patent manures had, in some mysterious way, a fictitious value beyond that indicated by chemical analysis.

At the same meeting of the British Association, I was asked to join the committee appointed the previous year to inquire into the "treatment and utilisation of town sewage," and, though avowedly a partisan of irrigation, I agreed to join, because I knew I could bring some practical experience to the aid of the committee; just as an extreme ritualist and an extreme evangelical were considered useful members of the ritual commission. I at once proposed to enlarge the scope of the inquiry and to increase the committee so as to include a representative of each branch of physical science to which any part of the entire question belongs. In order to procure the funds necessary for so extended an inquiry, the committee appealed to the various towns throughout the country for subscriptions, and their application has met with a favourable response from a large number of towns. It is their desire to inquire into every process having a semblance of practicability, and in this way, if any of these processes are indeed perfected, the fact will be authoritatively ascertained.

Should the committee continue in existence for several years, and sufficient funds be available, it is indeed by no means impossible that the combined researches of so many men, assisting one another with their special knowledge, may throw considerable light on the origin and nature of diseases, and on the much-vexed question of protoplasm, or the physical basis of life. Professor Tyndall's recent instructive experiments, following those of Mr. Crookes, go far to confirm the views of those who have devoted most time to the study of the spread of infectious diseases, but there is still much to learn as to their origin, while an attentive study of the organisms generated by the fermentation and decomposition of sewage, as well as of the abnormal developments induced in some plants by excessive stimulation with liquid sewage, cannot fail to reveal some further secrets of nature in that mysterious neutral territory where the animal protoplasm (if indeed this be an admissible term for an unknown and undefined principle), is for ever changing into the vegetable, and the vegetable changing back again into the animal.

But to return to the more immediate subject in hand, there is still a third principle of sewage utilisation, which is advocated very warmly by many persons, I mean the earth system. This is, no doubt, perfectly efficient within certain limits, and I have myself advised its adoption in several cases where I thought the circumstances admitted of its successful application. So far as a certain portion of sewage matter is concerned, there can be no question as to its complete efficiency, and as even a clumsy attempt to prevent waste is better than no attempt at all, I give Mr. Moule the greatest credit for the persistency with which he has warred against the present reign of waste. But his system is only that of Moses inverted. Moses told his countrymen to carry their sewage out of the camp and bury it in the

land. Mr. Moule tells his countrymen first to carry the land into the town to be mixed with the sewage, and then to carry them both out to be finally buried. In both cases the sewage has to be carried out, but in the last the earth has to be carried out as well, in addition to being previously carried in. I think, therefore, that Moses was the better sanitary engineer of the two; and irrigation is only the plan of the earlier engineer developed by modern appliances. Dumas said that water is the best dung-cart. It is the best spade also, for it buries the manure instantaneously, and is automatic in its action. The dispensation of sewage by irrigation is, therefore, strictly Mosaic.

I have said, however, that I have occasionally approved of the use of Mr. Moule's system, and I should explain that I limit such approval to cases where there is a deficient water-supply, or where there is a rigid discipline, as in workhouses or barracks. For the service of an ordinary private house, much more of a village or a town, I consider the system utterly impracticable. Unless the amount of earth used in each house were enormous, it would, of course, be impossible that the soapsuds, kitchen refuse, and so forth should be got rid of in that manner; yet nothing is more offensive in its decomposition than such stuff as this, although I am ready to admit that it may not be so dangerous to health as sewage matter proper. What, then, is to be done with this liquid? If it is allowed to go into the nearest river, the water will be hopelessly polluted for the purposes of drinking and cooking. Some system of precipitation or irrigation would, therefore, appear to be necessary, for this part of the sewage at all events, and is admitted to be so by Mr. Moule; but what a complication this admission implies. Supposing for a moment, however, that all the expense of sewers had been gone to, as in the ordinary water-carriage system, and that we were prepared to consent to the nuisance of long strings of carts bringing fresh earth into our towns, and longer strings of carts carrying away the used earth and the sewage, accompanied by their own peculiar set of harpies, disturbing our families at unseemly hours, and "making night hideous" by their uncouth sounds and imperious demands for beer, would the system, even then, work for a single week without a hopeless breakdown? I think not, and I will give a very plain reason for my opinion. On this system, all the bedroom "slops" would have to be divided into two kinds; one, the bath water and soapsuds, to be emptied down the sewers, the other to be mixed with the earth. This would necessitate a double set of slop pails, one with a bright crimson "E" for earth, the other with a black "S" for sewer. But how long does Mr. Moule imagine that the ideal British housemaid would condescend to carry about these two different pails, containing two different liquors, for disposal in two different receptacles? I cannot claim any special knowledge of the natural history of the housemaid, but I greatly fear that her organisation is not yet sufficiently delicate to enable her to appreciate this cloacinalogical refinement.

Surface irrigation is, in my judgment, both the simplest, the most efficient, and the most economical means of disposing of the miscellaneous waste and refuse from human habitations. The chance of anything going seriously wrong with the arrangements for getting rid of this noxious matter are reduced to a minimum, and the system is as beneficial to agriculture as to health. Of course, irrigation may be bungled just as any other kind of farming or manufacture may be bungled. But if the proportion of population to land is not excessive, and if the land is properly laid out at first, there is no reasonable probability of any sewage ever escaping into the stream unpurified, because, if it did, it would represent a loss of so much manure which the farmer has to pay for; therefore, it is his interest to apply it in such a way as to extract from it the greatest possible amount of organic impurity, and, if possible, to prevent Dr. Frankland from finding any traces of "previous sewage contamination," even in the third place of decimals. In point of fact, the sanitary and agricultural results will always go hand-in-hand, and the better the one, the better also will be the other. I do not yet go quite so far as my friend, Dr. Alfred Carpenter, however, who considers that sewage irrigation, by producing an abnormally rapid and vigorous vegetation, promotes the rapid disengagement of oxygen, in which he states that ozone is distinctly present. This is a most encouraging theory for an advocate of sewage irrigation, and, if he had been conducting his observations on my own land, I should probably have accepted Dr. Carpenter's theory, and started a Hospital for diseases of the chest in the middle of one of my sewage fields, guaranteeing to the patients a certain number of irrigations in the month with genuine, unadulterated sewage, as received direct from London or Romford, as the case might be. The suggestion has a very considerable charm for a plain farmer, and I confess that I have given up, with no little reluctance, the idea of a copropathic establishment on my farm, where London beauties might come out to recruit their wasted energies at the close of the season, and, attired in a *costume de circonstance*, with coquettish jack-boots, would perhaps at times listen to a lecture on agriculture from the farmer himself, while drinking his cream and luxuriating in the health-restoring breeze. But, as I said before, I am a plain farmer, and I felt instinctively that this was too pretty a picture to be realised on this earth; and then I remembered that, however faultless I might consider my own irrigation to be, yet that I did not approve of the method in which it is carried out at Croydon, where the proportion of population to land is so excessive that it is chemically impossible for the crops to exhaust the organic matter continuously supplied to them, and that, therefore, there must be a dangerous accumulation or escape of impurity somewhere. I also reflected that at least one of the effects observed by Dr. Carpenter, and attributed by him to the action of pure oxygen, might just as well have been produced by ammonia or by moisture and carbonic acid, and I resolved to postpone the building of the hospital, so as to allow time for further observations.

The first thing that the authorities of a town ought to consider, in purchasing land on which to utilise their sewage by irrigation, is whether their population is an increasing or a stationary one. If the former, they ought to secure as much as one acre for every 20 or 25 persons; and, if the latter, not less than one acre to every 40 or 45 persons, for this latter proportion represents as much sewage as land can either utilise or purify over a term of years. The land chosen should, if possible, be a light loam, because this is more easily cultivated, and better suited to the rapid growth of market-garden vegetables, not from its chemical composition—for with plenty of sewage this may be disregarded altogether—but from its physical condition, which admits of the delicate roots of young plants striking out more rapidly. The land chosen should, if possible, either be flat, or should consist of wide gentle slopes. Frequent and rapid slopes should, where practicable, be avoided.

I have, on a former occasion, pointed out that the utilisation of sewage by irrigation, to be properly understood, must be divided into three parts, each of which must be considered separately; and it is useful to keep these distinctly in view. They are:—1st. Conveyance from the town to the country. 2nd. Distribution among the different farms or fields in the district to be irrigated. 3rd. Application to the soil or crops.

The first is the province of the engineer, the second of the surveyor, and the third of the chemist and farmer.

With regard to the first, I will only say that I greatly prefer concrete, as now used so much in France, to either brickwork or earthenware pipes. Well made, it is absolutely water-tight and practically imperishable, two advantages which cannot be overrated. However, on this point I will not further enlarge, as I am already

regarded by the engineers as a heretic, my doxy being different from their doxy.

The second division of the question, or distribution, is one which presents very considerable difficulty. The expense of iron pipes is prohibitory, earthenware pipes are always going wrong, while earth ditches raised any height on embankment are very wasteful of ground, as their bases spread out to such a width. Wooden troughs have been used in some places where the sewage is required to be raised some height above the ground, but their perishable character renders them inadmissible. The only thing left to try was sheet iron troughs, and these are perfectly successful, and very convenient and cheap. The best form for strength and capacity, combined with convenience of working with sluices and openings, is what you see here. It has straight sides, which act as girders to carry the weight of the liquid, with flanges at the top to give lateral stiffness, and the bottom may either be semicircular, or flat, with rounded corners. Each form presents some advantages. Sheet-iron troughs of this size can be erected on legs of say four feet from the ground, painted and finished for 6s. 8d. per yard forward, or fitted with these very ingenious openings, the invention of Mr. Edwin Maw, at every 10 yards, for 7s. 2d. per yard forward, completed in all respects. For efficiency, durability, and economy, nothing can approach troughs of this description, and they will distribute sewage over land reasonably well adapted for it, but where the levels will not admit of the use of earth ditches, at a cost of from £5 to £10 per acre. Yet I was recently shown a letter from a disconsolate mayor of a town not far from London, addressed to the president of the Institution of Surveyors, in which he told the following piteous tale:—Under the strong pressure of the Court of Chancery, his town had been compelled to cease poisoning their neighbours, had purchased 50 acres of land, had conveyed their sewage to the land, which he said was well situated for its reception, and in an evil hour they applied to a certain eminent engineer, who fancied himself a great agriculturist, to lay out their little bit of land for them. This gentleman positively sent them in an estimate for this little job amounting to the astounding figure of £5,000. Now, this is a fact; I saw the letter in the mayor's own handwriting.

The third division, or the application of the sewage to the soil and crops, is a very simple process. The farm to be laid out having been carefully surveyed, tho levels accurately taken, and the general scheme of the distribution settled upon by the surveyor, the lines of the main distributing channels should be marked on the map, being taken as much at right angles to each other as possible. Then the intervening spaces should be divided into "beds" or "lands" about 30 feet wide, and from 100 to 300 or 400 yards in length, according to the fall of the land, and handed over to the farmer. Then he should obliterate the marks of the old cultivation by a little shallow ploughing and cross-harrowing, when one deep ploughing will often suffice to throw up the land into ridges, as marked on the map by the surveyor. The irrigating channels are then taken out by plough or hand along the ridges. As I am not addressing agriculturists, I do not propose to trouble you with the details of the cropping, I will merely say that, with the allowance of sewage per acre which I have indicated, the farmer or market-gardener will get far finer crops than with any other kind of manure, because, being already in solution, the manure can be more rapidly assimilated by the plants, and in larger quantities. As to the price that should be paid for the sewage, I have indicated what is its *bonâ-fide* value, but it is evident that the actual price obtained by the town must, like every similar transaction, be a matter of bargain, into which many local circumstances may enter slightly to increase or diminish the figure agreed upon, and it must also depend, of course, on whether the town has paid for the conveyance of the sewage, or whether the purchasers have done this.

Surely this little occurrence, mentioned above, of the £5,000 estimate is, however, a bitter satire upon the relations at present subsisting between the central government and the local authorities. In the provincial papers there are perpetually to be seen eloquent and heartrending cries for help from perplexed vestrymen, who see Scylla, in the form of the Court of Chancery, on one side of them, and Charybdis, in the shape of the engineer, with his hundred pounds' worth an acre of gimcracks, on the other. What are the poor people to do? They have duly polluted their river according to one Act of Parliament, and in many cases under considerable pressure from the Home Office; and now the Court of Chancery steps in and says that they must take their sewage out again, in accordance with another Act of Parliament, and they get neither pity nor assistance from the Home Office. This state of things had become so intolerable and anomalous that, a year ago, with a great flourish of trumpets, a "Royal Sanitary Commission" was appointed specially to devise a remedy. Many a despondent member of a local board has looked forward with the eye of expectant faith to the way of escape, to be indicated by the report of that august body, from the terrors of the Court of Chancery. To publish such glad tidings to trembling vestrymen was the final cause which brought the commission into existence, yet the president stated in the House of Commons, on the evening of Tuesday, the 15th instant, according to the *Times* report, "that scientific inquiry as to the best modes of carrying out various sanitary works they (the commission) postpone for the present, and entertain doubts whether public opinion is yet ripe for legislative prescription in such detail." That is to say they doubt the necessity for their own existence. But nevertheless we were informed, on the same occasion, that they were about to recommend a "plan of complete sanitary administration for all England and Wales, except the metropolis." The metropolis is no man's land, and therefore is left out, as a matter of course; but, in the present instance, the inhabitants of the metropolis may have reason to congratulate themselves on this strange exception, for what a terrible fate it will be for the other towns to be included in a "plan of complete sanitary administration," confessedly framed in an entire and absolute ignorance of all "sanitary works." This is tentative legislation with a vengeance. What would be thought of a doctor who physicked his patient first and inquired into his symptoms afterwards? The Royal Sanitary Commission consider that public opinion is not yet ripe for inquiry, but that it is ripe for legislation.

How a body of men, who are so sane individually, can be so insane collectively, is a psychological paradox that I will leave to the metaphysician; but it is quite clear that nothing but a vigorous expression of public opinion in an opposite sense can drive such a delusion out of their minds.

Now it has occurred to me that, as the present Home Secretary was such an active member of the Committee of this Society on Food, the Society might usefully draw his attention, first, to the delusion under which the Sanitary Commission are suffering; secondly, to the great hardship of the position of these poor little country towns, floundering along in tho dark; and, thirdly, to the enormous waste going on at present throughout the country of a manure which ought to be turned into food, and which represents, on the very lowest possible computation, four hundred millions of quartern loaves of bread, or their equivalent, in some other kind of food, lost to the country every year.

To utilise this manure would provide work for very many hands now idle, and would provide food for more than five times the total number of paupers in the three kingdoms. As a case in point, the Romford sewage farm, which is now in my occupation, formerly provided work, so I have been informed, for three horses, two men, and

a boy, with a little extra labour once a year. But the increased production obtained from land under sewage necessitates increased labour, and I have already got thirteen horses upon it, a dozen men, and shall very shortly have to increase the number of horses, and to more than double the number of hands, while the production of food will be augmented in a still greater ratio.

The utilisation of sewage is, then, the true statesmanlike remedy for the evil of pauperism. It would, so far as it is acted, be a radical cure, whereas emigration, so far as it acts, is only a Malthusian palliative. The one is creative—the other destructive. The one reproductive—the other exhaustive. The one increases the national wealth, directly and with certainty; the other decreases the national wealth, directly and with certainty, while it only offers a contingent prospect of an indirect benefit through possible future trade.

Surely, this is a question which is even more imperatively urgent than the Irish land question, yet government neglects it, or it is relegated to subordinate officials who have no power of initiation, and session after session passes, and nothing is done. Things drift on from bad to worse, the waste increases, the pollution of rivers increases, and pauperism increases, but the subject is dull, unattractive, by no means sensational, not altogether quite "proper," cannot be made a "cry" of, and so is voted a bore and shelved, and is not allowed by our politicians to come "betwixt the wind and their nobility." But there are some things which cannot and will not be shelved, because they are "irrepressible"—the negro was one, the pauper is another, and sewage is a third. There is a Nemesis for the punishment of all waste and all reckless extravagance; and even if we ship off all our present crop of paupers, yet, if we continue to waste our sewage, in another 25 years, when all the guano islands and mummy pits are exhausted, another crop of paupers will have sprung up, and there will be less to feed them with than ever.

If Mr. Gladstone will spend a day on my farm, as Dumas did, he will find that the waste of sewage is the reason why—in the words of his great speech on the Irish Land Bill—"we have not yet solved the problem, or got to the heart of the secret of how to relieve the destitution which is so rife among us." If his attention can only be attracted to this subject, the waste will be stopped; and if this Society can attract his attention to it, they will confer on the nation a great and a lasting benefit.

DISCUSSION.

Mr. Baldwin Latham said he fully agreed with many of the views put forward by Mr. Hope, though he differed with him on some points. With regard to the general question of the utilisation of sewage, there could be no doubt of its being one of the most important of the present day, particularly when looked at in reference to the general condition of the water-courses of this country, and to the enormous waste of fertilising matter which was going on in every direction under the present sewage system, and, therefore, any suggestions made by Mr. Hope, and gentlemen of his class, would be eagerly welcomed, he believed, by members of the engineering profession. He differed with Mr. Hope, however, not as to the value of sewage matter, but as to the mode in which it should be applied to land, for he believed that by the system advocated in the paper it was quite possible to apply sewage to land, and yet to speedily exhaust the most fertile fields. It was quite clear that if no manure were applied, the land would sooner or later become impoverished, and it was equally clear that even if sufficiently manured it would equally become exhausted, although the process would take longer; and he was convinced that by applying only the limited quantity recommended by Mr. Hope sooner or later there would be a failure. Taking an analysis of the Rugby sewage, which had been well ascertained, he found that its component parts represented for every 100 parts of nitrogen 27 of phosphoric acid and 42 of potash. It was, therefore, manifest that sewage was a manure poor in phosphoric acid and in potash, and consequently if sufficient were supplied to grow a good crop, it would be necessary to apply such a quantity as afforded the requisite supply of the poorest element. It was, therefore, impossible to get the full value out of the sewage without exhausting the fields, unless a sufficient volume were supplied. Very careful experiments had been made for the purpose of determining the proper quantity, and he believed that an acre of land ought to receive the sewage from 100 persons. And it must be borne in mind that, although particular crops would not require the whole of this, yet no loss would occur, because the affinity of soils for fertilising matter was such that nature would not allow the surplus to be wasted, but would store it up for future requirements. From an experiment of Liebig in a field near Munich, not of very great power of assimilating fertilising matter, it appeared that a stratum of soil, only four inches in depth, would absorb 2,076 lbs. of ammonia, 1,110 of potash, and 1,888 of phosphoric acid per acre; and if a crop of Italian rye grass were grown upon such land—that being the largest crop which could be grown—there would still remain behind much fertilising matter, which would remain stored up there for nine years before it passed away. But, in addition to that, Italian rye grass was a plant which died out in a limited number of years, and, therefore, it became necessary to substitute other crops, which would utilise the remaining valuable constituents, and thus no waste would occur. Mr. Hope also said that sewage contained matter in solution; but there could be no greater mistake. In dry weather sewers frequently brought down a large quantity of fœcal matter in a solid state, and if that were put on to the land, it would not only be destructive to vegetation, but would create an intolerable nuisance. It was therefore necessary that these solid matters, which were held in suspension, not in solution, should be removed before the sewage was applied in irrigation. Reference had been made to Croydon, and fault had been found with the quantity of sewage matter which was there applied to the land per acre; but it must not be forgotten that Croydon being almost the first town to adopt this system, and that not with a view to realise a profit, but really to get out of the clutches of the Vice-Chancellor, it could not be expected that the most perfect arrangements would be adopted all at once; and as soon as the present contract was terminated, a different course would be pursued, for he had already been instructed by the Local Board to procure a much larger area of land upon which the sewage might be deposited; in fact, it would be about four times the area at present in use for that purpose. Croydon had borne the burden and heat of the day in this matter, and therefore he did not think reflections should be thrown out at her expense without knowing what her present intentions were, for she was just as ready to go forward now as she was eight or nine years ago. He was sorry to say that much discredit had been thrown upon this system of sewage irrigation by the analyses put forward by Dr. Voelcker, to show how utterly impossible it was to purify a chemical solution when presented in a diluted form to the land. These results had been published in one of the agricultural journals, and he was sure that when the error, which must have occurred in the experiments, was pointed out, he would repeat them. As he was possibly the engineer pointed at in the paper, knowing pretty well what works were alluded to, he might say that the estimate of £5,000 included not only laying out and enclosing 70 acres of land, but the cost of construction of the whole out-fall works, the filtering works, and all the apparatus for intercepting the solid matter. In the whole of the irrigation works which he had in hand, and he was now laying out

upwards of 400,000 acres in England and on the Continent, the cost would not exceed £10 per acre for all purposes.

Mr. R. Rawlinson, C.B., said he knew Mr. Hope would not wish an erroneous statement to go forth, and therefore he might correct one observation in the paper by saying that the Sanitary Commission was not appointed for any executive purposes, as would be evident upon looking to the members composing it. It was simply a Commission appointed to inquire into and consolidate the present sanitary laws, one Act having been passed after another until confusion had become worse confounded. The chairman was Sir Charles Adderly, and he thought that fact was sufficient to justify his remark that the Commission did not intend to touch on the scientific part of the subject, and he hoped that as long as he lived, no Commission in this country would undertake to deal with such matters, so as to make teaching a government department as was the case on the Continent. Indeed he feared they were already going a little too far in the appointment of inspectors, but he hoped they would not at any rate begin to teach English engineers how to lay out a sewage farm so as to make the most of it. With regard to the practical part of the question, there were other differences than those mentioned by Mr. Hope. There were differences of position in many cases, and he differed with him as to the kind of land most appropriate for the application of sewage, being of opinion, having had some experience in the matter, that the most difficult land to irrigate would be a large area of comparatively flat land. He believed the most favourable was that having a limited contour elevation, and he should not even object to rather steep gradients in some instances, provided that the sewage at the commencement was sufficient for gravity, even if they had to go to some expense for pumping. His reason was this, that in irrigating land having a considerable fall, the engineer could pass his sewage by contour grips and lines over the upper areas, could then get it over the intervening portions into a second line of carriers, and as it was almost impossible to take out all the fertilising qualities of sewage by once passing it over and through any tableland area, he could pass it over twice, thrice, or even four times beneficially, and he could then discharge the water from the last carriers as pure as ordinary spring water. He did not say they would ever arrive at that pitch of perfection when it would be safe to recommend the clarified water from subsoil drains for culinary and drinking purposes, although he knew at that moment of an instance in which the strongest sewage he ever heard or knew of was used by the adjoining residents in this way as it flowed from the subsoil drains, and that was at the farm at Aldershot, and as this was the most perfect system of sewage irrigation that had come under his observation, a word or two in description of it might be allowed. It was perfect in every respect, not only because the difficulties overcome were the greatest, and the sewage by far the strongest, but because the results were by far the best. The Aldershot Camp Sewage Farm consisted of about 98 acres of land, which was, as an old north country farmer once said, worth "nowt" an acre. It was absolutely worthless, consisting of 90 per cent. of sand, with a mixture of peroxide of iron, which was absolutely poisonous. Mr. Blackburn, the engineer who had charge of the works, and who, fortunately, had had some experience in agriculture, broke up the subsoil, washed out the peroxide of iron, drained it, and laid it under a sewage irrigation of from 200,000 to 400,000 gallons per day, the sewage coming from the camp, and containing 20 grains of ammonia in the gallon; and an analysis showed that, while it had 20 grains of strong phosphoric acid to the gallon as it flowed on the land, the water from the subsoil drains only had $\frac{1}{2}$ a grain. Mr. Blackburn said it was no use to irrigate land with sewage on the surface, or to plough it in the ordinary way; he invented a plough for the special purpose, and broke up the subsoil to a depth of 20 inches, and having irrigated that well with sewage, he got a crop of Italian rye-grass of from 70 to 80 tons to the acre. After two years, he laid down a breadth in potatoes, which he sold on the ground at £25 per acre, the purchaser being at the cost of digging and taking them away, and leaving the tops behind as a solid dressing for the land of considerable value. In the same autumn the land was broken up, prepared and sown with Italian rye gas, which he himself saw showing two inches above the surface. If, however, a good profit was to be made out of land irrigated with sewage in the vicinity of a town, it should be made to produce every kind of garden produce used in the community, all kinds of grain crops being avoided, as entailing only waste of labour, land, and money. Italian rye grass, mangolds, potatoes, cabbages, French beans, and lettuces, could all be grown with advantage, but they required special knowledge and special care; for some must not be irrigated at all while the crop was in the ground, whilst others required quite a different treatment. In this way as much as from £100 to £200 per acre of gross receipts might be obtained, for he had seen a return made by persons on whom he could place implicit confidence, showing with a crop of cabbages and cabbage plants a gross return equal to £200 per acre. Between this and the ordinary produce of £5 to £10 per acre was a wide margin, quite sufficient to induce efforts in this direction. They were on the threshold of this question, and only just beginning to understand it; and as there had been so much joint-stock enterprise of late, he would suggest to any gentlemen who wished to make their fortunes that they could not do better than form an honest company and go to some of the distressed towns which had been described as in the clutches of the Vice-Chancellor, and treat with them for their sewage and the land necessary to utilise it. He knew many towns which would receive them with open arms, and let them have the land at a fair agricultural price, and let them have the sewage in for nothing, and if there was any truth in chemistry, this could hardly be a bad bargain. But at the same time, it must be conducted with knowledge and care, for he himself was concerned in a speculation of that kind where both the sewage and the land was as good as any in England, and the climate propitious, but, owing to defective management in some way, they only got a dividend of $1\frac{1}{2}$ per cent., whereas, by letting it in the ordinary way, having bought it on good terms, they could have realised 5 per cent. There were, therefore, two sides to the sewage shield, as to most others, but he believed, nevertheless, that in the proper application of this system there was a mine of wealth, by bringing common sense to bear, and avoiding blunders which had already been committed. On the other hand, in many places it had become a sheer necessity to do som thing of this sort, in order to avoid poisoning the rivers, and would be more and more so every day. Before sitting down, he would say that the man who could solidify sewage and make it a portable manure, could invent perpetual motion, and square the circle. The most perfect chemical researches had yet failed to do more than take out $\frac{1}{7}$th of the valuable properties of sewage in solid form; and taking a ton of sewage as being worth 17s. 6d., and treating it in any possible way—and he spoke from having been associated on the commission with some of the first chemists of the day—the result would be to take out solid matter to the value of 2s. 2d., and leave 15s. 4d. worth to go away with the effluent water, which might nevertheless appear perfectly pure and bright. On the other hand, when liquid sewage was passed through twenty inches of soil, it had but the barest trace of these valuable salts left in it. This, therefore, was the only true and profitable chemistry.

Dr. Voelcker said Mr. Hope was such a zealous advocate for sewage irrigation, that he could but regret his having put his pet child into such doubtful company as that of the negro and the pauper. Perhaps he had done so from

a feeling that sewage was a nuisance which must be got rid of; but though this had been the prevalent idea for many years, he was convinced that the time was coming when it would no longer be looked upon in that light. It appeared to him that they had not sufficiently considered the difficulties in the way of the successful application of sewage to land, and had taken too one-sided a view of it, as if it were only useful for particular crops, such as Italian rye-grass. Few experiments, if any, had been made as to the effect of applying it to fallow land, and he should like it tried in that way on an extensive scale, applying, say, 10,000 tons per acre, which he believed would much increase its fertility for a succession of years, during which a regular rotation of crops might be obtained; and he feared that if it were the fact that the sewage of not more than from 25 to 40 persons could be applied to an acre, there would be a very serious impediment thrown in the way of its adoption. He should rather agree with Mr. Latham, that an acre would take, at least, the sewage from 100 persons, and if it were applied to fallow land no doubt that quantity might be much increased. Mr. Latham's criticisms on his experiments had only been brought to his attention that evening, and he was hardly aware to what he referred. Probably that gentleman was of opinion that land was capable of absorbing every particle of ammonia, phosphoric acid, and potash, but if so he was in error. With regard to any special exception he had made as to the power of absorption and retention of ammonia and other fertilising matters, he had been corroborated by other chemists, who had gone very carefully into the matter, and who had found that although soils of every description had the power of fixing and retaining for a length of time immense stores of these bodies, yet they did not retain them in a very diluted, watery solution; and it was fortunate they did not, or how would the plants receive it? In these results he had been corroborated by Dr. Wolff, Dr. Knops, Professor Sonnschein, Warg, Stohmann, and other chemists, who had laboured in the same direction. In conclusion, he could not but agree with the general principles laid down by Mr. Hope, and trusted that before long they would be generally carried out in practice.

Mr. Mechi said he felt much indebted to Mr. Hope for his interesting paper, in the main points of which he fully concurred. London had a population of about 3½ millions, which consumed daily the average annual available produce of 20,000 acres of English land, in addition to innumerable cargoes of wine, sugar, coffee, and many other things which must be added to the total; and every farmer would agree that the results of that consumption must be highly valuable when restored to the soil. The only question was the application of it. He had applied sewage for the last 20 years, both in a solid and liquid state, the details of which he would not go into further than to say that, so far from spending £100 per acre, even with the use of iron pipes and gutta percha tubing, the cost had not exceeded £2 an acre. The great difficulty appeared to be this—everyone was anxious to get rid of sewage, but there did not seem a corresponding demand on the part of farmers to make use of it. One would have thought that the farmers and landowners would have taken a deep interest in this question, and, after all, there was no real difficulty in applying it; it was only a question of pipes and pumping; and two of the most eminent hydraulic engineers had stated in evidence before the House of Commons that 1,000 tons of sewage, as it came from the sewer, could be raised 300 feet at a cost of from 13s. to 14s., and then with a fall of five feet per mile, it would flow sixty miles. Water was, in fact, brought to Glasgow from Loch Katrine, a distance of 40 miles, with only a fall of 200 feet on the whole distance. To go back to his first illustration, he might say that the only difference in the consumption of 3,500,000 of human beings and the same number of sheep, considered in reference to the value of the proceeds for manure, was that the sheep consumed the bone earth in the food which they ate, whilst human beings did not; therefore town sewage was deficient in that most valuable constituent, which, however, Liebig had shewn could be supplied at a very small cost indeed. To throw away, therefore, the daily produce of 20,000 acres was a sinful neglect, and was as bad as throwing gold into the Thames. The great point was to get landowners to feel an interest in the question, and to appreciate the value of what was being now wasted.

Sir William Denison said that, as Chairman of the Rivers Commission, he had listened with a great deal of attention and interest to what had been said. The Commission had just sent in their report upon the application of sewage to the Mersey and Irwell. The difference of opinion seemed to be not at all as to the fact of sewage being highly valuable as manure, but as to the quantity and mode of applying it, the character and amount of its action on different soils, and a variety of other minor matters. The truth was, what was really wanted was a series of experiments, on a large scale, which would set many of these questions at rest. The business of the Rivers Commission was not to enter into the question of the application of sewage, but to see to the cleansing of the water of rivers, and it became a question, therefore, of practical importance over what amount of surface town sewage must pass before it was in such a state that it might be allowed to flow into the rivers without injury, and experiments had been conducted with that end in view. These were carried on at Woking, because there the sewage from the prison was at their disposal, and there was also convict labour which could be made use of; but the soil was not of such a character that any general deductions could safely be drawn from the results obtained. He hoped, therefore, that next year a more extensive series of experiments of this character would be carried on, and the results made known as speedily as possible. As far as his experience went, he agreed with Mr. Latham that the sewage from 100 people might be distributed over an acre of land; but he thought that after passing over this acre of land, though it would be sufficiently pure to be allowed to flow into a river, yet it would still contain matter which would be useful as manure. He believed, therefore, that the sewage from 100 people would irrigate profitably nearly six acres, and therefore the expense of pumping, which in many cases would be enormous if applied to one acre only, would be so distributed as not to be excessive. All these questions, however, were matters to be decided by experience alone, and would depend, in a great degree, on the character of the soil.

Mr. Target said he had a plan to bring forward by which he claimed to be able to thoroughly deodorise human excreta in an easy and simple manner, which he would describe. In the first place, he begged leave to hand to the Chairman a bottle containing the result, which was perfectly inodorous and innocuous. His plan was to deodorise the excreta when first evacuated, by means of elements which were at hand in every household. Moule's system had failed, not because it was a bad system, but because of the inconvenience of having to introduce a constant supply of earth; but he mixed simply the contents of the dust-bin, ashes, rags, dry refuse of all kinds which accumulated in every house, which had to be removed by the scavenger, and which he proposed should still be removed by the same agency, *plus* the sewage matter. This system was now in successful work in Salford, one of the most populous towns in the north, and also in Oldham, Rochdale, and other places. The plan consisted simply in lining a tub with zinc, into which the ashes, refuse, &c., were put, and mixed with a small quantity of sulphate of iron. The whole being mixed up, a mould was put into the tub, leaving a space of about three inches all round, into which the mixture was rammed, and the mould being removed, a cavity remained into which the dejections were received, when it was found that the urine was immediately absorbed, and the solid fœces were left almost dry and

totally inodorous. These tubs could be removed periodically, say once a week, and there would be no more pollution of rivers from this excrementitious matter finding its way down the sewers, and the Sanitary Commissioners and Acts of Parliament would be no longer feared. There was only one difficulty, viz., that no water must be admitted to the closet; but that had been got over by a slight modification of the apparatus, by which the water used in cleansing the pan of a water-closet was sent away to the sewers, whilst the dejections, and even the urine, were received into the tub below. They had thus got rid of the only difficulty in the way of the full success of what was called the "Gould absorption system." The patentees were so thoroughly convinced of the entire success of this adaptation, that they offered to carry out the system in any town, large or small, free of expense, relying for their remuneration simply on the sale of the manure, and this showed some confidence in the value of the inventioo. The cost of the materials was nothing, and therefore there was no expense in working it out.

Dr. Wyld said he could not agree with Dumas, that water was the best dung cart. By using it as the vehicle of sewage, there were exhalations constantly rising up into the streets and creating diseases. He had recently had a case of typhoid fever in his own house. A very bad smell had been experienced, the cause of which was found to have been rats eating a hole into the sewer, and he had every reason to believe that this was the cause of the fever. Turning excrement into the sewers was, he believed, the cause of a great deal of disease. The great merit of Mr. Target's system was, that all the materials necessary were at hand in every house. He could speak from experience as to its perfect success, and, in fact, a friend of Mr. Target kept one of them in his bedroom, and never experienced the slightest ill odour or bad effect, and he thought it might be carried out practically without much difficulty. In Salford a speculator had purchased from the corporation the privilege of removing the sewage, which had hitherto cost the town £3,000 a year. This gentleman had come forward, and given the corporation £3,000 a year to be allowed to do it, so that the thing was practically demonstrative, and not only was this the case, but the ratepayers were now up in arms, and asserting that the corporation had sold it too cheaply.

Sir William Denison said he had seen the operation of this system in Lancashire, and he believed it to be efficient in getting rid of a portion of the excrement, but that did not get rid of sewage. All the slops from the kitchen of every variety had still to go down the sewers, and the portion removed in this way was but trifling compared with the whole of that which polluted the rivers.

Mr. Rawlinson said that when he referred to solidifying the sewage he had only intended his remarks to apply to dealing with the liquid sewage at the outfall of drains, and to converting that into portable manure, but still he perfectly agreed with Sir William Denison, that removing human excreta was but a small part of the work required to be done in cleansing a town. There were the washings from the surface of the roads, which must be taken away by the sewers, and many other varieties of liquid refuse, which no such system as that referred to could get rid of. With regard to the effluvia which had been spoken of by Dr. Wyld, he would say that was simply the consequence of bad drainage. No drains should ever ramify beneath the basement of any house or any building, however large. They should end at the outside wall. In dealing with separate manipulative processes there would always be difficulties. He had three closets in his house, and some persons had a great many more, and he did not think they would ever get servants to pack these things and carry them backwards and forwards.

Dr. Burn said he had spent the greater part of his life in India, and there the system of dry manipulation of sewage matter was universally practised, and appeared to him quite successful.

Captain Selwyn, R.N., desired to call the attention of the meeting to the two tables showing the constant flow of sewage at Stratford, which really had nothing whatever to do with the question of human excreta, and therefore it was adundantly evident that any system of dry deodorisation, such as had been described, would be totally inefficacious for dealing with town sewage. It was a misapprehension of the whole question. They had to deal with sewers as they were.

Dr. Paul suggested that the discussion of systems of dry deodorisation of solid sewage matter was one foreign to the subject of the paper. It was well worthy of consideration of itself, but he did not think it was desirable to mix the two things together. There were some cases in which it would be useful, and others where it would be quite out of the question; as, for instance, in London and other large towns, where water systems had been already adopted. In all these cases, the point to consider was, how to dispose of the liquid sewage, but in other parts, and particularly in some of the populous towns in the north, he was aware there was a strong feeling against the use of water as a means of carrying off the town refuse. If, however, the subject were brought forward separately, it would be likely to receive more attention and more justice.

Mr. Hope, in replying to the observations which had been made, said he had been slightly misunderstood in some respects, in consequence of having omitted several points in his paper, in order to keep it within reasonable length. For instance, Mr. Latham had misunderstood him with regard to the number of persons per acre which he had mentioned. He did not mean to say that he would never, under any circumstances, apply sewage from more than 40 or 45 persons to one acre in a year, but that was about the amount which, on an average of a number of years, could be profitably applied. Mr. Latham said that there would be no loss in putting an extra quantity of sewage on the land, because what was not exhausted would be stored up in the soil, but if they continued this year after year it must come to an end some time; and where the land had stored up as much as it could hold, it was a necessary consequence that pollution would follow. With regard to irrigating with solid matter, that was another point which he had not enlarged upon, but he certainly should never propose to float down matter of that sort in its crude state over the surface of the land. It would be worse than useless from an agricultural point of view, and would, no doubt, create a great nuisance. All this solid matter must therefore be got rid of, either by mixing, which he believed was the best system, or by some process of intercepting it, which was not so effective, because it had then to be carried over the land instead of carrying itself. He did not agree with Mr. Rawlinson that land with steep slopes was the best for irrigation purposes. No doubt Mr. Rawlinson was right as an engineer, but he was wrong as a farmer, because it was impossible to cultivate such land properly and comfortably, so to say, if the sewage were applied by contour lines. Every time that land was ploughed it was moved either upwards or downwards, which would interfere with its contour lines, unless you used nothing but a turn-wrest plough, which formed the furrow the same both ways, and these were both more expensive and less durable than those of the ordinary construction. He had had experience on both flat and steep lands, and his opinion was that the convenience of the farmer was the great point to be looked at, and this was too often neglected by engineers, who were rather disposed to force their systems upon farmers, instead of ascertaining how they could meet their requirements. Mr. Target's plan had, he believed, all the defects of Mr. Moule's, and one more, because he did not see

how these things were to be arranged in villages and small towns where there were no scavengers. He should be very loth to ask his housemaid to operate on one of these affairs, and if he did, he did not think she would remain in his service after that day month.

The Chairman, in proposing a vote of thanks to Mr. Hope, said the result of the discussion showed that this was a very fit subject to be brought forward by the Society of Arts, and he hoped they would press it forward in every possible way. There was, first, that admixture of scientific and practical work to be done which required the ventilation which all such questions received at their meetings, and he had no doubt that good results would follow from that evening's consideration of it. Mr. Hope was evidently armed at all points on this question. There might, here and there, be a weak place in his armour, through which an adversary might thrust a lance, but he was, in the first place, thoroughly acquainted with the subject, and, in the second place, he had had practical experience upon the very point now at issue. The time was now passed when it was doubted whether sewage was offensive and noxious, and they had also passed the time when it was necessary to inquire whether they could substitute any other mode of treating town sewage in a great number of instances, for out of ninety-six towns which were thoroughly sewered, there were only fifteen where the sewage was made use of upon the land. This, therefore, was a question vitally affecting all these towns, and also the metropolis, and it ought to be argued to the full. He was therefore of opinion that the introduction of the question of earth closets and other systems of dry deodorization was rather out of place, but he had not thought it right to put a stop to the discussion, because he felt it was a question which, in many cases, had great practical value. The great defect of any such system must always be that it left behind a vast amount of fluid matter of a noxious character undisposed of. Nor was it at all certain that typhoid fever resulted from the decomposition of human excreta; on the other hand, there seemed rather reason to believe that it might be the result of the decomposition of vegetable matter; and a great quantity of this must always be passed down the sewer with the kitchen slops, whilst fungi would also vegetate in the drains themselves, so that typhoid fever might still occur, even if all solid human excreta were prevented from entering. The meeting seemed all of one mind as to the value of sewage matter, but the point on which difficulty arose was the application. The engineering difficulties were admitted not to be great, but still they required experimental inquiries into the best mode of delivering the sewage upon the land, and utilising it when it was there, and also as to the best kind of land, the proportion of land to a certain number of persons, whose sewage was to be applied, the character of the irrigation, the crops which might best be treated with it, and the proper seasons for its application. All these were points of detail, and as the object of the paper had been to raise a discussion upon them, no one could have brought it forward with better effect than Mr. Hope, who had had such favourable opportunities for forming an opinion, he having arranged for the exclusive use of the sewage from the small town of Romford, where he knew the number of inhabitants, and number of water-closets, and could easily guage the quantity of sewage that flowed from day to day and hour to hour; analyse it as often as was desired, and distribute it in a certain order and on certain principles. In conclusion, he would say that Mr. Hope deserved the most hearty thanks of the meeting for having brought this subject forward, and he hoped he would continue his experiments and make known the results. If he might say so without being considered fanciful, he would suggest that they might all take as their motto the name of the author of the paper, and might hope that in a short time sewage would be utilised instead of being wasted, and used instead of being abused.

The vote of thanks was carried unanimously.

Mr. Hyde Clarke writes:—"The valuation of sewage manure is to be taken in food and not in money. The sewage of London, valued at £1,000,000, would grow corn for at least 2,000,000 of people, and this food-producing substance is now thrown into the Thames. It is worthy of inquiry, what is the quantity of corn imported into Belgium, which has a population of nearly 5,000,000 on a very limited surface. The production of food in Belgium is chiefly dependent on the economical application of manure, and particularly of human manure, and that to inferior land, the soil of Flanders being a sand, with a thin layer of humus. The increase of the population in Belgium actually contributes to the increase of food, while here these resources are annihilated by the novel legislation of the last few years. It is most desirable to have the experience of Belgium made known, a country within sight of us and in the same climate, where town manure is applied to a variety of crops—grain, cabbages, roots, potatoes, flax, tobacco, &c., and where the rent on light land is very high."

FOOD COMMITTEE.

The following is a report of Mr. Tallerman's information, laid before this Committee on February 2, and referred to in the account given in the *Journal.*

Mr. Daniel Tallerman, of the Australian Meat Agency, attended, and in reply to the chairman said:—I am an importer of Australian meat generally. I import directly, and buy in this country from other persons who import also. I came over to this country on purpose to establish a business in Australian meat. Finding there was no settled trade in that meat, it became necessary for me to establish a trade. I imported at my own risk at first, and then went into the market to buy, and have since continued my own importations, and have been inducing persons to consign. I do not confine myself to meat preserved by any particular process, or any special meat that comes here, for my purposes. I take any meat that is good, by whatever process prepared, but I use principally the meat that comes packed in fat. It is cured by the ordinary curing process.

Q.—When you say "cured," do you mean that salt is used?—The mode of curing varies. Some curers use salt, sugar, and spice; and some use salt, spice, and bisulphite of lime, and different chemicals, but there is always salt.

Q.—The Morgan system is one of injection, I believe?—Yes; but it is not in much use. It is an unsatisfactory mode. The meat should be allowed to cool for a certain time before the curative process is applied. You may put salt in meat before it is set, and then it never comes out properly.

Q.—Do you use the Australian meat preserved in tins, or that preserved by some particular process?—I use the cured meat for my purposes for the penny dinner, but I sell the tinned meat generally.

Mr. Tallerman exhibited a specimen of his meat, and then said:—The only process to which my name is attached is that I have mentioned, viz., packing with fat. Instead of the meat being packed in ordinary brine, it is packed with layers of fat; it is a very old method, I believe, but I think I was the first to have it done as a commercial undertaking. The meat is cured, that is to say, salted in the ordinary way, with the addition of sugar and other ingredients, as I have said before. The bones are taken out, and the whole carcase, say of a sheep, is thrown into a pickle-tub. Instead of the meat being packed with brine, the casks with the meat are filled up with melted fat; they put in first a certain quantity of fat, and then a layer of meat, running in fat to fill the interstices. When it sets, they then put another layer of meat and another of fat, and so on, till the cask is

filled. The fat has a special advantage over brine. It hermetically seals the meat from the air to a certain extent, and keeps it fresh.

Q.—Is the brine proof-pickle?—I cannot say. I am not a curer. They have commenced using the bisulphite of lime or chemicals since I left the colony.

Mr. Tallerman here showed another sample of meat packed in spice pickle, and said it was from one of the last shipments, and had only been unpacked some twelve hours.

Q.—Which of the samples you have shown us do you think has the least salt?—That would all depend upon the curers. I believe we shall have less and less salt, and ultimately arrive at a minimum.

Q.—Before you cook your meat, do you adopt any process different from that applied to ordinary meat?—I soak it for twelve hours over-night, and then cook it in the morning. The water takes a good deal of the salt out. This, however, depends upon the shipments, for sometimes the meat will come to us with very little salt, and will require no soaking. The main difficulty I have is the irregular way in which it is cured.

Q.—What is the relative cost of it as compared with fresh meat?—The price at which it is being sold here retail is, mutton, from 4½d. to 5½d. per pound without bone, the latter being for the prime joints.

Q.—And how much the beef?—5d. or 5½d. wholesale, the retail price being 6d.

Q.—What would that yield for the price of an ordinary sheep in Melbourne?—I have not gone into that.

Q.—Could you roughly guess?—About 3d. a pound in the colony.

Q.—How many pounds does a sheep yield?—A 60 lb. sheep would turn out from 38 to 40 lbs. of meat.

Q.—And 40 lbs. at 3d. will be ten shillings. That will be without bone and spare fat and skin?—Yes.

Q.—You would want a good deal of this spare fat for packing?—Yes.

Q.—That is very important, as the supply would be illimitable if there can be anything like a remunerative rate got for it, and ten shillings is a remunerative rate?—We can throw the fat in. The fat has a good sale.

Q.—What is your meat sold for in England now?—4½d. to 5½d. per lb.

Q.—Is there a large sale at that?—It is increasing every day. There would be a larger sale if I had more depôts for selling it.

Q.—Do many people buy it to cook for themselves?—Yes, a very large number.

Q.—And do they come back again?—Yes; the same people come over and over again. Some come a mile for it.

Q.—What class?—The middle class, including clerks and the superior class of workmen. They are not the lowest class of people.

Q.—What do you say is the average price of such meat as that bought in butchers' shops at this time, say, a shoulder?—It would be 8d. or 9d. per lb., and have 15 per cent. bone in it.

Q.—What part of the town are you speaking of when you quote 8d. or 9d? Would this be charged in the East-end, or to persons who would go to a cheap market for it? Could they buy your meat at 5½d. equal in quality to butchers' meat?—You may go through the east of London, and even the west, and you will not see meat in such prime condition or equal in quality to that now on the table before you.

Q.—Have you different qualities sent over?—It is all as good as this. It varied at the time of the drought in the colony, and was not then in as good condition as now. The meat coming now is magnificent.

Q.—What do you say about beef?—Very little beef is coming now. There are very few curers except in Melbourne, where beef is comparatively dear. Since they have succeeded there they have commenced preserving in Victoria, Queensland, and New South Wales, where beef is cheaper than mutton, and we shall be getting more beef soon. Referring to the saltness of the meat, I may point out that, by cutting the meat small and using vegetables with it, it loses that character. At my dining place salt is always on the table, and at least eighty out of every hundred persons take it with this meat. I find that the vegetables I use more than absorb the salt in the meat.

Q.—Do you know whether the bisulphite of lime has been used with this specimen?—I can't exactly tell. We can generally see it by a white coating outside. In the cooking of this meat, it is necessary to add vegetables to absorb the fat. If simply boiled, the fat separates, and rises to the top of the water. The fat, which is exceedingly nutritive, is absorbed by the vegetables, and is thus palatable to most people.

Q.—How many persons have you dining every day at your place?—From 700 to 1,000. The number has come down this week, owing to the warmer weather. The penny dinners are subject to the same fluctuations as other trades.

Q.—Do you say that this meat would do for a person's dinner who had not the power of cooking a large quantity of vegetables, to make it a palatable stew; say a labouring man in the country?—He could not cook this so. If he boiled 1 lb. he would only have nine ounces. The rest would be on the top of the water in the shape of dripping.

Q.—Can he roast this meat?—No; it should be chopped up in small pieces, and then boiled with vegetables. It will bake by being cut up in small pieces, with alternate layers of meat and potatoes. You must have something that will absorb the fat, or else this is a wasteful meat.

Mr. Tallerman here handed round some plates of pea-soup and other dishes, consisting of Irish stew, curry, &c., for the Committee to taste. The Irish stew, he explained, in answer to questions, was made of vegetables and chopped up Australian meat. It was exactly what was supplied for a penny, both in quality and quantity. One plateful of the soup alone was given for a penny. Bread was charged for extra. Mr. Tallerman also exhibited a box, which, he said, had been constructed on the principle of the Norwegian cooking-box for the purpose of supplying cheap dinners hot at workshops, factories, &c., where there might be 100 or more workpeople employed. Another dish was handed round, which Mr. Tallerman said was an imitation of the well-known Scotch dish "cock-a-leekie." This dish is 1½d., and with a slice of bread (the sixth part of a loaf) is 2d.

Q.—Which is the favourite dish?—They all sell in their turns; when we are out of one we sell another, but I think Irish stew is the favourite.

Q.—Do you sell much pea-soup with the bread?—We don't give bread, but we sell a good deal of the pea-soup.

Q.—Do you give your customers rice with their curry?—No.

Mr. Tallerman next exhibited a jar, containing what he described as being his last idea in connection with Australian meat. The purchaser had nothing to do but put the contents of the jar in a saucepan, add a little water to it, and cook it. It would be sold for 6d., 8d., and 10d. a jar, each of which would make a family dinner. Persons might bring their basins or jugs to the depôts, and take the contents of a jar, or leave so much on the jar. The contents of the jar were 1 lb. meat, 3 lbs. potatoes, ½ lb. of onions, 1 lb. of turnips, 1 lb. of carrots, ¼ lb. of pearl barley, and sundry herbs, &c. It would weigh 7 lbs. altogether, and the retail selling price would be 10d. altogether. The retailers would have a fair profit, whilst the purchasers would have a substantial dinner sufficient for seven.

Q.—The dinners you sell cost how much?—The twopenny dinner cost 1½d. The halfpenny will provide the

fuel, working expenses, &c. I beg to hand in a calculation made by Dr. Watson, of Norwich. He bought his own vegetables, and has been giving dinners of his own. One hundred dinners cost 6s. 9d. One hundred retail penny dinners would of course be 8s. 4d.

Q.—Have you tried your meat as against the meat of this country? In other words, have you made these various preparations of pea-soup, Scotch soup, and Irish stew, and then compared the cost to you and the quality, as against the cost and quality of English meat?—I have never tested Australian meat against fresh meat at all.

Q.—If you were to go to Smithfield Market, and buy the parts that would be most suitable for these stews, you would get them for 5½d. and 6d. all round?—You might get them at 4½d. from me, but mine would be the best-part article, the other would be the inferior joints.

The Chairman then thanked Mr. Tallerman, who then retired.

The Committee met on Wednesday, February 16th. Present: Benjamin Shaw, Esq., in the chair, Dr. Pitman, Rev. J. E. Hall, Messrs. E. B. Saville, E. W. Hollond, J. T. Ware, and J. Youl.

The Committee had before them a specimen of meat prepared by Mons. Thibierge's process (described in the *Journal*, vol. xviii., p. 62). This specimen had been in the Society's house ever since the commencement of November. The process had failed to prevent decomposition.

The Committee had also before them specimens of Bancroft's "desiccated beef," from Queensland. It is prepared in that country by mincing the raw meat, drying it on iron plates heated by steam from below with fanners above. It is then ground, and packed in tins. The specimens sent were stated to have been prepared twelve months ago. They were in excellent condition, showing no signs of any deterioration. This material was before the Committee on a previous occasion, but at that time it did not appear to be an article of commerce, as is the case now. The following is the result of an investigation by a distinguished chemist, which was made for the use of the Commitee:—

"Under the microscope, fibrous matter, like dried muscular fibre, seen. No acari; no vegetable matters.

Organic fibre, with abundance of nitrogen and sulphur	90·6
Water	7·7
Mineral ash, sulphate of potash chiefly	1·7
	100·0

"Highly nutritious. Would require a little soaking before use."

The meat is stated to be specially useful in the preparation of soups, beef tea, potted meats, curries, and hashes.

The Committee then adjourned, on the invitation of Mr. Tallerman, to taste a variety of dishes prepared from the cured Australian meat imported by him, the object being to show that such meats were, by suitable cooking, capable of being made into dishes of a much higher character than those shown on the former occasions. The dishes placed on the table were barley broth, curry, haricot, fricassee, fried meat balls, rissoles, ham and eggs, croquets, and galantine. All the dishes, with the exception of the eggs, were prepared from cured legs of mutton.

As these meats are still under investigation by the Committee, no opinion can at present be pronounced.

INTERNATIONAL EXHIBITION OF 1871 (EDUCATION DEPARTMENT).

The following is the Society of Arts Committee formed for the purpose of co-operating with Her Majesty's Commissioners for the Exhibition of 1851, in the formation of an educational collection, and discussion and examination of methods of teaching:—

Abel, F. A., F.R.S., *Member of Council Soc. of Arts*
Abbott, Rev. E. A. (Head Master of the City of London School)
Aguirre, B. B. (King's College)
Allies, T. W. (Secretary to the Catholic Poor Schools Committee)
Anderson, John, C.E.
Andrews, Samuel, *Member of Council Soc. of Arts*
Angus, Rev. Dr. (Principal of Regent's-park College)
Ansted, Professor D. T., F.R.S.
Ball, John
Bangor, Bishop of
Barrett, W. F., F.C.S.
Barry, Rev. Dr. (Principal of King's College)
Barry, Rev. F. S., M.A. (Head Master of the Mercers' School)
Bartley, G. C. T., *Auditor Soc. of Arts*
Baskcomb, W. B. (Science and Art Department)
Bates, Rev. Jonathan, M.A.
Bell, John, *Member of Council Soc. of Arts*
Bell, Rev. G. C. (Head Master of Christ's Hospital)
Bodkin, Sir W. H. (Assist. Judge), *V.P. Soc. of Arts*
Bourne, Alfred (Secretary of the British and Foreign School Society)
Bowler, H. A. (Science and Art Department)
Bradby, Rev. E. H. (Principal of Haileybury College)
Bradley, Rev. G. G. (Head Master of Marlborough School)
Brewer, Rev. J. S., M.A. (King's College)
Brooke, Charles, M.A., F.R.S.
Bruce, Right Hon. H. A., M.P., *V.P. Soc. of Arts*
Buchheim, Dr. (King's College)
Byng, Hon. and Rev. F.
Canterbury, the Archbishop of
Carlisle, Bishop of
Cary, F. S.
Chadwick, Edwin, C.B., *Member of Council Soc. of Arts*
Chambers, D. N.
Chambers, Robert
Clark, Rev. Samuel, M.A.
Clarke, Hyde, *Treasurer Soc. of Arts*
Cole, Henry, C.B., *V.P. Soc. of Arts*
Cooper, Sir Daniel, Bart., *V.P. Soc. of Arts*
Costa, Sir Michael
Cowper, the Right Hon. W., M.P.
Cromwell, Rev. Canon (Principal of St. Mark's College)
Crowe, Eyre (Science and Art Department)
Curwen, Rev. John (Tonic Sol-fa Association)
Daniel, Rev. Evan (Principal of Battersea Training College)
Davies, Rev. T., D.D. (Principal of Haverfordwest College)
Davis, G. H., L.L.D. (Representing Religious Tract Society)
De la Rue, Warren, F.R.S.
De l'Isle and Dudley, Lord, *V.P. Soc. of Arts*
Devonshire, Duke of, K.G., *V.P. Soc. of Arts*
Dilke, Sir Charles W., Bart., M.P., *Member of Council Soc. of Arts*
Dixon, G., M.P.
Donnelly, Captain, R.E., *Member of Council Soc. of Arts*
Eardley-Wilmot, Major-General F., R.A., F.R.S., *Member of Council Soc. of Arts*
Edgar, Rev. J. H., M.A.
Exeter, Bishop of
Fawcett, Professor Henry, M.P.
Flower, Prof. W. H. (Royal College of Surgeons)
Fox, Francis E. (representing British and Foreign School Society
Frankland, Prof., F.R.S. (Royal College of Chemistry)
Franklin, J. A.
Franks, C. W. (Endowed Schools' Commission)
Fuller, Professor G., C.E.
Galpin, Thomas Dixon
Gerstenberg, I.
Gloucester and Bristol, Bishop of
Goldschmidt, Otto

Goodeve, Professor T. M. (Royal School of Mines and Woolwich Military Academy)
Granville, Earl, K.G., F.R.S., *V.P. Soc. of Arts*
Grote, George, LL.D., F.R.S. (President of University College, London)
Guthrie, Professor, Ph.D.
Hall, Rev. T. G., M.A. (King's College)
Hamilton, R. G. C. (Privy Council Office)
Hamley, Colonel, C.B., R.A.
Harness, Colonel, C.B., R.E.
Harrowby, the Earl of
Hart, Solomon, R.A.
Hawes, William, *V.P. Soc. of Arts*
Hogg, Robert, LL.D.
Hornby, Rev. J. J. (Head Master of Eton)
Hoskyns, C. Wren, M.P., *V.P. Soc. of Arts*
Hudson, Rev. T. P., M.A.
Hughes, Professor William, F.R.G.S. (King's College)
Hullah, John
Huxley, Professor, F.R.S. (Royal College of Mines)
Her Majesty's Inspectors of Schools, as follows:—
Arnold, Rev. E. P.
Arnold, M.
Barry, Rev. H. B.
Bellairs, Rev. H. W.
Binns, Rev. B. J.
Blakiston, Rev. J. R.
Bowstead, J.
Brodie, E. H.
Cornish, Rev. F. F.
Cowie, Rev. B. M.
Crabtree, Rev. E. W., M.A.
Du Port, Rev. C. D., M.A.
Fearon, D. R.
Fitch, J. G.
Fraser, Rev. S. J. G.
French, Rev. G.
Fussell, Rev. J. G. C.
Gordon, J.
Gream, Rev. N.
Hernaman, Rev. J. W. D.
Howard, Rev. W. W.
Hughes, Rev. H.
Johnstone, Rev. C. F.
Kennedy, Rev. W. J.
Kerr, John
Lomax, Rev. J.
Lynch, H. J.
Middleton, D.
Mitchell, Rev. M.
Moncrieff, Rev. G. R.
Oakeley, H. E.
Parez, Rev. C. H.
Pickard, Rev. H. A.
Robinson, Rev. C. J.
Routledge, Rev. C. F.
Sandford, Rev. H. R. P.
Sewell, Rev. Capel
Smith, Rev. H.
Stokes, S. N.
Synge, Rev. F., M.A.
Temple, Rev. R.
Tinling, Rev. Canon
Tregarthen, Rev. W. F.
Warburton, Rev. W. P.
Watkins, Rev. F.
Watts, Rev. E. T., M.A.
Wilkinson, Rev. F.
Williams, W.
Isbister, A. K., M.A., LL.B. (Head Master of Stationers' School).
Iselin, J. F., M.A. (Science and Art Department)
Jeffrey, Henry
Jex-Blake, Rev. T. W. (Principal of Cheltenham College)
Johnson, Rev. Jas., B.A. (representing the Home and Colonial School Society)
Jowitt, Rev. W. (Head Master of the City Middle Class School)
Key, T. Hewitt (Head Master of University College School)
Lennox, Lord Henry G., M.P., *V.P. Soc. of Arts*, and Chairman of Council
Lichfield, Bishop of
Lincoln, Bishop of
Llandaff, Bishop of
London, Bishop of
Longman, William
Lubbock, Sir John, Bart., *V.P. Soc. of Arts*
Lyttelton, Lord, *V.P. Soc. of Arts*
Macfarren, G. A.
Mackenzie, Rev. C. (City of London College)
Macmillan, Alexander
Mariette, Prof. Alphonse (King's College)
McLeod, Walter (Royal Military Asylum, Chelsea)
Merrifield, C. W., F.R.S. (Royal School of Naval Architecture)
Messrs. Chapman and Hall
Moseley, Rev. Canon
Mundella, J., M.P.
Murby, Thomas
Murray, John
Murray, John, *Treasurer Soc. of Arts*
Neate, Charles
Norwich, Bishop of
Oxford, Bishop of
Pakington, Right Hon. Sir John S., Bart., M.P., *V.P. Soc. of Arts*
Percy, Professor John, M.D., F.R.S. (Royal School of Mines)
Peterborough, Bishop of
Petter, G. William
Phillips, J. A.
Pistrucci, Professor (King's College)
Pitman, Frederick
Playfair, Dr. Lyon, C.B., M.P.
Price, Rev. Bartholomew, M.A., F.R.S.
Ramsay, Professor A. C., F.R.S. (Royal School of Mines)
Redgrave, Richard, R.A.
Redgrave, Samuel, *V.P. Soc. of Arts*, and Vice-Chairman of Council
Reed, E. J., C.B.
Reynolds, Rev. H. R. (President of Cheshunt College)
Ridding, Rev. G. (Head Master of Winchester School)
Rigg, Rev. Arthur, M.A.
Rigg, Rev. Dr. (representing the Wesleyan Training Institutions)
Ripon, Bishop of
Rochester, Bishop of
Rogers, Rev. W., *Member of Council Soc. of Arts.*
Routledge and Co., Messrs.
Russell, Earl, K.G.
St. Davids, Bishop of
Salisbury, Bishop of
Samuelson, B., M.P.
Scott, Rev. C. B. (Head Master of Westminster School)
Shaw, Benjamin, *Member of Council Soc. of Arts*
Shuttleworth, Sir J. Kay, Bart.
Sinclair, Venerable Archdeacon (representing the National Society)
Smyth, W. W., F.R.S. (Royal School of Mines)
Sopwith, Thomas, F.R.S.
Sullivan, Arthur
Sydney, F. J., LL.D. (Royal Coll. of Science, Dublin)
Sykes, John, M.A. (Privy Council Office)
Teulon, Seymour, *V.P. Soc. of Arts*, and Vice-Chairman of Council)
The Chief Rabbi
The Lord Chancellor, F.R.S., *V.P. Soc. of Arts.*
The Lord Mayor
The President of the Royal Academy
The President of the Royal Academy of Music (Earl of Dudley)
Thomson, T., M.D., F.R.S. (Science and Art Department)
Trevelyan, Sir Charles, K.C.B., *Member of Council Soc. of Arts*
Tufnell, E. Carleton, *Member of Council Soc. of Arts*
Twining, Thomas, *V.P. Soc. of Arts*
Twisden, Rev. J. F., M.A. (Science and Art Department)
Unwin, Rev. Dr. (Principal of Homerton College)
Vaughan, Henry, *Auditor Soc. of Arts*
Ware, James, *Member of Council Society of Arts*
Whitworth, Sir Joseph, Bt., LL.D., F.R.S., *V.P. Soc. of Arts*
Williams, Rev. J. D., M.A. (Principal of Brecon College)
Williamson, Professor A. W., F.R.S. (University College)
Willis, Professor (Royal School of Mines)
Wilson, Rev. Alexander, M.A. (National Society)
Woolley, Rev. Dr. (Royal School of Naval Architecture)
Worcester, Bishop of
Wylde, Professor, Mus.D.
Wylde, R. G. (Science and Art Department)
York, The Archbishop of, *V.P. Soc. of Arts*

INDIA COMMITTEE.

The adjourned Conference on the subject of a Gold Currency for India was held on Friday, January 21st, W. S. FITZWILLIAM, Esq., late member of the Supreme Legislative Council of India, in the chair.

(*Continued from page* 280.)

The Chairman, in closing the discussion, said:—I am sure that everyone interested in the important question of a gold currency for India will feel with me deeply indebted to Mr. Andrew Cassels, for the valuable and interesting paper which he read at our previous meeting. To the gentlemen who have so ably assisted us in the discussion I feel also personally indebted—a feeling in which I am sure all those present at this and the previous meeting will concur. My reason for making it a personal matter is, that I have for many years taken a great interest in the important questions connected with the currencies of the world, and especially of late years with those of India. Indeed, I have given so much attention to it in that country that I have been accused of exaggerating its importance. This charge, however, has been answered by the fact that abler men than myself have taken an interest in its discussion, and have advocated its adoption. I refer to the late Mr. James

Wilson, Sir Charles Trevelyan, Mr. Arbuthnot, Sir Bartle Frere, Sir Wm. Mansfield, Mr. Walter Cassels, Colonels Smith, Ballard, and Hyde, Mr. Rowland Hamilton, Mr. Claude Brown, and other gentlemen of Indian experience; and now that the question has been so ably discussed in this room, I feel that my labour has not been lost. Differences of opinion there will always be upon questions of such importance, and the consequent discussion seems to develop opinions which help us to arrive at the true merits of the questions so discussed. But whatever may have been the difference of opinion as to how a gold currency would be best introduced into India, I am glad to find that there is no difference of opinion, either amongst the authorities I have named—who have discussed the subject in India—and those who have expressed their opinions in this room, as to the necessity for its introduction. As I said before, we are much indebted to Mr. Cassels for the paper he has read, and to a great extent I concur in the opinions he has expressed. We are also indebted to Mr. Hendriks for the very able manner in which he has brought his great experience in currency questions to bear upon that which has been under discussion; I am sure that those who heard his paper read will concur with me in the opinion, that it contained much information, and from which I have certainly profited. My friend, Mr. Rowland Hamilton, who had previously published an able treatise upon gold currency, has also done the cause good service by the paper he read at the previous meeting. To Mr. Hyde Clarke and Colonel Smith we are also indebted for the interest they have taken in the discussion, the more so as the latter gentleman has had, as a mint master in India, great experience, and is a recognised authority upon the subject. So also is Dr. Boycott, who has just addressed the meeting. In fact, the question has been so ably discussed—I may say exhausted—that I feel I should be trespassing upon your patience if I did not express my own opinion upon it as briefly as possible; in fact, in so doing, I shall only express my concurrence in many of the opinions previously expressed, especially those of Mr. Cassels, Colonel Smith, and Mr. Rowland Hamilton. After much consideration of the question in its various bearings I felt assured that the proposition, which was to some extent recently adopted by the government of India, for commencing the establishment of a gold currency for India, by the receipt of English and Australian sovereigns, at 10 rupees 4 annas, into the Indian Mint, and from whence they supposed they would be taken out for circulation, would result in a failure, and so it has proved. 100,000 were so received, and were taken out again. They were paid in by bankers who had received them from England or Australia, as an exchange operation, and taken out again for the same purpose, or by native dealers in bullion for conversion into ingots, but not for circulation. I remember in, I think, 1861, about 200,000 sovereigns were received in Calcutta by one steamer from Australia, which were all sold to native bullion merchants, at about 10 rupees 4 annas, and they, in less than 48 hours, converted them all into ingots, and dispatched them from Calcutta to their correspondents in the upper provinces and Central India. You will probably ask with what object? Merely because the receipts of gold into the Indian ports had, for reasons of exchange, been for some time almost *nil*, and, consequently, the demand for native mints and the manufacture of native gold ornaments had become largely in excess of the supply. The native dealers in bullion were therefore able to realise a good profit on their ingots, though they were produced from sovereigns costing 10 rupees 4 annas each. As a rule, it will not pay the European banker to import sovereigns from Australia or elsewhere, unless he obtain for them from 10 rupees 3 annas to 10 rupees 4 annas, and, even at those rates, it will not always pay as an exchange operation. The government cannot therefore depend upon receiving any amount of sovereigns for the purposes of circulation or otherwise, even at the high rate they now offer, and what they do receive they are likely to keep, unless the native demand, before referred to, be sufficient to make a profit for the dealer. Therefore, any addition to the currency by the means proposed is, I believe, impracticable. But there is another mode of increasing and establishing a gold currency for India, and that is the coinage of a sovereign at the Indian mints which shall represent the intrinsic value of ten silver rupees. To the mint masters must be left the question of the best means to arrive at this representative value, though I know that there is no difficulty in accomplishing it. Rumour says, and I can only hope that the report is true, that orders have been sent out to the Indian mints to coin sovereigns and half-sovereigns upon this principle. Let this be done, and the public may feel assured that such coins will find a ready and large currency, quite sufficient to meet, eventually, all the requirements of commerce throughout India, and with this advantage, that a coinage which only represents the actual or intrinsic value of ten or five silver rupees will not be readily taken for the native coinage of gold mohurs or the manufacture of jewellery. It may be taken for hoarding purposes, but even then it will probably be soon again in circulation, and especially so when the native traders and peasants of India begin to appreciate more thoroughly the value and convenience of a government paper currency. I am aware that much has been said about the necessity of changing the present Indian standard. If a gold currency is to be introduced, or that a double, say a gold and silver standard, may be found necessary as a temporary measure—for I am quite aware what an important position the silver currency holds in India, especially as regards native dealers and traders—yet I see no difficulty in eventually superseding it by a gold currency, especially if ten and five rupee gold pieces are coined. Silver coins, as a token, will always pass current throughout the country, and will, with copper coins, meet all the requirements of the natives in their small transactions in produce or other articles of trade. The mints must, however, for the present, continue to coin both gold and silver, if only for public convenience; for, though I fully agree with Mr. Hyde Clarke that in the memory of most of those present nearly all Europe had a silver currency, which has now to a great extent, been replaced by gold, in India, where sales and purchases amongst the lower classes are, to a great extent, limited to a few rupees, a medium of payment less in value than five rupees must, at least for some time, be retained. To meet these requirements, a silver coin, as a token of value, will do all that is required. So much, however, has been placed before you by the gentlemen who have preceded me, that I feel it now my duty to complete my own remarks by hoping, with Mr. Cassels and Colonel Smith, that the publication of the report of this meeting by the Society of Arts will have the effect of calling the attention of the proper authorities to the subject. For years it has been discussed in India, and the result of the discussions referred to the Indian authorities in England, who have again referred it back to India, and thus, as Colonel Smith says, it has been, shuttlecock fashion, thrown from office to office without any result beyond a probable entombment in red tape, or some such disposal of the whole question. However, I should state that, though advocating the introduction of a gold currency for India, I do so because I believe that it would be a valuable auxiliary to the government paper currency established by the late Mr. James Wilson, the extension of which has, I regret to say, been cramped and retarded, and, if I may use the expression, "muddled" by those in authority, both here and in India, who, since the death of Mr. Wilson and the resignation of Mr. Laing, have held office. However, new blood has been infused into the Indian counsels both at home and in India, and we may hope

that both the paper and the gold currency questions will now receive that attention which their importance demand at the hands of the government. He concluded by saying that the public was much indebted to Mr. Hyde Clarke for suggesting these conferences on Indian matters.

APPENDIX.

MEMORANDUM, BY MR. HENDRIKS, AS TO THE RELATION BETWEEN PROPOSED INDIAN GOLD COINAGE AND THE METRICAL SYSTEM.

It appears, from some observations made at the last Conference, that it was not clearly understood by all who spoke on that occasion that the suggested new gold coins for India are in very precise and symmetrical relation with the weights of all other international coins. In fact, taken as a whole, they form as easy and perfect a metrical scheme as can be devised. The practicability of finding a more homogeneous one may be challenged, except the method were to be a clean sweep of all existing leading coins of the world. This would be utopian, impolitic, and impracticable at the present day, and even the supremacy of any one leading coin over another is not for one moment contemplated by those who have promoted an extension of the principles of the Monetary Convention of December, 1865. All they have aspired to is the establishment, by reciprocity in slight concessions between nations, of perfectly accurate, well-defined, and easily-calculable proportions between the values of all the gold coins in use by the great commercial nations. If we examine the matter carefully, we shall find that the most simple and convenient relations that can be wished for really exist inherently in the plan of the convention, ready at hand for application to the discovery of the mint weights and values of sums of money expressed in any of the leading coins or units used in the world, so soon as they shall be brought into more exact harmony with each other, in the terms of the convention. And so easy are they, that a child of ordinary capacity at school could, without reference to tables, discover for itself and solve questions as to the weight of any given sum of gold coin of any country included in the convention, provided it could carry in the mind the rudimentary knowledge of the relations to each other of a few familiar units, to be learnt quite as readily as the names—now usually taught in all schools—of the capitals of different countries. When it can be remembered that a sovereign (*A*), a napoleon (*B*), a dollar (*C*), a rupee or florin (*D*), and a franc (*E*), are to each other, when turned into francs, as the figures 25, 20, 5, $2\frac{1}{2}$, and 1 respectively, the alphabet of international coinage has been practically mastered, and with it a student of the average sort can readily tell how many of one denomination is contained in another. Next, if he desire to know the gross weight of any quantity of gold coin of any of the countries, even to the minutest exactness, he has only to be instructed as to the key-stone of the arch on which the whole superstructure rests. That keystone, or talisman, as it might be termed, is the number 3,100, a very easy one to remember. Dividing the number of francs in the coin by 3,100, he finds the weight in kilogrammes of gold nine-tenths fine. Thus, the mere recollection of the brief alphabet we have described, of the five factors 25, 20, 5, $2\frac{1}{2}$, and 1, and of the divisor 3,100, gives far more power, under the international system, to know the weight and value of the coin of the world than is now possessed by skilful computors with the aid of elaborate tables or works of reference. For national or local purposes, as distinguished from international, the process is of course shortened, as division alone is then necessary, the labour of conversion into francs being spared. But for this object the divisor varies according to the unit of coinage employed in the particular country, and the number 3,100 is applicable here for ascertaining the weight of francs only. The following table shows the divisor for each unit, the resulting quotient giving the weight in kilogrammes, corresponding with the weights of coin of the convention in gold nine-tenths fine:—

	Units.	Divisor.	Weight. kilogram.
A. INDIA, and ENGLAND, and France, &c.	10 Rupee piece, New Sovereign, 25-Franc piece.	$\frac{1}{124}$ =	·00806451
B. France, Italy, Belgium, Switzerland, Spain, Greece, Austria, &c.	Napoleon, or 20-Franc piece, or 8 Rupees.	$\frac{1}{155}$ =	·00645161
C. United States, &c.	New Dollar, or 5 Francs, or 2 Rupees.	$\frac{1}{620}$ =	·00161290
D. India, Austria, &c.	Florin, or $2\frac{1}{2}$ Francs, or 1 Rupee.	$\frac{1}{1240}$ =	·00080645
E. France, Italy, Belgium, Switzerland, Roman States, Greece, Austria, Spain, Roumania, &c.	Franc.	$\frac{1}{3100}$ =	·00032258

As practical examples:—

(1). What is the weight of 3,100 ten-rupee pieces, or new international sovereigns, or 25-franc pieces?

Answer.—25 kilograms $\left(\frac{3100}{124} = 25\right)$.

(2). Of 3,100 napoleons?

Answer.—20 kilograms $\left(\frac{3100}{155} = 20\right)$.

(3). Of 3,100 international dollars, or 5-franc pieces?

Answer. — 5 kilograms $\left(\frac{3100}{620} = 5\right)$.

(4). Of 3,100 new rupees, or florins?

Answer.—$2\frac{1}{2}$ kilograms $\left(\frac{3100}{1240} = 2{\cdot}5\right)$.

(5). Of 3,100 francs, gold coinage of any country?

Answer. — 1 kilogram $\left(\frac{3100}{3100} = 1\right)$.

If these simple relations to each other of all the coins that might be embraced in the scheme of the Monetary Convention were more generally known, it would be understood that, for all practical purposes, it is perfect and admirably easy. This weakens the case of those who, in a general manner, and without adducing any proof, pretend that a more scientific and a simpler plan, and which shall not cause intolerable inconvenience, can be devised. These are not the real friends of the project. Something which will tend to the promotion of commerce and of better understanding amongst nations generally has been started, and favourably considered. And when it is shown how the movement may best be aided, its accomplishment is impeded and adjourned indefinitely by imaginary theories that a universal unit of account for all countries is a condition precedent to the adoption of an international coinage. Thus, by grasping at too much, such theories imperil the whole enterprise. If the advocates of them could teach nations how to forget, at one jump, old and time-honoured units of account, it would be different. But this is not possible. The world must be educated to this view by degrees. That beginning of education in the matter of coinage consists, in the first place, in the internationalisation of the great units of coinage and of account of various countries, by the establishment of a proportion between

heir respective values in intrinsic metallic contents, that shall be free from fractions, and shall conveniently measure each coin. In the next place, decimalisation of the leading units should be carried out in every country where it is practicable. All this can be begun at once, and the nations who longest neglect it will be the greatest sufferers in the end. FREDERICK HENDRIKS.

February 19th, 1870.

THE EDUCATION BILL.

This Bill, for the introduction of which leave was obtained by Mr. Forster on Thursday, the 17th inst., has been printed, and it is now proposed to give a brief account of its provisions.

It refers only to England and Wales, and contemplates the whole of this area as divided into school districts, which, in towns, are to be comprehended within the municipal boundary, with the exception of London, where the existing workhouse school districts will be adopted. In the country, the parish is to be the school district, but power is reserved to the Education Department to form "united districts," by grouping several parishes together, where this may be thought desirable.

The first step to be taken under the Bill is to obtain returns, showing the educational state of each district, the number of children, the number of scholars in the schools, and the number who ought to be at school. These returns are to be furnished by the local authorities, and, when necessary, tested by government inspection; and whenever it appears that there are sufficient "public elementary schools," * and, in fact, that proper educational facilities are afforded, no further step will be taken. If the Department considers that there is a deficiency in this respect, it is to publish a notice to that effect, giving the authorities twelve months to supply the want; and if this still exists at the expiration of that period, it may cause a "school board" to be formed for the district. These boards, which are to consist of three persons, "or a multiple of three, not exceeding twelve," are, in towns, to be chosen by the town council, in the country by the vestry, and, where there is such a thing, by the select vestry. To these boards will be entrusted the work of providing such public school accommodation as is necessary, and this must be done within twelve months. The powers given to these boards are considerable. They may provide new schools, or take over existing ones with the assent of their managers; they may appoint (and remove) managers for their schools; and may grant pecuniary aid to existing schools submitting to inspection (from which religion is to be excluded, except when the managers desire it, and the Department gives its consent), and accepting a conscience clause.†

These boards, moreover, are to be rigidly kept to their duties by the Department. If they leave their work undone, or if they "do, or permit any act in contravention of, or fail to comply with the regulation according to which a public elementary school is required to be conducted," the Department may declare the board "in default," and may "appoint any persons not less than three or more than twelve to be members" of the board, and, in fact, to supersede the defaulting members, who "shall be deemed to have vacated their offices as if they were dead." When this new board shall have done the required work, it may cease to hold office, at the pleasure of the Department, and a board may be elected for the district as before.

The expenses of the school board are to be paid out of a fund called the school fund, to which are to be carried all fees received from scholars, or moneys provided by Parliament, or raised by way of loan, or in any manner whatever received by the board, and any deficiency is to be raised by the board out of local rates.

Every child attending a school provided by a school board is to pay such weekly fee as the board may prescribe (with the consent of the Department), but the board may remit the whole or any part of such fee in the case of any child, when they are of opinion that the parent is unable from poverty to pay the fee, and such remission is not to be deemed to be parochial relief given to the parent. An important clause also gives power to any board who can satisfy the Education Department that, on the ground of the poverty of the inhabitants of any place in their district, it is expedient, for the interests of education, to provide a school at which no fees shall be required from the scholars, to provide such a free school subject to such rules and conditions as the Department may prescribe.

With reference to compulsion, the Bill gives power to every school board to frame bye-laws compelling parents to send their children to school between the ages of five and twelve, unless they can plead a reasonable excuse for keeping them away—such as that they are already being taught elsewhere, or that they are suffering from sickness, or that there is no public elementary school within a mile of their home. These bye-laws must be approved by the government, and lie on the table of both Houses of Parliament for a certain time before they come into operation. Proceedings to enforce these bye-laws may be taken in a summary manner, the penalties for each offence not to exceed five shillings. Powers are also given to school boards to build industrial schools "within the meaning of the "Industrial Schools Act, 1866," subject to the jurisdiction of a secretary of state.

The above are the main provisions of the Bill, which, in its recognition of existing voluntary and denominational schools may be said to approximate to the principles of the Union; in its provision of funds, by rating, and its introduction of direct compulsion, it accords, to some extent, with the views of the League, while, in dealing with the religious difficulty, it takes a middle course.

The favourable reception which the proposed measure has met with from all political parties is most remarkable. This was shown in the course of the debate which followed Mr. Forster's statement, and has been equally evident in the comments of the press.

Lord Robert Montagu, as an ex-Vice-President of the Council, followed Mr. Forster, and his chief point was that the existing deficiencies had been overstated. As, however, the Bill is designed to come into operation only where a deficiency is discovered, this does not seem very material. Mr. Dixon, President of the League, thanked the Government for the Bill, though not agreeing entirely in the mode by which the religious and the compulsory difficulty were got over. Sir John Pakington declared himself strongly in favour of the Bill, but he regretted that it did not propose to create a Minister of Education, a resolution in favour of which, it will be remembered, was unanimously passed at the recent Educational Conference held at the Society of Arts. The same speaker, as well as Mr. Hibbert and Mr. Fawcett, questioned the propriety of leaving the introduction of compulsion to the discretion of the proposed local school boards, and the last-named gentleman, in a letter to the *Times*, reiterates his objections to "permissive compulsion." He points out that "in one town it may happen that every parent is compelled to send his children to school; in a neighbouring town, where the municipal authorities are chosen by a less educated constituency, and where, consequently,

* These are defined as follows:—The term "elementary school" means a school or department of a school at which elementary education is the principal part of the education there given, and does not include any school or department of a school at which the scholars are boarded or clothed, or at which the ordinary payments in respect of the instruction, from each scholar, exceed ninepence a-week.

† The Conscience Clause in the Bill is as follows:—"No scholar shall be required, as a condition of being admitted into or of attending, or of enjoying all the benefits of the school, to attend or to abstain from attending any Sunday-school, or any place of religious worship, or to learn any such catechism or religious formulary, or be present at any such lesson, or instruction, or observance as may have been objected to on religious grounds by the parent of the scholar, sending his objection in writing to the managers or principal teacher of the school, or one of them."

education is more needed, no compulsion is brought to bear upon the parent, who, rather than sacrifice a few pence which he is accustomed to spend at the public-house, permits his child to grow up in absolute ignorance. Then, again, compulsion is only to be brought into operation by the school boards, and these boards will not be constituted where the inspector reports that the educational appliances are 'efficient, sufficient, and suitable.' Consequently, those boroughs and parishes which have done the most to supply themselves with schools will be debarred from enjoying the advantages of compulsory education." He also maintains that "the principle of permissive compulsion will create endless difficulty and confusion in providing schools where they are deficient. Directly the Bill passes, inspectors will report how many new schools are required in each school district. Their calculations will be based upon the supposition that accommodation must be provided for every child of the school age. They will have no means of knowing beforehand whether compulsory attendance will be enforced. If it is not enforced, a great number of the children who ought to be at school will not be there, and thus the general body of taxpayers and ratepayers of the locality will have to pay for the building and maintenance of a greater amount of school accommodation than will be used."

The comments of the press upon the Bill have been generally favourable:—

The *Times* believes "that a new organisation of the Department of Education must follow the adoption of the Ministerial Bill, but it accepts the measure as it stands with hearty satisfaction. . . . . Provision is made for the education of all the children in the country, and care is taken that the education given may embrace such a measure of instruction in religious knowledge and duty as the common sense of the community approves, while the right of every man to withdraw his child from the influence of such teaching is unreservedly respected.'

The *Standard* regards "the Bill, as a whole, as an eminently moderate, but by no means a hesitating or timid measure; and it is not surprising that it met with the approval of most of the best friends of education on both sides of the House. . . . . . It does all that we expected; it avoids nearly all the evils we most dreaded, and which we feared were inseparable from its main proposals." Upon the whole, the *Standard* approves of the permissive character of the Bill. "We require," it says, "a different course of action in different districts; and this is best attained by leaving large legislative powers to the local bodies. It would be a monstrous thing to force secular schools upon parishes where ninety-nine in a hundred of the inhabitants can comfortably avail themselves of the instruction of a Church schoolmaster and of a trusted parish clergyman; it may be quite necessary to provide secular schools for a divided parish, or for a great city like Liverpool. Again, the question of compulsion is, in the first place, unripe for detailed Parliamentary legislation; and in the second, requires wholly different treatment in different places. The rules of attendance must be totally different in agricultural and in manufacturing districts; in different manufactures; in Liverpool and in Manchester; in Staffordshire and in Newcastle. Not only in order to give room for experiment, but in order to afford play to the action of different local conditions, it was needful to give a large discretion to local authorities, and Mr. Forster has not extended that discretion one whit further than was desirable under the circumstances."

The *Daily News* thinks that the Bill "contains the material of a settlement. Its leading merits are the narrow limits within which it confines interference with existing agencies, and the scope which it allows to voluntary effort in the new element which it introduces. The two most serious objections to which it lies open are the scope which it gives to local bodies, and the manner in which it deals with the religious difficulty. The power of direct interference which the government reserves for itself, should the school boards prove inefficient or obstructive, may meet the former danger. The concession which Mr. Forster makes to the denominational principle in new public schools is likely, we fear, to make every borough and parish the scene of sectarian squabbles; Churchman striving against Nonconformist, and Baptist against Methodist for ascendancy, and for the privilege of exercising a tolerant patronage through the medium of a conscience clause. This mistake, however, if it should prove one, admits of correction."

The *Pall Mall Gazette* "considers the Bill has one unfortunate blot, in that the direct compulsion of the parent is left to the voluntary action of the school boards. It may be, however, that under present circumstances, this is an unavoidable blot, that it would not be possible to carry a more rigorous measure than that now presented. At all events, it is an immense advance to have direct compulsion recognised in any shape. Indeed, it may be said generally that the strength of Mr. Forster's Bill lies rather in the principles it introduces for the first time into educational legislation, than in the details by which it is proposed to carry these principles into action."

CORRESPONDENCE.

The following letter has been received from Mr. Langford Locke, honorary corresponding member of the Society:—

"Mr. Cooper started from Suddya on 29th November. A Chousam Gohine (Rajah priest), whom I introduced to him as a guide, accompanied him through the districts of several hill tribes amongst whom he possessed influence; and the last intelligence received was that after leaving the Digarrow, he had engaged a Singfoo chief to conduct him the next stage on his eastward route The Mishmees, who have such a pugnacious name, Cooper had found quiet and friendly. It has been stated that he was unacquainted with the Chinese language. Now he and his Chinese servant, an intelligent and most amusing character, sojourned at my bungalow at Suddya for several weeks, and I can testify to their talking away glibly enough in that ya-yo-ho lingo. It has also been reported that he received an encouraging communication from the Bishop of Taisanloo. Three days before he started he did receive a letter from that dignitary, which greatly cheered him in his enterprise, and he read the letter for me. I hope in due time to communicate tidings of his safe arrival in the Llama territory.

"Deebroghur, Upper Assam, 15th January, 1870."

Mr. John Locke, of Dublin, in a letter enclosing the above, says:—

"My son states that he was the only European in the station when Cooper started, and remained to shake hands and bid him God-speed. He corroborates Cooper's testimony about the Mishmees, and himself found the tribe frank and friendly when his engineering business took him to their borders. He met a war party of them on one occasion, and had a parley in broken words, as both had a slight knowledge of each other's language. A large boat or canoe was lying between him and the Mishmees, and wishing to examine closely some medallion-like ornaments which they wore round their necks, he touched the boat with one hand, and lightly vaulted over into the midst of the party; they started and stared, then laughed, 'Sahib, big jump; Sahib, come see the Mishmees, must have house, and shoot, and fish.' This was shouted in half-Mishmee and half-English. He observes that, if not insulted or cheated in any mercantile dealing, the fierce mountain tribes are frank and friendly, but one must never show any fear of them."

Sir,—Will you be so kind as to correct, in your next issue, my remarks upon a gold currency for India. In the 21st line from the bottom of the 1st column, on the 276th page, the words "maximum value," ought to be read as the *minimum price*. There is also a figure "8" inserted accidentally at the left-hand corner of the first line of the same page.—I am, &c.,

J. Smith.

FORTHCOMING PUBLICATIONS.

The Financier.—It is notified that on the 1st of March will appear the first number of a new daily financial paper, entitled the *Financier*, and conducted by the gentleman who, after holding the City editorship of the London *Daily News* for nearly twenty years, has just resigned it.

GENERAL NOTES.

Congress of Geographers.—There is a talk of an International Congress of Geographers at Antwerp. Many eminent French *savants* have promised to take part.

Warehousing Petroleum.—At Antwerp, some interesting experiments are now being made, for the purpose of testing a suggestion of the possibility of escaping the danger of a conflagration from the ignition of petroleum, by warehousing it under water.

The Acclimatation Society of Paris has awarded to Mr. P. L. Simmonds its silver medal, of the first class, for his paper on "Silk Cultivation and Supply," read before the Indian Conference of this Society last year. A similar medal has been awarded to Mr. G. W. Hart, of Hayling Island, for his labours in oyster culture.

Cultivation by Steam Power.—The *Newcastle Courant* states that a company has recently been established, named the Northumberland Steam Cultivation Company, for the purpose of procuring engines, with the necessary tackle, with the view of letting them out on hire. The capital to be invested is £22,000, of which £18,000 has already been subscribed. The shares are £50 each.

The Postal System of England and France.—The *Français* of February 22nd, says that a postal convention has been signed by the British and French Governments, in accordance with which the rate of postage is reduced to 30 cents (3d.). The same journal has reason to believe that arrangements are being prepared for the establishment between the two countries of a system of post-office orders for amounts not exceeding 250 francs.

A Railway in Japan.—A contract for the construction of a railway has been concluded by Mr. H. N. Lay, C.B. He represents capitalists who have entrusted him with money to be lent to the Japanese government for the construction of reproductive public works, and he advances one million sterling to the Japanese Government for a line from Yeddo to Osaka, some 300 miles, to be constructed by English engineers. The railway will be the property of the government.—*Overland China Mail*, Jan. 11.

The Postage of Money, Jewellery, &c., in Letters to Belgium.—The Belgian Post-office has given notice to this department that the laws of Belgium forbid the transmission by the post, within that country, of letters or packets containing money, jewellery, or other articles of value, and that, henceforward, any letters containing such articles which may be sent in the mails to Belgium will be returned to this country undelivered. The Postmaster-General thinks it necessary to make this regulation known to the public.

The Free Trade Controversy.—As bearing on the free-trade controversy in France, the *Nord* quotes statistics to show that the exportation of wine, which, in the year 1861, was of the value of 196 million francs, amounted, in 1862, to 210 millions, in 1863 to 229 millions, in 1864 to 234 millions, in 1865 to 260 millions, and in 1866 to 258 millions. Thus, the vine-growing interest has profited much more by the treaty of 1860 than the cotton manufacture, which, in 1866, amounted only to 88 millions.

New Cabs.—The London Depôt Carriage Company will, in a very short time, be in a position to offer to the public, private carriages at the same rate as the existing cabs. These carriages will combine the convenience of the so well-known *voiture de remise* in Paris, with the comfort of a London brougham. There will be covered stands provided for them in all the principal thoroughfares, to each of which there will be an overseer or checktaker, who will be responsible for the civility of all the men under him. There will be 900 new carriages, without straw in the bottom; 900 strong horses, at the cheap rate of 2s. 6d. the hour, or arrangements to be made for a whole or half a day.

Coal in Abundance.—At the Midland Counties Institute of Mining Engineers at Dudley, Mr. Walter Ness, a mining engineer, read a report last week, from which it appears that 34 square miles of the Firth of Forth, which he blocks out, would yield an amount of coal, if properly dredged, equal to the whole produce of the collieries of Great Britain during the last fifty years; or, taking the coal-bearing area of the Firth, he anticipates that 12,672,000,000 tons might be raised; and, taking other parts of the British coast as jointly capable of yielding a similar quantity, we should then have coal to the value of £950,000,000—a sum, Mr. Ness remarks, more than sufficient to cover the national debt.

London Omnibuses.—The report of the London General Omnibus Company, just issued, states that during the half-year ending the 31st of December, 1869, the number of passengers carried was 20,889,595, and for the same half of 1868, 20,654,366, showing an increase of 235,229 passengers. The average traffic receipts per omnibus per working day was £2 10s. 7d., against £2 12s. 9d. in the same half of 1868. The average fare received per passenger was 3·07d., against 3·25d. The earnings per mile run were 10·38d., against 10·86d., and the total number of miles run was 6,188,064, against 6,177,632. During the half-year, 19 new omnibuses were constructed at the company's coach factory, and put to work in the metropolis.

Acclimatisation in Australia.—Interesting reports of the success of various acclimatising experiments made by the Victorian Society are constantly coming to hand. At a recent meeting of the Council of the Association, a letter was received from Mr. Samuel Wilson, of Longerenong, in which he said, "I have now the gratifying news to tell you that the ostriches have hatched twelve young birds in one nest, which are getting on very nicely. As this is the first time that ostriches have bred in the colonies, the event is the more interesting. The incubation was continued for about six weeks, and only one egg failed to produce a bird. The male and female sit on the nest by turns, which was seldom if ever left without one or other. The nest was a sandy hollow, without any grass or rubbish, and the eggs were quite uncovered. Another pair laid eleven eggs, but the time was too early in the winter, and, owing to the cold, the hatching was a failure. All the birds are in good condition, and now that a commencement has been made, a rapid increase in their numbers may be expected. I shall forward a parcel of feathers soon. The axis and red deer continue to increase, and are still doing well. The Angora goats seem to enjoy the climate, and have yielded a beautiful fleece of long silky mohair."

Glazing Walls.—I have very closely examined the pieces of old Assyrian and Babylonian bricks at the Museum of Practical Geology in Jermyn-street, and I have glazed several common bricks with various colours similar to the old specimens referred to, and also painted designs on some and burnt them in, and have been successful in making the bricks non-absorbent, and at the same time ornamental for external and internal work, and I have not the least hesitation in saying that if the matter were thoroughly gone into, common bricks could be ornamented and made quite impervious to moisture or our London dirt, at moderate cost, and every shower of rain would clean our external walls, and make the buildings look quite fresh again; and, for inside work, we should get permanent ornamental walls, without the expense or use of plaster, paper, or paint.—*Correspondent of the Builder.*

New Land Bill in Victoria.—The *Melbourne Age* says: —"It is sufficient to say that, taking the circumstances of the colony and its vast resources into consideration, the new land law of Victoria is certainly as liberal, and perhaps more liberal, than that of any colony of the empire. We offer a home to all, and any quantity of land up to 320 acres, for £1 per acre, with 10 years to pay the purchase money in. This should certainly induce a healthy stream of immigration to our shores, especially when it is remembered that labour is scarcer and wages are higher than they have been for years past, that all the necessaries of life are far cheaper than in England, that we are just about commencing a main line of railway to the northern limit of the colony, and that for some years we shall be engaged in the work of railway extension, so that, with the settlement that is rapidly taking place, there must be a constant and increasing demand for labour of almost every description for a very long time to come."

Zinc.—The yearly production of spelter in Europe amounts now to 100,000 tons at least, of which quantity about 50,000 tons are made in North Germany, 35,000 tons in Belgium, and 15,000 tons in England. The largest establishments for smelting and manufacturing the metal are those of the Vieille Montagne Company, in Belgium; the Schlesische Actiengesellschaft, in Silesia; and the works of Messrs. Vivian and Sons, in England. The metal has attained an importance through the whole civilized world, which places it among the most valuable treasures of national wealth in several countries, and ranges it, by its applicability and cheapness, next to iron among our most useful metals. Large quantities are annually exported to the remotest places of the globe, and it is curious, and no less satisfactory, to note the alteration in the direction of the spelter trade. Two hundred years ago we find the metal was exported from India to Europe; now large shipments of it (by far larger quantities than we ever received) are being made from Europe to Asia.—*Mining Journal.*

The Thames Embankment.—The works of the Thames Embankment between the Temple-gardens and Blackfriars-bridge are now progressing favourably. The river wall is wholly complete for a length of 250 ft., and the remaining length of about 400 ft. is constructed to an average height of 7½ ft. above Trinity high-water mark. The length of the subway completed is 850 ft., and of the sewer 794 ft. The concrete retaining wall, on the land side of the new road, is completed to a height of about 30 ft. for a length of 550 ft. The minor sewage and drainage work on the foreshore of the river are all complete. Considerable progress has been made with the intended subway from the river to the City Gas Company's works. The four old houses in Chatham-place have been pulled down, and the materials are nearly all cleared away for the formation of the approach to the Embankment from Bridge-street. Of the portion of the Low Level Sewer between the terminal point of this contract and the commencement of the part now being constructed by the Metropolitan District Railway Company in connexion with their works from Saint Andrew's-hill, a length of 458 ft. has been constructed. Between these two points 570 ft. of the subway, 430 ft. of the smaller sewer, and 39 coal vaults have also been constructed. The excavations for the penstock-chamber to be formed near the bridge are sunk to a depth of 16 ft.

Cotton Cultivation in India.—Mr. J. Login, C.E., F.R.S.E., who has recently visited Egypt, thus compares, in a letter to the *Cotton Supply Reporter*, the system of agriculture in that country and in India. With regard to the state of agriculture, he says:—"That of Egypt appears to me far in advance of anything I have seen in India, for, taking cotton as an example, one acre of properly irrigated land can produce eight or ten times as much cotton as the same area now produces in Northern India, so that, without increasing the area under cotton cultivation, I believe, by the introduction of the Egyptian system of agriculture into India, the produce may be doubled or quadrupled, without its being necessary to reduce the quantity of land required for food. I have no doubt at all that cotton in much larger quantities, and of a better quality, could be produced in India by an improved system of agriculture. What I would venture to suggest is, that a dozen or two of Egyptian cultivators should be selected and sent to the various provinces of India, to aid in bringing about an improved system of farming, as possibly the natives may be more ready to listen to their advice than to that of Europeans."

Progress of Japan.—The Yokohama correspondent of the *New York Tribune* of February 5th, gives a striking account of the extraordinary progress made by Japan in a single decade. "Ten years ago," he says, "not a single steam-engine was to be found in the whole empire of Japan, and even a square-rigged ship was unknown. To-day, there are no less than twenty steamers, owned and manned entirely by Japanese, in the offing before the capital." And he adds that at two of the open ports the manufacture of iron steamers is actually in progress. A telegraph is now stretched along the great high road to Yeddo, and will soon be extended from one empire to the other. A railway is also contracted for to connect the two great cities of Japan. Four lines of steamers run regularly to Europe, America, and the Chinese ports. A considerable coasting trade, besides, is carried on by first-class steamers and sailing-vessels. Raw silk is the chief support of the European steamers. Next comes tea, which furnishes the great bulk of freight for the American ports, very little going to either Europe or its colonies. Silkworm eggs furnish the third export; they go chiefly to Italy and France, to re-establish the stock of worms suffering from disease. The export of worms alone last year amounted to nearly 5,000,000 dollars, the value of the raw silk was not far from 10,000,000 dollars, tea was from 3,000,000 to 4,000,000 dollars, and other products between 1,000,000 and 2,000,000 dollars, making a sum total of 20,000,000 dollars.

Chinese Mode of Preparing Indian Ink, &c.—The great superiority of the ink made in China, over any other kind known, has always been a subject of some curiosity, and we are not aware that any European has described the exact method adopted by the Chinese in its production. M. Champion, a French chemist, who lately visited China, succeeded in obtaining admission to several ink factories in Shangai and other parts of the empire, and has described the process in the work on "Chinese Industries," lately noticed in the *Journal*. In parts of the north of China, where oils and grease are pretty abundant, the lamp-black, which forms the foundation of the ink, is manufactured much in the same way as in Europe, but the more ordinary mode is different. The old method of making the lamp-black was in tall furnaces expanded at the sides, the smoke being deposited in receivers placed one above the other;

the later and present method is to employ furnaces, or ovens, built on the ground, varying from eight to forty or even fifty feet in length, and with a mouth about two feet in diameter. The general material used is pine or other resinous woods, or the resin itself, which is burned at the mouth of the stove. The black used for fine ink is that which is condensed at the farther end of the stove; all the rest is proportionately coarser. The fineness of the grain depends also upon the slowness of the combustion. The very finest black, however, is said to be made from pork fat, the next from oils and other kinds of grease. The smoothness of the ink also depends in a great measure on the careful sifting of the lamp-black through silk bags or sieves. The first operation in the making of the ink is to soak a quantity of glue made from buffaloes' hide, and which is of excellent quality, and when swollen by the water to set it aside; in this state it will keep for several days. When the ink is to be made, the glue is melted in an iron bowl, and as much lamp-black added as will produce a soft paste. This paste is very carefully kneaded by hand, then a small quantity of oil made from oleaginous peas is added, and the whole is maintained at a temperature of about 130° or 140°, until the paste is found to be perfectly homogeneous; it is then poured out in the form of flat cakes, weighing one or two pounds each, and is left in that state, to ripen, as the Chinese say, for many days. It often happens, when the weather is hot and damp, that the cakes become covered with mould, but this does not seem to produce any ill effect. Separate workmen are employed to make the paste, while others mould it into the forms we are accustomed to see it in. Seated at a bench, with a small brazier beneath, the moulder warms a piece of the paste, kneads it vigorously in his hands, presses it into a mould, places the latter under a long lever, on the end of which he seats himself, so as to press the ink violently, for some seconds, filling a fresh mould during the time, and so on till the work is completed. The moulds are made of wood, the characters to be impressed on the cake being engraved also on wooden dies; one of these is dropped into a square cavity, with sloping sides, in the bottom of the mould, while the other is laid on the top of the paste in the mould. Common ink is often pressed into large moulds with several partitions, so that the cakes, when dry, can easily be broken off from each other. For wholesale manufacturing purposes, we may add, the best is simply rolled, and the sticks, having a hole near one end, are strung together in bunches of half-a-dozen or a dozen. The drying of the cakes occupies five or six days, according to the temperature. The high polish which they have is given by brushing the cakes over with a hard brush impregnated with tree-wax, which has the effect also of preventing the ink soiling the hands when moist. The peculiar odour which the fine ink possesses is given by mixing a small quantity of Borneo camphor or musk in the paste while hot; the common kinds have no scent whatever. The gilt letters and decorations are produced by applying with a hair-pencil gold, silver, &c., held in suspension in water in which a little gelatine has been dissolved. Cakes of ink are sometimes worth five or six shillings each. The Japanese make ink in the same manner, but that of Chinese is most esteemed by them; the superiority of the latter lies in the great care with which the lamp-black is prepared; for Japanese glue and gelatine are as excellent as those made in China. These nations take excessive care in the glue manufacture; the best kind is said to be made from stags' horns, of which the outer coating is removed, they are then steeped for several days in rice water, and afterwards boiled for a long time. Another sort, made from the swimming bladders of certain kinds of fish, is said to be almost as fine as isinglass. The finest ink should be slightly brownish in tint; when quite black, blueish, or grey, it is inferior. A stick of fine ink gives a clear, sharp sound, when struck; if the tone be dull, the ink is not homogeneous. In direct opposition to lamp-black, the heaviest ink is the best. Lastly, it improves in colour and brilliancy by age; and very old ink is held in such high estimation, that the mandarins frequently present cakes, enclosed in elegant boxes, to the emperor. M. Stanislas Julien found in a Chinese work the following description of the method of making a very fine ink. A mixture is made of the oil of the *Cannabis sativa* and glutinous rice, and wicks having been dipped in it, are burned under a earthenware bell, with a small hole at the apex; the lamp-black thus obtained is mixed with rice, finely powdered, and boiled with seed-pods of the *Mimosa fera*. The paste is perfumed by the addition of camphor or musk. It may be added that the Chinese sometimes use tea for rubbing up their ink. The test of good ink is that it will produce a tint of any depth without the slightest appearance of irregular grains of colour. The yellow or red inks, or rather pigments, used in China, are prepared in the following manner. Fine natural orpiment, or sulphate of arsenic, is finely powdered and mixed with water; when the coarser particles have been precipitated, that which remains in suspension is filtered out; to this is added the bark of the *Fraxinus longicuspis*, fruit of the *Gardenia*, seed-pods of *Mimosa fera*, seeds of *Croton tiglium*, and a small quantity of animal glue or gelatine. The whole is very carefully ground and mixed, made up into cakes like black ink, and dried in the shade. This pigment is of a reddish yellow colour. The red ink used for making impressions from seals, is made of fine cinnabar and castor-oil. These are beaten in a mortar until the oil ceases to rise to the surface; in other words, until the mixture is complete; to that is added a small quantity of the filaments of wormwood, and the pounding is carried on until these are as completely disintegrated as possible. The use of the wormwood is curious; its object is to give the impressions more relief than they would otherwise possess.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. 1. Mr. R. B. Shaw, "A Visit to Yarkand and Kashgar." 2. Mr. J. Markham, "A Journey through the Province of Shantung, and Visit to the Tomb of Confucius."
Social Science Assoc., 8. Mr. W. H. Michael, "On the Financial Position of Local Sanitary Authorities."
British Architects, 8.
Actuaries, 7. Mr. W. M. Makeham, "On the Proper Method of Loading the Premiums required for the Grant of Life Annuities and Assurances."
London Inst., 4.

Tues ...Civil Engineers, 8. 1. Discussion upon "The Mhowke-Mullee Viaduct" and "The Pennair Bridge." 2. Mr. J. N. Douglass, "The Wolf-Rock Lighthouse."
Social Science Assoc., 8. Lecture, at the house of the Society of Arts, by Dr. W. B. Hodgson, "On the True Scope of Economic Science."
R. Medical and Chirurgical, 8½.
Royal Inst., 3. Dr. Masters, "Plant Life."
Anthropological, 8.
Syro-Egyptian, 7½.

Wed ...Society of Arts, 8. Mr. G. W. Jones, "On the Causes and Consequences of High Charges for Passengers by Railway, and the Advantages to be expected from an Adoption of Low Fares."
Pharmaceutical, 8.
Obstetrical, 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. J. Broughton, "Note on Hybridism among *Cinchonæ*."
Chemical, 8.
Royal Society Club, 6.
Artists and Amateurs, 8.
London Inst., 7½.
Royal Inst., 3. Dr. Odling, "Chemistry."

Fri ......R. United Service Inst., 3. Mr. A. G. Findlay, "Ocean Currents and their Influences."
Geologists' Assoc., 8.
Royal Inst., 8. Mr. Reed, "Iron-built Ships."
Archæological Inst. 4.

Sat ......Royal Inst., 3. Prof. Max Müller, "Science of Religion."

Journal of the Society of Arts.

FRIDAY, MARCH 4, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

March 9.—"On Tramways in Streets." By W. Bridges Adams, Esq. On this evening Chas. Hutton Gregory, Esq., will preside.

March 16.—"On Surface Decoration." By William Pitman, Esq.

March 23.—"On State Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

March 30.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

INDIA COMMITTEE.

This evening (Friday), March 4th, Sir Frederick Arrow, Deputy Master of the Trinity House, will open a conference on the subject of "The Influence of the Suez Canal on Trade with India." The chair will be taken at Eight o'clock, by Sir Bartle Frere, K.C.B., G.C.S.I. Members and their friends are invited to attend.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at 8 o'clock.

Syllabus.

1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat.

2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel.

3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smelting furnaces; means of arresting combustion; extinction of fires.

4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin oil; measurement of light; photometry.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce, and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph.

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce.

The Council invite Members of the Society to forward to the Secretary, on or before the 25th of April, the names of such men of high distinction as they may think worthy of this honour.

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—

Hitchin, Mechanics' Institution and Public Library.

NOTICE TO LOCAL BOARDS.

Secretaries of Local Boards are requested to notice that candidates desirous of being examined in Musical Composition, holding the Tonic Sol-fa Association Certificate of "Honorable Mention" in Musical Composition, and the Member's Certificate of "General Musical Culture," need *not* undergo the Preliminary Examination.

COMMITTEE ON ORGANISATION OF SCHOOLS.

This Committee met on Monday, 28th. Present:—Seymour Teulon, Esq., in the chair.

The Committee took into consideration the provisions of the Government Educational Bill. The further consideration was adjourned to the next meeting of the Committee.

POSTAL COMMITTEE.

This Committee met on Wednesday, the 2nd instant, when numerous adhesions were reported, and the Committee now consists of the following:—

Abel, F. A., F.R.S., *Member of Council*
Alger, J.
Andrews, Samuel, *Member of Council*
Anstruther, Sir Robert, Bt., M.P.
Baker, R. B. Wingfield, M.P.
Bass, M. Arthur, M.P.
Bazley, Sir Thomas, Bart., M.P.
Birley, Hugh, M.P.
Bodkin, Sir W. H. (Assist. Judge), *Vice-President*
Bolckow, W. W. F., M.P.
Bourne, Lt.-Colonel, M.P.
Bowring, E. A., C.B., M.P.
Brady, Dr. John, M.P.
Brodrick, Hon. Wm. M.P.
Buxton, C., M.P.
Campbell, H., M.P.
Cassell, Petter, and Galpin, Messrs.
Chadwick, Edwin, C.B., *Member of Council*
Charley, W. T., M.P.
Clarke, Hyde, *Treasurer of the Society*
Cogan, Rt. Hon. W. H. F., M.P.
Cole, Henry, C.B., *Vice-President of the Society.*
Corry, Right Hon. H. M.P.
Croft, Sir Herbert, Bart., M.P.
Crofton, Lord
Dickson, Major A. G., M.P.
Dilke, Sir Charles W., Bart., M.P., *Member of Council*
Dodds, Joseph, M.P.
Drax, J. S. W. S. E., M.P.
Eastwick, E. B., M.P.
Elliot, G., M.P.
Forster, Charles, M.P.
Francis, J.
Gourley, E. T., M.P.
Graves, S. R., M.P.
Granard, Earl
Haddington, Earl of
Harrington, Earl of
Hay, Rear-Admiral Sir John C. D., Bart., M.P.
Hole, James
Hoskyns, C. Wren, M.P., *Vice-President of Society*
Howard, James, M.P.
Johnson, Edmund
Lennox, Lord Henry G., M.P., *Chairman of Council*
Lichfield, Earl of
Longford, Earl of
Mar, Earl of
Marling, S. S., M.P.
McArthur, William, M.P.
McLagan, Peter, M.P.
McMahon, P., M.P.
Melly, Goerge, M.P.
Meyrick, Thomas, M.P.
Miall, Edward, M.P.
Mills, C. H., M.P.
Moray, Bishop of
Morley, S., M.P.
Muntz, P., M.P.
Normanton, Earl of
O'Reilly-Dease, M. M.P.
Pim, Jonathan, M.P.
Plimsoll, Samuel, M.P.
Ranelagh, Viscount
Read, C. S., M.P.
Redgrave, Samuel, *Vice-President of Society*, and *Vice-Chairman of Council*
Reed, Charles, M.P.
Rylands, Peter, M.P.
Salisbury, Bishop of
Shaw, Richard, M.P.
Smith, W. H., M.P.
Southwell, Viscount
Strathmore, Earl of
Sutherland, Duke of
Taylor, P. A., M.P.
Tipping, William, M.P.
Tollemache, Hon. F. J., M.P.
Villiers, Right Hon. C. P., M.P.
Ward-Jackson R., M.P.
Ware, James T. *Member of Council*
Watts, Dr. John
Wedderburn, Sir D., Bart., M.P.
Wethered, T. O., M.P.
White, James, M.P.
Wingfield, Sir C., M.P., K.C.S.I., C.B.
Wilmot, Col. Henry, M.P.

CHANNEL STEAMERS.

The Committee met on Tuesday, the 1st March. Present:—Seymour Teulon, Esq., Vice-Chairman of the Council, in the chair; Admiral Ommanney, Capt. Tyler, Messrs. E. J. Reed, C.B., and C. W. Merrifield. Finally settled the report to Council in this competition.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

THIRTEENTH ORDINARY MEETING.

Wednesday, March 2nd, 1870; Edwin Chadwick, Esq., C.B., Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Allan, George, C.E., 18, Leadenhall-street, E.C.
Clark, Frederick A., Hammersmith-mall, W.
Cubitt, James, 26, Finsbury-place, E.C.
Dickinson, Sebastian Stewart, M.P., 12, Suffolk-street, Pall-mall, S.W., and Brown's-hill, Stroud, Dorset.
Frielinghaus, Charles, 2, Lawrence-lane, Cheapside, E.C.
Gream, G. T., M.D., 2, Upper Brook-street, W.
Holm, John, F.R.C.S. Edin., Lifford-lodge, Barnsbury-park, N.W.
Morgan, Robert, C.E., 8, Richmond-terrace, Whitehall, S.W.
Tasker, William Henry, 4, Telford-street, Bradford, Yorkshire.

The following candidates were balloted for and duly elected members of the Society:—

Carson, James Alexander, La Belle Sauvage-yard, Ludgate-hill, E.C.
Casey, James, 25, Philpot-lane, E.C.
Constable, William H., Magdalen-street, Cambridge.
Domville, William Henry, 15, Gloucester-crescent, Hyde-park, W.
Franchi, Giovanni, 15, Myddelton-street, E.C.
Kerr, James, 54, King William-street, E.C.
Le Riche, E. W., Warwick-house, 6, Warwick-court, Gray's-inn, W.C.
Newton, Marcus Bourne, Wharf No. 4, inside Great Northern Goods Station, King's-cross, N.
Soares, Augusto, 40, Seething-lane, E.C., and The Poplars, Alridge, Essex.
Verity, George, 31-33, King-street, Covent-garden, W.C.
Verity, John, 31-33, King-street, Covent-garden, W.C.
Weil, Salomon, 27, Clifton-gardens, Maida-hill, W.

The Paper read was—

ON THE CAUSES AND CONSEQUENCES OF HIGH CHARGES FOR PASSENGERS BY RAILWAY, AND THE ADVANTAGES TO BE EXPECTED FROM THE ADOPTION OF LOW FARES.

By G. W. Jones, Esq.

Amongst the highly important inventions of the last half-century, the railway ought to hold the foremost place; and that its usefulness is only half developed arises from causes which it cannot but be useful to consider. When the locomotive engine was at first applied to railways, very few indeed were those who thought it would ever be generally used for the haulage of passen-

gers—that it would supersede the use of the travelling carriage, the post-chaise, the old stage-coach, and the other means of conveyance used on ordinary roads. The carriage of minerals, heavy goods, and general merchandise, was its only aim, and was thought to be its only province. The danger, it was thought, of travelling behind or of being pushed along by means of a locomotive engine, would be sufficient to deter the greater part of the community from ever generally availing themselves of such a means of transit; the great expense of producing such a conveyance, compared with the cost of an ordinary four-horse coach, it was also thought would operate against it; and that the railway should ever hold out the inducements of speed, safety, and comfort for passenger traffic, in comparison with a private carriage and post-horses, was impossible. Cheapness of conveyance by such a means was out of the question. In all railway Acts, therefore, in the first place, will be found a careful provision for the tolls payable for the carriage of each description of merchandise, and then follows incidentally, as if it were an afterthought, a provision for the carriage of passengers and other live-stock. The following is the form and order in which the scale of charges appears in railway Acts:—"That it shall be lawful for the company to demand any tolls for the use of the railway, not exceeding the following (that is to say):—in respect to the tonnage of all articles conveyed upon the railway, or any part thereof, as follows: for all coals, coke, ironstone, iron ore, pig-iron, bar-iron, &c., per ton per mile, one penny; and if conveyed in carriages belonging to the company, an additional sum per ton per mile, not exceeding one farthing."

Now, a momentary digression may be useful here, to note the evident unconsciousness of what the locomotive was to become which pervaded the minds of our legislators, in fixing such a tariff as this for the carriage of coals and other minerals, iron, bricks, &c., by railway. By this clause and the one which follows it, the railway companies are empowered to charge 1d. per ton per mile for all coals conveyed over their line of railway, a further charge of ¼d. per ton if conveyed in a carriage belonging to the company, and yet a further charge of 1d. per ton for the use of the engine to draw it, in all, 2¼d. per ton per mile, for the haulage of coals, &c., a perfectly prohibitory charge for long distances; whereas, at the present time, thanks to the competition afforded, not by competing lines, but by canals, rivers, and the sea, for the conveyance of coals and other minerals, the companies have been driven to draw coals at ⅜ of a penny and even at a ¼d. per ton per mile, being one-ninth of the amount which they are authorised to charge; and at that rate, as shown in the report of the Royal Commission on railways, after allowing for the cost of returning the empty trucks, the companies are realising the enormous profit of 421 per cent. upon the actual outlay. The statement is as follows:—

	s.	d.
Receipts, 320 tons at ⅜d. per ton per mile ..	10	0
Expenses, 320 tons at 23d. per double mile..	1	11
Profit	8	1

And, but for the competition of water-carriage in the article of coal, and the accidental discovery of the very small cost at which it could be conveyed by railway, it is to be presumed the railway companies would have adhered to a very much higher scale of charges, whereby the whole of the great coal-trade of London must have been lost to them altogether. The great advantage the companies have derived from opposition in this matter is recorded at page 8 of the report of the Royal Commission on railways, as follows:—"It is worthy of remark that, in order to check the use of this line (the Stockton and Darlington Railway) for conveying coals for shipping, and to confine it to inland traffic, parties interested in rival ports contrived to insert a clause limiting the charge for the haulage of all coal to Stockton for shipping to one halfpenny per ton per mile, whereas the rate of 4d. per ton per mile was allowed for all coals transported for land sale. It was supposed by all parties that it would be impossible to carry coals at such a low rate without loss, but this rate not only turned out profitable, but formed ultimately the vital element in the success of the railway."

To resume; the tolls clause proceeds:—"For all dung, compost, and all sorts of manure, &c., per ton per mile, not exceeding 2d.; and, if conveyed in carriages belonging to the company, an additional sum per ton per mile, not exceeding ½d. For all culm, charcoal, and all stones for building, &c., per ton per mile, 3d.; and, if conveyed in carriages belonging to the company, an additional sum per mile, not exceeding one penny. For all cotton and other wools, drugs, manufactured goods, &c., per ton per mile, not exceeding 4d.; and, if conveyed in carriages belonging to the company, an additional sum per mile not exceeding one penny. And for every carriage of whatsoever description, &c., not weighing more than one ton, carried or conveyed on a truck or platform not belonging to the company, per mile, not exceeding 5d.; and a sum of 2d. per mile for every additional quarter of a ton or fractional part of a ton which such carriage may weigh." And after all this provision made for the carriage of minerals, goods, and general merchandise, the clause proceeds as follows:—"In respect of passengers and animals conveyed in carriages on the railway, as follows:—For every person conveyed in or upon any such carriage, per mile, not exceeding 2d.; and, if conveyed in or upon any carriage belonging to the company, an additional sum per mile, not exceeding one ½d."

And the next clause is as follows:—"That the toll which the company may demand for the use of engines propelling carriages on the railway shall not exceed one penny per mile for each passenger, or animal, or for each ton of goods, or other articles, in addition to the several other tolls or sums by this Act authorised to be taken."

The competition which canals and the sea afford for the conveyance of coals is not equally applicable to the carriage of cotton, wools, and manufactured goods, and consequently they are still charged for at monopoly prices, to the serious detriment of the manufacturing industry of the country.

Now, if we were not otherwise conscious of the fact, it is clear by the wording of these clauses, that the railways were intended to be free for the use of the public, as the ordinary roads are, for their carriages and trucks, and even for their locomotive engines, if they chose to work them. But if any speculative person or company were disposed to run passenger trains upon a railway, paying the railway company a fair compensation for the use of the rails, and giving the public the enormous benefit that would accrue to them by cheap and frequent trains throughout the country, they are debarred from doing so, for, by the same clause which gives the public the right of running trains, the privilege is practically withdrawn by arming the companies with a perfectly prohibitory tariff, amounting to no less than 3½d. per mile for every individual—passenger or attendant—conveyed; and thus the railway companies themselves are rendered the sole carriers of passengers upon their own line of railway; and the public are not yet furnished with the means of competition, in regard of passengers, which canals, rivers, and the sea have afforded them for the transport of coals.

All the notions regarding the carriage of passengers by railway which were prevalent forty years ago are now exploded. The danger attending railway travelling was an illusion. The expense of carrying 100 passengers by rail is less than to carry 10 by coach. The speed, the comfort, nay, the luxury of railway travelling are such that that afforded by the post-chaise, or even by the now almost forgotten travelling-carriage, affords a contrast, but no comparison. Upon all our principal lines of railway, what is not so generally known as it

ought to be, is the fact that not only has the Queen her travelling palace replete with comforts and conveniences, but every commoner who can afford to pay for it has the same luxurious accommodation at his command. The Great Northern, North Western, and Great Western, and other railways, are provided with family carriages for the use of the public. On payment of four first-class and four second-class fares, one of these carriages may be engaged for a family or private party to go any distance. The family carriage comprises a saloon, an attendant's apartment, a dressing-room and closet. The saloon is fitted with soft couches, armchairs and a table; it is carpeted, of course, and warmed by hot-water vessels. I was told at the Great Northern Railway that any part of the moveable furniture would be taken out if desired, and other substituted to suit the wishes of the travellers. The saloon communicates by a sliding door with the attendant's apartment, and across the entrance passage is the dressing-room fitted with a handsome looking-glass, a wash-stand, water laid on, and a chamber closet. No requisite convenience is omitted for comfort on ever so long a journey; and the whole carriage is fitted on springs, which reduce to a minimum even the motion of the train. Such a luxurious means of locomotion was never even pictured in fable until the last half century, and the cost to the railway company of running the whole of this commodious suite of apartments, with its full complement of passengers, is considerably less than it used to cost the postmaster of former days to run a post-chaise and pair, with its two occupants only, a quarter of the distance.

It has been shown in the report of the Royal Commission on Railways (page 76), that by railway, to draw 320 tons of coal a mile costs only 11½d.; so that, if each passenger with his luggage average, two cwt. (the average weight assigned to them by Mr. Houghton, of the London and North-Western Railway), 3,200 passengers (*i.e.*, ten times 320) could be conveyed by railway at the cost of 11½d. per mile; that is, 70 passengers for one farthing, 280 for a penny. Sir Daniel Gooch says that, for water, fuel, wages, oil, tallow, and sundry stores, it costs 4d. a mile (4·09) to run a Great Western locomotive engine, weighing 40 tons, on the Great Western Railway, and each carriage that follows it costs about a ½d. a mile. Each modern carriage, as used on the Metropolitan Railway, seats 80 passengers; it would require 40 carriages, therefore, to seat 3,200 passengers; 40 halfpence is 1s. 8d., and 4d. the engine, makes 2s. To convey 3,200 passengers, therefore, on the Great Western Railway, according to Sir D. Gooch, would cost 2s. a mile, or one farthing to carry 33 passengers, each weighing 16 stone, that is, 132 passengers for a penny. Mr. Fairlie says that his justly-celebrated "Bogie" engine, when supplied with water and fuel for 40 miles, with its carriage and 90 passengers, weighs only about 20 tons, whereas the engine and tender alone on the Great Western Railway weighs 40 tons; that his engine, on ordinary duty, can be worked by one man instead of two; that it would consume one-fourth part only of the fuel and water required by a Great Western train; that the wear and tear of the train itself, the rails and superstructure, would be reduced to less than one-fourth of the cost at present incurred. He does not give us the exact figures, but by analogy, if 280 passengers can be carried a mile for one penny by a Great Western train, by the application of Mr. Fairlie's system the same number can be carried for infinitely less. Is it not preposterous, then, to charge 1d., 1½d., 2d., 2½d., and even 3d. a mile for the conveyance of a single passenger by railway? Yet such are the charges made by our railway companies. Is it not an outrage upon the public that the ordinary charge by railway from London to Brixton and other suburban districts should exceed the ordinary charge by omnibus to the same localities, the cost of conveying the passenger by the two conveyances being out of all proportion in favour of the railways? And this, too, whilst every man in the country has a vested interest in the management of railways, and a right of interference, whereas the omnibus, on the contrary, is purely and entirely the private property of its individual owner. Let us, then, consider how these high charges came originally to be fixed, and the causes which perpetuate them, to the infinite prejudice of the State, and the annual loss in dividends of the railway shareholder.

When an Act of Parliament was first applied for to enable a company to convey passengers by rail, it became necessary to determine what was a fair charge and payment for the service; and the only guide for determining that point was the charges then made by the conveyances then in use. Horses were the only means of traction; and the travelling-carriage, the post-chaise, the stage-coach, and the waggon or carrier's cart, afforded the only accommodation. The usual charge by coach was found to be 4½d. per mile inside, and 2½d. per mile outside; and the average expense of posting was 2s. a mile with a pair of horses. It was then considered the first-class should represent the inside of the coach, the second-class the outside, and the third-class was left to represent the waggon or the carrier's-cart, by which conveyance the poorer classes then used to be conveyed. A mile, and even half a mile, then was a noteworthy distance for horses to drag a vehicle, and the prime cost of drawing a stage-coach by 4 horses rendered the charge made fair and reasonable. Very few people at that time travelled more than ten miles away from home, unless impelled by urgent business. The maximum fares payable by rail, therefore, for the carriage of passengers were fixed somewhat within those charges.

Now, the carriage of passengers by railway is a perfect monopoly in the hands of the companies; and it is the common failing of monopolists, without duly considering the cost of production, to contract the use of the commodity or convenience at their disposal by charging a large price for it. Thus, notwithstanding the proofs which experience has now afforded them of the extremely small cost at which the passenger can be carried on a railway by steam power, the railway companies at the present day maintain about the same charge for the carriage of passengers, except where Parliament has stepped in to control them, or where some potent opposition by steamboat has interfered with them, which they did when railway travelling was first introduced, and when the want of experience rendered the charge excusable. A further cause for continuing the present high charge for the carriage of passengers by railway is traceable to the management of railway property. A large community of proprietors become a corporate body, and elect from among themselves a board of directors. The shareholders chosen to fill the post of directors are selected for their wealth and supposed influence in the locality of the line—their aptitude for business being quite a matter of secondary consideration; or they are professional men, barristers, engineers, ex-officers in the army or navy—gentlemen of good repute and honour, but of no commercial experience; men to whom the emoluments of the office are agreeable, and the playing at directors a pastime; or perhaps they are merchants, with a full and profitable employment for their time in their own counting-houses, which leaves them little leisure or inclination to devote much of their valuable time and energies to the task of inducing the dull heads with whom they are associated to adopt any new and probably profitable course of action in lieu of the old and antiquated; or may be they are schemers, who use the power and influence reposed in them to promote the growth of branch lines, or other adventurous schemes, the shares of which they have command over, and can appropriate to themselves and to their friends at will, men ready to sacrifice the property they are paid to succour to their own individual advantage. One universal anxiety, however, pervades the class, it is the care so to act as to obscure from the body of proprietors any trace of individual impropriety or neglect of duty which should exclude them from the customary vote of thanks,

and jeopardise their re-election when their period of office shall expire. Many of these companies eventually become amalgamated under conditions agreed upon between themselves, and the rule and government of the several lines of railway, forming what is called a railway system, is vested in a single board of directors, by whom a managing director, or manager of the whole system, is appointed, and this makes the stumbling-block to reform complete. The manager, assisted by the secretary, prepares the agenda for the weekly meetings; the directors attend, nod assent to the propositions contained thereon, and, having recorded their names, disperse with all convenient speed to attend to other duties. The manager remains, but he of course is too wise, unless driven by external pressure, to bring upon himself the labour and the obloquy of troubling the board with what they might think new-fangled notions; and, last of all, a proposition greatly to reduce the tolls. Such a consideration, if weighed at all, must inevitably cause a large consumption of time, thought, and labour on the part of the directors. And, after all, owing to the trammels by which a majority of the directors in their judgment might order the experiment to be encumbered, would not improbably fail, to the discomfiture of the over-zealous official, and the inevitable resumption of the previous state of things.

As I proceed with my paper, I shall have occasion frequently to allude to Sir Daniel Gooch, and the evidence given by him before the Royal Commission on Railways. But in the observations I shall make, I am sure he himself, and the entire meeting, will acquit me of uttering a single word intended to be personally disrespectful towards that gentleman.

Sir Daniel Gooch is the chairman of the Great Western Railway. For twenty-seven years he was the locomotive engineer of that great system of railways. He is the managing director, the great controlling power, the "one mind," as he himself expresses it, which controls that gigantic system, comprising 1,358 miles of railway. He, of course, was chosen to fill that important position in consequence of his great experience in connexion with the line; from having so long filled, with honour to himself, and with perfect satisfaction to the proprietors, the office of its locomotive engineer. Known and esteemed as a man of energy, and of first-rate skill in his profession; but, for the true interests of the shareholders and of the public at large, a worse choice, perhaps, it would have been impossible to make. Sir D. Gooch is an engineer; he knows the power of Great Western Railway engines; he knows all the gradients of the line; the state of the rails; the lengths of the platforms and of the sidings, and their distances apart, all important things to know; but, unfortunately, he also knows the cost of the plant, the amount which the railway has cost to construct, and the amount of dead-weight which every engine has to draw with every passenger it carries. Like Mr. B. Houghton, the engineer of an equally important system of railways, he knows that every passenger weighs two tons (not two hundred-weight) with train accessories. And, with the last-named gentleman, he asks the public "to relinquish the idea that a railway passenger is a feather-weight," and labours to convince them that the railway is "an exacting, devouring, and insatiable monster," and urges them to be "reconciled to the existing tariffs of fares and rates," which, no doubt, competition, and the wish to act in a just and liberal spirit towards all parties concerned on the part of railway executives, he says "has already reduced to the lowest admissible rate." And this knowledge is one of the material elements which prevent Sir Daniel Gooch becoming so truly valuable a servant to the company and to the public in the post he now occupies, as he was whilst its locomotive engineer.

Sir Daniel Gooch is an engineer. He is neither a manufacturer nor a trader, whose wont is to look for his fortune, not to the large profit obtainable on one transaction, but to the cumulative aggregate of atoms in immense returns. As an engineer, he deals with known quantities, and makes the most of them. Give him coals and a factory, and he will produce steam and machines to draw the utmost weight with the least consumption of fuel. Give him passengers, and he will convey them to their destination so as produce the largest amount of profit per train mile. It is no part of the work of an engineer to study the habits of a people, and the means calculated to lead them to the railway station; it is his province to carry them at the most productive rate when they present themselves. He grudges to see his noble engine, calculated to draw 500 tons, set to draw 100 people, and as a remedy he reduces the number of trains that the people may agglomerate. He knows that the receipts per train mile are less than they ought to be. He is aware that he is only "getting 110 miles a day out of the engine which would run from 200 to 300 miles a day, and the same distance out of the engineer who ought to go 160 miles a day;" but the number of travellers, in his view, is a fixed quantity; and "the company run a great many more trains now than the traffic requires," and therefore it is that Sir Daniel Gooch says:—"I do not think that either the fares or the rates admit of any reduction; we ought rather to have improved rates than a reduction." To the question, "Do you think raising the present fares would increase your gross receipts?" he says, "What we care about is not so much the gross receipts as the net divisible balance. If we can get less receipts at a much greater cost, that is the figure we are interested in." Asked, "In fact, if you carried less at a higher price, you would make a better thing of it? He answers—"No doubt we might. . . . . What would answer the purpose of a railway company the best, would not be the diminution of weight of a particular train to a small extent, but if there was a considerable diminution in the number of passengers, we might diminish the number of trains, and the saving to us would become very palpable. For the purpose of accommodating the public, we now run a great many more trains than the traffic requires, and the consequence is that our receipts per train mile are much less than they ought to be. Then you are decidly of opinion that any reduction of fares would be prejudicial to the interests of the company?—That is quite my opinion. . . . . People will not constantly travel because they can go cheaply. Have not the lower fares been maintained because it has been found that the lower fares were more profitable than the higher?—Not as a rule. I do not think merely reducing the fare tempts people to travel. The working-classes have not the time to travel. A man who has a necessity to travel, does not care whether he pays 2s. more or less from London to Bristol. I presume you think the Great Western and the North-Western are sufficiently large in themselves for any board to manage?—They are quite sufficient for any staff to control, because one mind must control the one system."

The above forms part of the evidence given by Sir D. Gooch before the Royal Commission on Railways, in 1866, four years ago, and acting upon the principles laid down therein, the fares on the Great Western have been rather increased than diminished, and the number of trains has been considerably reduced.

It may be no part of the duty of an engineer to study political economy. The engineer of a railway company may look to what concerns the interests of the company alone. But the directors, or their representatives, are bound also to consult the interests of the public, from whom their exclusive privileges have been obtained. What Sir Daniel Gooch points out as the interest of the company, is that which is most inimical to the interest of the State. "If there was a considerable diminution in the number of passengers (he says) we might diminish the number of trains, and the saving to us would become very palpable." Such an opinion may be respected in an engineer; but no merchant, manufacture, or trader, nor any man who felt bound to study

the good of the Commonwealth, would give utterance to such a sentiment.

Besides, Sir Daniel Gooch says:—"Any reduction of fares would be prejudicial to the interests of the companies." "A man," he says, "who has a necessity to travel does not care whether he pays 2s. more or less from London to Bristol; merely reducing the fare will not tempt people to travel." "The working-class have not time to travel," and "people will not constantly travel because they can go cheaply." It does appear to me that a collection of more erroneous opinions seldom happens to be strung together.

In coaching days, a mile, and even half a mile, was a noteworthy distance. The old hackney-coach fare was 1s. a mile, and 6d. for any distance less than half a mile beyond the mile completed. But a mile by railway is a distance not worthy to be considered. There is no English coin so small as the sum which a passenger should be required to pay for travelling a mile by railway. In former times the coach was the engine, the coachman the engine-driver. The stage-coach horse ran ten miles out and ten miles home, and his day's work was ended; and one coachman drove about four teams out and four teams back again. By railway, the men are tired long before the engine. Sir Daniel Gooch was asked, "What is the most economical distance which you consider an engine should travel so as to keep the wages of the enginemen and firemen at a minimum per train mile? He answers, We think 160 miles per day. Is that for every day in the week?—No; it is rather a question of enginemen than engines; our engines will run a great deal more than our men will. Then you consider 160 miles a day a fair day's work for an engine?—That is what we endeavour to get, but we do not get it on an average. What is the average that you do get?—We do not get more than from 110 to 120 miles per day. . . . . It is as I have said, more a question of enginemen than of engines. We do occasionally run engines a considerable distance. We used to run the engines of our express trains from London to Birmingham and back, and also from London to Bristol and back. Your calculation that the engines would run 160 miles a day is without any undue wear and tear?—Yes; even more than that. As far as the engines are concerned, they would run 200 miles a day. It is not a question of engine at all; it is quite a question of the fatigue we can subject our men to with safety."

It is not the custom to charge a steamboat passenger by the mile. It was not the custom so to charge a passenger by the old stage-coach, neither is it the custom so to charge him by the modern omnibus, and what good reason is there so to charge him by the rail? If we get into an omnibus at the Bank and ride to Ludgate-hill the fare is 3d.; if we extend the ride to Charing-cross still the fare is 3d. From the Bank to Kensington the fare is 6d., and if we ride three miles further to Turnham-green the fare is only 6d. In my opinion, to charge by the mile forms one of the greatest impediments to a great reduction in the fares by railway; and, by the evidence just quoted, it is clearly shown that a mile by railway is an inappreciable distance. We ought, therefore, to discard the mile, and instead of it inaugurate "the stage." From ten to twenty miles should constitute "a stage," and anyone who travels over any portion of "a stage" should pay as if he travelled all the way, and thus the shorter distances would contribute for the longer ones, and by our current coin suitable and proper payment could be made, even for the shortest distance travelled.

"The working-classes," Sir D. Gooch says, "have not the time to travel." What is meant by travelling? Is it merely taking a pleasure trip, or submitting to the cost of riding when driven by necessity to do so, because the distance is too far to walk? This might have been a good definition fifty years ago, before railways were thought of; before the railways had extinguished thousands of the dwellings of the working classes in large cities, increased the rent of what remains, and driven their occupants into the suburbs, miles away from their occupation, to seek a shelter for their families. It might have been a good definition before the Saturday half-holiday drove the working classes once a week, at two o'clock in the afternoon, from profitable occupation. It might have been a good definition before railway companies, by originating excursion trains on Sundays, had inspired the working classes with a wish to see the world. But now it is no longer so; travelling now is a necessity to save the poor man's time; travelling is made a daily necessity for workmen, and Parliament has required that companies should place the opportunity within their means, not at per mile, but at per stage. And although the boon was originally granted with reluctance, already the companies have learned that to carry workmen at a penny a stage forms part of their most profitable business, so much so, that although required by Parliament only to run a single workmen's train per day each way, they now run several workmen's trains per day, solely to accommodate the working classes; or rather they now run several workmen's trains per day, the accommodation of the working classes giving place to the consideration of their own advantage. Nor have the working class been slow to avail themselves of the boon accorded to them.

Sir Daniel Gooch maintains "any reduction of fares would be prejudicial to the interest of the shareholders, for people will not constantly travel because they can go cheaply." Perhaps it would not be possible to furnish an answer better calculated to refute both the opinions expressed in this short sentence, than by a simple statement of the result of the operation of workmen's trains on the Metropolitan Railway. Of the thousands of labourers who now daily travel in and out of London by the rail, few of them comparatively would ride if charged per mile, even though the sum fixed were one farthing only. The Metropolitan Railway is $7\frac{1}{2}$ miles long, and the labourer is carried the whole length of the line, or over any part of it, to or from his work for a penny. If he had to pay a farthing a mile it would be a matter of calculation, and for the longer distances it would amount to a sum worth saving. A sum which the labourer could not afford to pay, a penny a-day added to the twopence, is a serious sum to the man with a wife and family to keep, whose earnings are from 12s. to 18s. a-week, and, therefore, he must walk. But the charge is a penny, so he rides, and having left off walking and gone a few times by the rail, to ride becomes a habit, and he can no longer walk. He constantly travels by the rail himself because he can go cheaply, and soon he inspires his fellow-labourer to do so too, and what is the result? The Metropolitan Railway—to their honour be it told—commenced running workmen's trains in 1864—before Parliament issued an intimation that they ought to do so—and in the first year they carried 151,643 workmen at a penny the journey. Omitting fractions, in the next year they carried 350,000; in the next year, 455,000; in 1868, 580,000; and last year, 765,000; being a five-fold increase in little more than five years. The experience on the Chatham and Dover Railway shows the same results, and its manager, as well as the manager of the Metropolitan Railway, states, in his report, that the pecuniary advantage to the company of the workmen's trains is equal to that of any trains that run upon the line.

But the working-class, as they are called, that is, the ordinary labourer, is not the only class that have to be considered. There is another class as numerous, still more necessitous, more enduring, and to whom economy is quite as needful—the city clerk, and the apprentice, and the many young women who are employed in business. They form a class that well deserves to be considered. Their occupation, as a rule, does not begin so early as the labourer's, and many of them, like the labourer, have been driven to the suburbs, where also thousands more would gladly go if the means of intercourse were cheap and frequent. All the workmen's

trains commence the journey before six a.m. From eight to eleven o'clock the trains are overcrowded with the ordinary passengers, but from six to eight o'clock the trains run light. These two hours might be appropriated to accommodate the class just named. If these two hours were so appropriated, at a slightly increased charge upon the labourer's trains—three-pence for the return journey—and a similar privilege were given also in the middle of the day, between twelve and two o'clock, when also the trains run light, so as to enable the clerk and apprentice occasionally to dine at home, the boon would be no less to that needy and deserving class of labourers than the earlier trains now are to the working-classes. And if their final journey were retarded until half-past six p.m., returning these in second-class carriages, whilst the labourers would occupy the third-class, the trains in the busy hours would be partially cleared for the ordinary passengers, and on all the metropolitan lines the trains throughout the day would be more equally loaded than at present, and the shareholders and the public would experience a mutual benefit from the arrangement.

But there is yet a still more numerous class whose claims have never been considered, whose wants remain utterly disregarded, and to the neglect of their wants, in a great measure, is attributable the scantiness of the dividends of which the railway companies complain. Here is the gold mine of which the companies have not yet cut the lode. It is that numerous class whose dwellings are from five to fifteen miles distant from the nearest market town. Most of the large towns of England possess not only a better mart for the disposal of the produce and wares of the surrounding neighbourhood, and the purchase of the articles required, but for the most part they possess advantages for education and instruction far superior to what is obtainable in the villages of the surrounding district; and at the present time, when middle-class schools, mechanics' institutes, penny readings, and other means of instruction are so largely on the increase, they are likely to be greatly multiplied in the larger towns. But from all these advantages the families of the small farmer, the mechanic, and the labourer in the districts named are more or less shut out, owing to the infrequency of railway trains and the mileage charge exacted by the companies.

If we take up a railway map of England, we find, thanks to railway competition in this respect, that with few exceptions, from every large town in the country to every other large town there is one way there by railway, and another way by railway to return. In other words, the railways of the country form a network of squares, circles, and irregular figures on the map—diamonds they ought rather to be called, for it is the most appropriate appellation by which their value can be symbolised. On the Great Western system, and others of the large systems of railway, many of these double avenues from place to place are under the sole control and management of a single company. The diagram upon the wall exhibits four of them, between Windsor and Shrewsbury, controlled entirely by the Great Western Company, and on it the stop-stations, or completion of each stage, is distinguished by being written in red ink. These two ways from one town to another have generally been formed by separate companies, and were sanctioned partly to afford competition, by which the public should be benefited, but for obvious reasons that intended advantage to the public has not been realised; and it is the habit to allude to this double supply of railway accommodation as an evil, as a waste of capital, an unprofitable outlay of capital in constructing two lines of railway where one should suffice, an addition to the cost of the plant which makes it necessary to exact high fares. But I think it may readily be shown that this is an error of judgment on the part of the railway companies; that, like the accidental circumstance which taught the Stockton and Darlington Railway Company how cheaply they could carry coals at a profit, and that equally fortunate but unwelcome requirement of Parliament, which has taught the metropolitan companies how profitable it is to carry the labourer for a penny a stage instead of a penny a mile, instead of being a cause for regret and a source of loss, these double lines of communication may be made "the vital element in the success of the railway." That it is the untried source capable of producing the greatest profit to the railway company.

There are many in this room besides myself, who can remember the introduction, by Shillibeer, of omnibuses into London, and who will also be able to call to mind how very few were the riders then in the few stage coaches which worked between London and the suburbs, charging 1s. 6d. inside, and a 1s. outside for the same journey that is now performed by omnibus for 3d., and it was only by the regular daily riders—the old fogies of that day—whom the coaches called for at their doors, that the "glass-coachman and stage proprietor" used to be supported. The casual rider was a *rara avis*. Everybody rides now, and many hundred omnibuses make four or more journeys a-day each in and out of London, taking up and setting down at every hundred paces of their journey, and paying well at 3d., and even 2d., a stage, the rider of the shorter distance compensating for the long one. This typifies the mode in which the entire passenger traffic of the country ought to be developed. But this can never be done whilst the railway traveller is charged by the mile.

Be pleased to observe this diagram:—These circles of railway from Windsor to Oxford, from Oxford to Warwick, from Warwick to Birmingham, and from Birmingham to Shrewsbury. The circle from Windsor to Oxford, touching Reading, Moulsford, Wallingford, Abingdon, Oxford, Thame, Wycombe, Cookham, and Maidenhead, encircles 200,000 inhabitants.

The circle from Oxford to Warwick, touching Shipton, Blockley, Stratford, Warwick, Leamington, Banbury, and Woodstock, encircles 100,000 inhabitants.

The circle from Warwick to Birmingham, touching Leamington Solihull, Birmingham, Stourbridge, Kidderminster, Worcester, Pershore, Evesham, and Stratford, encircles 500,000 inhabitants; and the circle from Birmingham to Shrewsbury, touching Wolverhampton, Wellington, Shrewsbury, Troubridge, Bridgnorth, Stourport, Stourbridge, Oldbury, and Birmingham, encircles 750,000 inhabitants.

These circles of railway, from 80 to 120 miles round, touching the most populous towns of the neighbourhood, encircling from 100,000 to 750,000 inhabitants, furnished with some such contrivance as Fairlie's light passenger carriage, which, with its locomotive and carrying trucks, carrier-frame, water and fuel for 40 miles run, is stated to be under 14 tons weight, gliding, as it were, on tip-toe over the line at twenty or five and twenty miles an hour, at scarcely any cost, seem specially designed to develop the traffic of the country. Set these railway omnibuses running round these circles each way, every half-hour of the day, charging by "the stage," the labourer 1d., middle-class 3d., and first-class passenger 6d., for "the stage" of ten or fifteen miles, and Sir Daniel Gooch soon will be convinced that the people will constantly travel because they can go cheaply. Soon we shall witness all over the country, to the infinite profit of the shareholder, the landowner, the houseowner, the landlord, and the tenant, and the entire community, what has long been seen in Germany, "the labourer travelling by railway, the women coming in with their large baskets of vegetables and fruit a distance of 10 or 15 miles into a market town, make their marketing before 12 o'clock in the day, and go away in crowds." We shall soon see the farmers' and mechanics', and even the labourers' sons and daughters, going daily by railway to the middle-class, endowed, or good parochial school, which now they cannot reach; their fathers and elder brothers, instead of wasting their time and their health boozing and smoking in the settle of a public-house, going, together

with their wives and mothers to join them later in the day, to attend with the children the mechanics' institute, the penny reading, or other rational amusement, and at night returning home together. Seme of the children even going home to dinner, and paying the company 4d. a day, whereas now they miss all these advantages, and the company gets nothing. We shall then no longer, in Ireland see "carriers' carts numerous on all the roads where railways are," "all the traffic going by a route running parallel with railways and passenger trains empty;" but we shall see the Irish fisherman following with diligence his occupation, himself taking his fish to his factor in Dublin, and going next day to take his money, instead of being "compelled to sell his fish to some hawker who now gets all the profit." Then, we shall no longer hear of the directors of a railway company acting like those of the Irish Great Western, who refused to reduce their tolls, although one of their body, "Lord Clancarty, offered to guarantee the company against loss if they would do so." By these facilities, afforded to the public as they ought to be, the coffers of the railway companies would soon be amply filled. This done, we should no longer hear of applications to Parliament for leave to abandon privileges already granted, nor of the probable abandonment of lines already working, for want of traffic to cover their expenses. This done, the long trains would be, to a great extent, relieved of the short-distance passengers; excursion trains could be discontinued, and accidents would be less frequent; and we should soon hear of dividends of 8, 10, and 12 per cent. on railway shares, instead of none at all, or of the miserable dole which the traffic now produces.

And here we may, with all propriety, remark that, although the public have a strict right to be well considered by the companies, and to have their comfort, their convenience, and their safety strictly studied and provided for, it is but right also that the companies should be protected against inordinate loss and imposition. When many people travel by a train, the company is more liable to casualties then when few are in it; and if an accident happen to the well-filled train itself, the cost is likely to be far more serious to the company. This, of itself, furnishes the public with an additional guarantee for vigilance and care on the part of the company, even with a limit fixed for compensation. It is improper and unfair to call such a limitation "setting a price upon the peor man's life." Facilities by insurance offices are afforded to those who travel frequently to protect their families in case of accident. If, therefore, the companies cheapen the means of locomotion to enable numbers to travel, and thereby increaso their own risk, it is but reasonable that they should be protected by having a limit set to their responsibility.

According to the last published returns, the receipts in the goods department of the railway business of the country amount, in round numbers, to twenty-one millions and a half a-year, and the entire cost of the whole business, including tho cost of all the passengers conveyed, as well as all the goods—which cost, Mr. Chadwick maintains, by unity of management, might be reduced 27 per cent.—is nineteen millions and a-half a-year. Thus the goods traffic alono pays every expense incurred—every extravagance and wasteful expendure—and leaves two millions sterling, and all that can be made by the carriage of passengers and their luggage, and all parcels, carriages, horses, dogs, and her Majesty's troops, and the mails, a net profit for dividend, leaving scope for speculation with regard to tho carriage of passengers if even that were needful. Besides, Sir D. Gooch shows us that much more than half of the engine-power of his great company, and nearly half the available labour of tho engine-drivers and tho firemen are allowed to run to waste. Ho says:—"Engine men and firemen should travel 160 miles a-day. Engines would run 200 miles a-day or more. They used to run from London to Birmingham and back, and from Lendon to Bristol and back, but we do not get, from engines and men, more than 110 or 120 miles a-day on the average." And he also tells us the cost of running additional Great Western Railway locomotives is only fourpence a mile, and each carriage that follows it about one halfpenny; and Mr. Fairlie says the cost of running his bogie-engine and carriages for ninety passengers, would only be about one-fourth of what it costs to run a Great Western train to carry the same number. Here, then, is abundant provision for cheap conveyance, if only people can be found to travel.

Almost the entire passenger-traffic of the country, it may be said, remains to be developed, as will at once be seen, if we glance for a moment at the very small number of people who do travel, out of the 31 millions of our population. It is the custom to say "300 millions of passengers travelled by railway last year;" the exact number recorded is 287,688,113, besides season-ticket holders. But this mode of stating the fact leads to a most erroneous conclusion. It is not 300 millions of passengers that are annually carried on our railways—(and people smile if one talks of 3,000 million being carried, as if that were not to be expected)—but it is 300 million tickets that are issued in a year to 31 million people. A passenger from Aldersgate-street to Moorgate-street requires a ticket, although the distance is barely half a mile, and a single ticket suffices from London to Inverness. Of all those who travel by railway —short distances and long ones—it will not be an exaggerated average to assign three journeys a-week to each passenger. Three journeys forth and back expend six tickets; six tickets a week are 312 tickets a-year. One million travellers, then, consume the 300 million tickets and 12 millions over, and 30 millions of the people do not travel at all.

The labourer travels daily to his work, and back; he makes twelve journeys a-week, and half-a-million such travellers figure as 312 millions of passengers travelling by rail, although they comprise little more than $1\frac{1}{2}$ per cent. of the population. The raw material, then, for railway companies to make profit out of in the shape of railway travellers, amounts to $98\frac{1}{2}$ per cent., or, at the lowest computation, to 97 per cent. of the entire population of Great Britain.

So great is the increase of passengers that may be expected by runing omnibus trains in the way proposed, reducing the fares and charging *per stage* instead of *per mile*, that it is no excessive estimate to contemplate a saving of £150,000 a-year in tickets alone, by ceasing to issue tickets to 3rd-class passengers, and, instead thereof, using a turnstile in the way pointed out in my pamphlet on railways.

But the railway companies may be sceptical as to the advantages of running omnibus trains. They may refuse to do so, and where is the remedy? The remedy is not so distant as at first appears. Railway companies aro the owners of the line, but there is no Act of Parliament for constituting them the sole carriers upon the line. True, by the tolls clause tho tariff allowed for the passage of independent trains of passengers is prohibitory, but Parliament has the power of revisien.

Steam-boat companies on the Thames used to pay the pier companies a halfpenny a head for landing or embarking passengers. That was reduced to 3s., 2s., and 1s. 6d. a hundred, and now that the Thames Conservancy has the control of tho steam-boat piers, the charge is fourpence in summer and threepenee in winter, for each time a steam-boat calls at a pier, no account being taken of the immense numbers landed and embarked.

Tho circumstances are analogous.

If the companies refuse to do what is needful for the public accommodation, and the railways remain in the hands of the companies, Parliament must fix a reasonable price to be paid to the railway companies for the use of their stations, wear-and-tear of their rails, and a supply of water for the engines of independent individuals or companies who may be willing to run such trains; and in-

dependent companies will soon be formed to carry out the project.

With the facilities that would be afforded by such omnibus-trains, the number of long trains now running would probably afford all the accommodation requisite for some time to come; and, the omnibus-trains acting as collectors of traffic and feeders for the main lines, taking also the passengers from it to their destination along the branches, the through trains, which Mr. Stewart (of the London and North-Western Railway) shows entail so much additional expense, and cause so much delay in working the traffic, would be wholly superfluous and unnecessary. Each long train would run its length straight out along the main trunk lines. The charge by the ordinary trains would be—people's class, 1d. a stage; middle-class, 3d.; and first-class, 6d. a stage; and double this fare by express trains, viz., middle-class 6d. and first-class 1s. a stage. (The effect of this will be seen by reference to the tables on the walls, which indicate the proposed fares from London to Holyhead, and from London to Edinburgh, or any intermediate station on the line.) Any part of a stage travelled over would be paid for as if the whole length of the stage were travelled over. And those passengers who could afford to pay for it could still be saved the inconvenience of leaving their carriage for the branch lines, by freighting a family carriage, described in the early part of this paper, which could be hooked on to the ordinary or express train, and detached where necessary, so as to convey the passenger and his belongings to his destination; and with such a tariff of ordinary fares as is here described existing, the charge probably for the family carriage, with all its luxurious accommodation, soon would be no greater than the first-class passenger now pays for the convenience which the ordinary first-class through train now affords him.

In the pamphlet before alluded to, and which will be found in the library of the Society, will be seen arguments to prove the sufficiency of the tariff of charges here suggested, and the large profits that it is calculated to yield to the companies. Examples also are therein given of the extremely low fares charged for passengers on the Belgian railways being

Less than $\frac{1}{2}$d. a mile 1st class	0·46	centimes.
,, $\frac{1}{3}$ of a 1d. a mile 2nd class	0·32	,,
,, $\frac{1}{4}$d. a mile 3rd class......	0·23	,,

In harmony with the opinion expressed by much more experienced and abler men than I am, I much fear that the British public never will experience all the advantages to which they are entitled through the introduction of railways, until the entire command of all the railways is vested in government. The railway companies still have a golden opportunity if they will act wisely in time by meeting the reasonable requirements of the public. If they will not, and that quickly, the opportunity will perhaps be lost to them for ever. Belgium, and other Continental countries, afford us the example of government working a portion only of the lines of the country, and the tariff of fares and charges adopted by the government influences the charges made by the companies. In like manner, in my pamphlet, I have proposed that our own government should purchase two of the trunk lines of this country, one leading to Ireland and one to Scotland, and by working them in the way suggested, the other railways would soon be driven to adopt a similar course of action.

Cheap locomotion for the people is calculated, in as great a degree as cheap transit for their merchandise, to promote the commercial prosperity of the country. Two minutes' conversation in business is worth two days of correspondence, notwithstanding the existence of cheap postage and electric telegraphs. As regards the health, the education, the morality, and the comfort of the masses, and the development of their wealth, I cannot conceive anything calculated in so great a degree to promote these objects, of the highest importance, as the establishment of the universal omnibus trains at low fares; and wherever they exist they cannot fail to be accompanied also by an incalculable increase in the value of the land and other fixed property of the country. Are we to wait, then, for these almost invaluable blessings until some lucky accident prove to the railway companies, even against their will, that their own prosperity is bound up in the general prosperity of the entire community, the promotion of which is greatly retarded by themselves? Are we to see our continental neighbours sap the foundation of our commercial prosperity by cheap transit of merchandise, and listlessly look on whilst they, with less than half the railway facilities that we possess, carry their passengers first class for less than half what we charge our third class passengers?—the traveller from Brussels to London paying about 4s. only from Brussels to Ostend, and 20s. for an equal distance from Dover to London! Tramways, Port Madoc railways, Bogie engines, and road steamers, which improve ths roads whilst they use them (the most recent invention, by Mr. R. W. Thomson, C.E., of Edinburgh), ought to awaken and affright them. If Parliament delay to relieve the companies of the control of the railways, and they neglect to comprehend the signs of the times, it is probable a much worse fate awaits them. If the railway companies wait for the pressure of a similar salubrious and potent opposition in respect of passengers to that which water carriage fortunately provided them in respect of coals, they may find it come upon them more quickly than they contemplate, and when it does appear, it may be found too potent to be successfully resisted. They have yet the monopoly in their hands of the most productive and the most profitable branch of their great business — that by which satisfactory dividends may be realised out of the least productive lines. But if they delay to increase the number of their trains, and to reduce their charges to the full extent suggested, by which opposition may be paralysed, they may soon find railways from town to town throughout the country, of 2 ft. or 3 ft. gauge, with carriages for passengers and parcels, propelled by Bogie engines or road steamers at the rate of 15 or 20 miles an hour, the trains running through the centres of large towns, as they do through many of the cities of America, taking up and setting down their passengers and parcels with much greater convenience to the public than the present railways can effect; and Sir Daniel Gooch, and the great system of railways which he controls, may be left with only the heavy goods' traffic to feed upon, in addition to what in his evidence before the Royal Commission he pronounced to be the panacea for railway prosperity—such "a considerable diminution in the number of passengers, that he may diminish the number of trains," and find "the saving to the company become very palpable," but, it may be added, the cream of the profits of their business driven into other channels.

DISCUSSION.

Mr. Hyde Clarke said, notwithstanding the applause with which the paper had been received, it might be safely anticipated that the opinion of railway managers on the statements and conclusions of Mr. Jones would be that they were utterly impracticable. At the same time there was nothing Mr. Jones had stated that was not proved by the experience of the last thirty years; and whenever the question of cheap fares had been considered it had always been proved that cheap fares were profitable, and dear fares were not, and also that after fares had been raised for the purpose of obtaining increased profits, the almost invariable result had been entire failure. It was a very remarkable circumstance that, with such experience, railway directors should still maintain the retention of high fares. To a certain extent it ought not

to be a question either of high or low fares, because what the railway managers had to do, irrespective of the rate of fares, was to obtain the greatest amount of net profit for the company. Mr. Jones had explained many of the reasons for the deficiencies of railway administration, but one very important cause, which had not been mentioned, was, that apart from the circumstance that railway directors were not qualified by experience for administration on a large scale, they had, particularly in this country, neglected statistics on railway matters. He referred to that, because in other countries these statistics were closely followed, and there was hardly a great undertaking, managed either by government or a private company, the statistics of which were not better kept than those of English railways, and it was an undoubted fact that, without such study, it was impossible to obtain sound experience. Whenever experience had been regarded, it was found that cheap fares were the most profitable to the railway proprietors. Unfortunately, they must come to the conclusion that, so far as England was concerned, such statistics could never be obtained until railways were placed under government management. He must, therefore, concur with Mr. Jones, that private enterprise had endowed this country with greater abundance of railway accommodation than was supplied on the Continent, in so far as the construction was concerned, but so far as regards management, they must just as certainly come to the conclusion that England was far behindhand. It would soon be no longer a dispute upon theory between railway managers and those who held the opinion of Mr. Jones, but a question which would touch the nation in its most vital interests, and some remedy must be applied if the manufacturers and working classes of this country were to be placed on an equal footing with their continental rivals. He had, at a former period, closely followed the subject as a railway statistician, and he could bear testimony to the general accuracy of the opinions now advanced by Mr. Jones; and, although to some persons Mr. Jones's views might appear impracticable and absurd, the period was fast approaching when the whole of what he advocated, romantic as it might appear, must and would be realised.

Mr. William Pare said that he had had large experience of railway statistics and management during the last 40 years in all parts of Great Britain and Ireland, as well as in foreign countries, and he had some pretensions to form opinions on the subject under discussion, particularly as he had, in addition to hearing the paper just read, had an opportunity of reading the pamphlet formerly published by Mr. Jones. He admitted that, generally speaking, all that had been advanced by Mr. Jones was quite within the compass of probability, and very likely within the next decade a very great alteration would be seen in railway matters. They would see a very large reduction of expenditure for the maintenance of way and rolling stock, incident on the adoption of a new and lighter system of engines on an improved construction, and whilst there would be a large reduction of expenditure in this way, he believed railway companies would be compelled by their own interests to adopt some such system as had been sketched out in the paper, which would produce an immense increase in the traffic. Of course, many persons pooh-poohed such ideas, simply because they were new, and at first sight startling, but these objections were only those which had been brought forward against every new scheme. The same objection was made against the introduction of railways themselves, against the great schemes of penny postage, of steam navigation, of gas lighting, and, in fact, every great improvement which had been seen within the last half-century, and, therefore, he did not think such objections was really worth combating. In giving evidence before committees of the Houses of Parliament he had been accustomed to say that there were three elements which people took into consideration in travelling, cost, time, and convenience, and one or other or some two of these entered into most men's minds when they travelled. To a professional man and man of business cost was of little importance, and time was everything; convenience, perhaps, was of some importance, but still it was secondary. To the large mass of the public cost was almost the sole consideration, particularly to the labouring classes. At holiday times, when they could visit their relatives and enjoy social intercourse, time was not of great consequence, and convenience was the secondary consideration. On the other hand, to the idle rich, to ladies and to invalids, convenience was almost everything, and cost and time were not so much considered. But as to the working classes cost was everything, it was to that class railway companies should address themselves in order to fill their half-empty trains, which were now running in all parts of the kingdom. There was no doubt, however, that this system could only be carried out successfully where there was a large population, but here in England there was that condition. In the early history of railways, when giving evidence before Parliament as to the probable increase of traffic in consequence of railway facilities, he found that even highly intelligent gentlemen on committees in the Houses of Parliament could scarcely believe that traffic would be doubled or trebled.

Mr. Joseph Samuda said he had listened to the paper with great pleasure, but there was one ground of the argument to which he must take exception. He did not believe in the rights of the public, that much pampered body, which was always very much flattered and spoiled, particularly when railway matters were under consideration. He had himself seen a great deal of what railway companies had done for the public, but he had yet to learn what the public had done for railways. There were countries in which railways had received public aid, and there unquestionably the public had a right to interfere; and even with respect to gas and water companies, which had been allowed to trespass upon the public highway without paying anything for it, something might be said, but railway companies paid for everything they bought, and surely the public could not, to use a homely phrase, eat the cherry and have it too. He could not admit that railway companies had any privileges except those of paying three times the value of the property they passed through, and of paying for a bruise what would be ample consideration for a broken limb. Under these circumstances, he thought the matter should be left to the principle of supply and demand. The railway companies had made the railways at their own risk, and gave the public the means of travelling at half the price and double the speed, and if the public were not content, let them use their own highways, which the railways did not interfere with. It was said that there were no coaches at present, but that was only another way of putting the argument, for if the public did not find great convenience and economy by using railways, they would soon discontinue them and find other conveyance. He must admit that it would be to the convenience of the public to have cheap fares, but he altogether denied it was a right, though unquestionably, as far as it could be reconciled with the interests of railway companies, the interest of the public should be considered; but the first thing railway companies had to do, like any other commercial company, or any private individual in trade, was to make the most of their undertaking. The partisans of high and low fares were divided into two camps, and each had very cogent arguments to bring forward, but he considered the question was still *sub judice*. It was quite clear there was a maximum of fares beyond which the public would refuse to pay, and there was also a minimum at which the receipts would be so small, compared with the expenditure, that the railway companies could not make a profit, and he could not help thinking that Mr. Jones had put his minimum rather too low.

One thing had clearly been shown by experience, that whatever the variation of fares, railway companies had never been able to work at the per-centage which Mr. Jones endeavoured to prove was a practicable one; and however strong might be the arguments put forward, there was no resisting the logic of facts. And Sir Daniel Gooch was unquestionably right in his evidence with regard to workmen's trains, and the hours at which they were run. It would be totally useless to lower the fares in the middle of the day, for they would be merely running empty trains for next to nothing. It certainly was desirable that the attention of railway companies should be drawn to the fact that, at particular times, it might be useful to the public, and beneficial to themselves, to lower their fares, but to establish a system such as was now asked for was contrary to all experience, although no doubt in this matter, as in everything else, they must live and learn.

Mr. Haggard said he had gone somewhat deeply into this railway question, and he could see that there were several points on which a great deal of misapprehension existed. For instance, they had heard how cheap travelling was in Belgium, but it had not been stated that in that country the cost of making the railways was about £14,000 per mile, whilst the average cost of English railways was about £35,000 or £36,000, and that of the Metropolitan line was £500,000 a mile. It was an undoubted fact that no great work would ever be completed unless a dividend were to be expected from it, and if it were once proved that railways resulted in loss there would soon be an end to them. With regard to cheap fares it had been said by Mr. Brandon that if the fares were cheaper, six times the number of persons would travel, but he found that, in 1867, double the traffic could not have been carried by those trains, and therefore it must have been a great loss if the fares had been lowered, because there would have been a vast additional expense in wear and tear and many other things. A railway train was subject to certain laws which could not be got over, whatever might be done by Mr. Fairlie in the way of lightening engines and carriages. If a man weighed 1 cwt. the carriage in which he was conveyed must weigh something, and if it were put at the same weight as an omnibus, that would be another cwt. But then there was this fact, which could not be altered, that, in 1867, (and other years would show the same result), for every 19 miles travelled by the train, the passengers only went a little over 12, and therefore when reference was made to that statement that for every passenger carried there was a dead weight of two tons, it should really be three tons, because, if he only travelled two-thirds of the distance, he must be debited with the other third. The London, Chatham, and Dover Company had really lowered their fares because the Brighton Company had lowered theirs; but the result had been that he had seen the Brighton stock go down day after day, and their receipts had diminished; and the London, Chatham, and Dover had carried, since the 1st of January, 60,000 more passengers, and had received £1,000 less. But they would have carried 20,000 more, as the natural increase, without lowering the fares, so that they had not only lost the £1,000, but also the fares of the 20,000 people, simply because they had been obliged to lower their fares. He did not say it was impossible to run trains more cheaply, but there were a great many points to be considered, and no two railways could be treated in precisely the same way. If these cheap fares were introduced, express trains must be given up, for there could not be speed and economy. No doubt the railways could do much more for the public in one way if the conditions were altered in another. A few years ago the Brighton Company were running so many trains a-day, to oblige the public, that they actually only got 23s. net profit per train, and, after cutting off a large number of trains, they only raised the average number of passengers from 60 to 92 per train, which was about the general average of the United Kingdom, whereas it ought to be more like that of the South Eastern, about 114. All these things had to be taken into account by railway managers and engineers. The Festiniog Railway had been referred to as paying 30 per cent. He had looked over the returns with regard to it, and found that it was about 14 miles long, and, although he could not find what was the capital, he discovered that it was using nearly 1,000 trucks and carriages and four engines, whilst the gross receipts were £18,000 for the year, and the working expenses £8,000, or 43 per cent. He did not expect to find them so low as that, but he did not believe that the capital could be so small as to allow of a net receipt of £10,000 per annum paying a dividend of 30 per cent. He believed that railway managers were thoroughly awake to their position, and competent to do their duties, and that under different conditions they could procure cheaper fares, but an Englishman would never give up speed, regularity, plenty of trains, and comfort, and these things must be paid for.

Mr. Pare said he was not aware what dividend was paid by the Festiniog Railway, except from what had been stated by Mr. Fairlie, but it must be remembered that that line was a most exceptional one. Its gauge was only half that of the narrowest in ordinary use, or less than 2ft., and therefore the cost of construction must have been very low, but the gradients were very heavy, as high as 1 in 79, and its curves very sharp, which would make the working expenses proportionately high.

Mr. James Allport (Midland Railway) said that Mr. Jones had adduced many theoretical acquirements, but not one practical one. Time would not permit him to go through the details of the paper which had just been read, still less of the pamphlet formerly published by the same author, which he had also read; but he would say a word or two on the question of workmen's trains in the metropolis. It was quite true that the Metropolitan Company last year carried 750,000 workmen, the fare being 1d. per journey, and the distance traversed was 4,200 miles. The total receipt would be therefore £3,000 per annum, and he was quite certain that any man practically acquainted with railway matters, would say that no trains could be run for anything like the amount per mile which that sum would give when divided; and consequently, the Metropolitan Railway, although they carried 750,000 passengers, must have lost by them considerably. Mr. Jones had also alluded to the statement of Mr. Forbes, with regard to workmen's trains on the Chatham and Dover line, but he had reason to know that that statement had been much misrepresented, and that Mr. Forbes was much opposed to the views of Mr. Jones. The Great Western also had been lately experimenting upon workmen's trains, and, as Sir Daniel Gooch had informed him very recently, the result was that the average number of passengers using these trains was 40 per day, which could not pay anything like the working expenses. He (Mr. Allport) was the oldest railway manager in the United Kingdom, and perhaps few had tried more experiments with regard to passenger traffic, and he stated most unhesitatingly that whether railways were in the hands of the government or of private individuals, if a system anything approaching that laid down by Mr. Jones were adopted, it would be utter ruin. It would be impossible for the company to work, or for the lines to accommodate the trains numerous enough to give anything like a sufficient return on the capital expended in this country for railways, which amounted to about 500 millions. Even if they could carry the number, the working expenses would be very great. They must have a certain weight in the engines and carriages, and the rails were constantly wearing out. Mr. Jones had stated, quoting apparently from the evidence of Sir Daniel Gooch, that every additional engine on the Great Western line costs 4d. per mile, but he had no hesitation in saying that the

permanent way expenses alone amounted to more than 4d. per train mile run on that line—at any rate, they did on the Midland, which was one of the largest in the kingdom. It might perhaps be possible to extract from the evidence of Sir D. Gooch words which would bear that construction, but he spoke from intimate knowledge of these things, and he was positive that it was quite impossible to run a locomotive by itself, without any carriage behind it, at 4d. or even 6d. a mile. Taking the average throughout the country the expense per train per mile was not less than 2s. 4d., and, however you multiplied the number of miles, the result would remain pretty much the same. A great deal had been said about the fares on foreign railways, but Mr. Jones forgot to state that in France, for instance, the railways were made in a great measure by the state, the company being only called upon to lay down the permanent way, and find rolling stock for a certain number of years, at the end of which time the whole thing passed to the Government, so that, in order to make a profit, they had only to charge enough to cover the cost of the rails—the permanent works, bridges, embankments, and land being all found by the government. To his knowledge the Belgian government were now anxious to hand over the railways to private companies, and he believed that ultimately the French government would do the same. It was most unfair to compare foreign railways with English, which had cost an average of £35,000 per mile; and with all the light of past experience, he did not believe that if they were all to be made now the cost would be much less. There must be a certain return, therefore, upon the capital invested, and certainly up to the present time the railway companies had not benefited so much as the public had from the establishment of railways. Mr. Allport then alluded to the increase in the trade and wealth of the country which had followed the development of the railway system.

Mr. Brandon said, that having read a paper on a similar subject two years ago in that room, he was glad to find that other thinking men were following in his wake. Mr. Jones agreed with him that the radical defect was the mileage system, but he went further than Mr. Jones, and advocated the adoption of a single fare for any distance, the results of which would be much more favourable than those expected by Mr. Jones. If workmen's trains paid, and, notwithstanding the remarks of Mr. Allport, he preferred to take Mr. Forbes' statement as published in the company's report, that they did pay—why should fares for clerks and any other class of persons be put higher? Why should not every one be allowed to avail themselves of these low fares? One of Mr. Jones's suggestions, that independent companies might have power to run trains on the existing lines, he must say was utterly impracticable; no two persons, and much less three or four, could work on the same line of rails. Mr. Haggard said that the railway companies could not have carried double the number of passengers in 1867, but he found that the average number in each train in that year was 90, and it would, he thought, be very difficult to persuade any one who knew anything about the power of an engine that more than double that number could not have been carried with hardly any extra cost. With reference to a remark of Mr. Allport, that the Belgian government were desirous of handing over the railways to private companies, he had very recently been informed by a Belgian gentleman that the result of the recent reduction of fares had been such as to prepossess the government very strongly in favour of the measure, and that a still further decrease was contemplated.

The Chairman, in proposing a vote of thanks to the reader of the paper, said:—Opinion is widely advancing on this question. In America it has been declared by a leading public man that they have had their conflict with the slavers of the South, and that their next battle for freedom and the public rights must be with the great railway companies. On the Continent, trading company management is becoming more and more unpopular. I need not describe the progress of opinion here. But since the subject was last discussed here, considerable progress in the recognition of principle has been made. The question of freedom of transit of persons and goods —of freedom from excessive charges—is a great free-trade question, which depends on principles of legislative and administrative reforms, which have been upheld here as necessary to art and science progress. Before adverting to the paper read this evening, I would congratulate the members on the sanction given by the Legislature since the subject was last discussed to those principles as they were here propounded. They were these. That all the means of transit and intercommunication should be under the control of the government on its exclusive responsibility, as a service to the public. We controverted the doctrines that any of these means could be properly given over to private trading companies, trading for a profit on the necessities of the people, or on the existing conditions in this country. We averred that the public highways, of which railways were a form, could not properly be made the subjects of trading competition. That such competition was and must be detrimental to the public interests, and injurious to the shareholders, who had, by derelictions of governmental duty, and by improper legislative sanctions, been induced to engage in them. We set forth that correct principles of legislation might be reverted to with advantage, and often with due reparation to the misled shareholders, as well as with advantage to the public. We pointed out that by unity of management, to be obtained by the resumption of governmental duties, savings might be effected, and a fund obtained, which might be divided between the public and the shareholders, that to the shareholders might be given compensation on recognised principles—that is to say, on the recognised principles of compensation for forced sales—and that to the public might be ensured increased accommodation at reduced rates. Now, these principles have been sanctioned by the Legislature in the case of the postal telegraph measure. They were resisted by railway directors in the House of Commons, especially on the ground that the measure was in principle a precedent applicable to their disestablishment. In that sense Mr. Bouverie did his best to thwart it. Mr. Grimston, the chairman of the largest company, made a fierce attack upon the measure, and in a pamphlet which was sent round to members of Parliament he indicated myself as the prime mover in it. The terms he demanded, twenty-four years' purchase, were not complied with. His opposition and that of the other directors was of no avail, and it was carried against them. The shareholders have reason to be satisfied, and in due time I have no doubt the public will be so too. But it is rather noteworthy that testimonials are being proposed to Mr. Grimston, as well as the other companies' chairmen and directors, for their exertions in behalf of the shareholders, who benefit by the change they contended against. Will their modesty allow them to accept them, and overlook any recognition of that labour to which they, or Mr. Grimston at least, ascribed it? The next step of progress in the recognition of the principle we railway reformers have contended for is the appointment of the Royal Commission to examine the Irish railways, and report on the terms of the purchase. This they have done as you may be aware. But, in my view of the evidence of such practical witnesses as the late Mr. Dargan, they greatly under-estimated the gains derivable from unity of management, whilst with reference to the experience of Belgium, I have stated that they greatly over-estimated the time in which a reduction of travelling rates to some 40 per cent. would be replaced. They considered that the revenue could not be restored in less than eleven years. Since

the Commissioners made their report, a yet greater reduction of rates than I believe they contemplated has been made in Belgium. I will cite an instance to show the extent to which that reduction has been carried. I will take an example of one line, that from Brussels to Ostend, which is 74 miles, and it may be compared with the rates on the London, Chatham, and Dover line, which is 78 miles. The fares on that line are—1st class, 20s.; 2nd class, 15s.; 3rd class, 13s. The Belgian fares were, from May, 1856, by express 1st class, 10s. 5d.; 2nd class, 7s. 5d. In May, 1866, these fares were reduced, for the 1st class, by express, 5s.; 2nd class, 3s. 4d.; 3rd class, 2s. 6d; and for the ordinary trains, 1st class, 4s. 2d.; 2nd class, 2s. 9d.; 3rd class, 2s. 1d. Or I may present another illustration, for the information of Ireland, and compare the rates from Dublin to Galway, which is 126 miles, with the Belgian rates for 130 English miles, from Ostend to Ans, a town not far from Liege. The Irish company rates are, for the 1st class, 22s.; the 2nd class, 17s.; the 3rd class, 10s. 6d. The Belgian government rates were, for the 1st class, 14s. 1d.; for the 2nd class, 10s. 7d.; for the 3rd class, 6s. 5d. Since May, 1868, these rates were reduced for the express train, 1st class, 6s. 1d.; for the 2nd class, 4s. 7½d.; for the 3rd class, 3s. 4d. For the ordinary trains, 1st class, 5s. 7d.; 2nd class, 3s. 8½d.; 3rd class, 2s. 9½d. Here is a reduction which railway directors and managers, including Mr. Allport, would be scared at, and would declare to be ruinous.

Mr. Allport—So it is; it is ruinous to the companies.

The Chairman—This is just what I expected. But here are the words of the Minister of the Public Works of Belgium, in his report upon the results of the change:—"If the tariffs applied since May the 1st, 1866, have occasioned a deficiency in the receipts of the state railway, that deficiency, which tends to disappear yearly, is far from being considerable." (It was £24,000.) "The accusations which have been made against the reform, as to the deficiency which it might have produced, or as to the prejudice it might cause to private companies, must now fall to the ground." In answer to the opinion cited of Sir D. Gooch, the following extract from a report of Messrs. Voelcker and Jenkins, on the agriculture of Belgium, may be cited:—"When a railway is opened in a new district in the Walloon country, what is the effect? A man can travel in Belgium 100 miles for half-a-crown, so the agricultural labourers go to the manufacturing districts in search of work, and get it, and in three months the rate of wages in the newly-created district will have risen 20 per cent. Think of the application of this tariff to the poorer districts of Ireland and the depressed labourers of markets." In the northern districts of Belgium the reporters state that the value of the land has augmented 30 per cent. within the last ten years of cheap state railway development. Much of the railway administration proceeds upon the vulgar economical fallacy that consumption is a fixed quantity, and a necessity upon which you may exact your own prices. "People only write the letters they are obliged to write, and, therefore you will only lose revenue by reducing the rates," was the ground of opposition to the penny post. Colonel Maberly declared that the revenue would not be replaced in some forty years. "Nobody travels, as a rule but those who are obliged to travel, and, therefore, you will get no more traffic if you reduce fares," is the fallacy of the common railway management, answered by the rise of consumption with the stimulus given to it as in the Belgian instances and others. Another vulgar economical fallacy that adheres to the directorates and managers, and which we have heard repeated to-night, is this: that, because the railways in this country have cost much, that therefore high rates must be charged for travelling upon them. Now the cost of construction, whether a road has cost a hundred thousand pounds or a penny, has nothing to do with the commercial question, and you pretend to manage the railways as commercial concerns. The commercial question is simply what fares pay the best. Now, here is a fact of large import, and a commentary on the fallacy in question—that the third class of passengers (the lowest rates) are increasing in profit; that the third class passengers throughout the country are not only the most numerous, but that, with very few exceptions, they now yield the largest revenue! The sooner these directorates and trading managements with these doctrines, which have so grievously failed commercially, which promised so much, and have yielded so deplorably little, are superseded, the better will it be for the shareholders and for the public. When I am mentioned as the authority of the gains derivable from unity of management, I wish to state that I did so on the authority of the late Captain Lawes, the manager of the Lancashire railways, who stated them at 20 per cent., and since his time the capitals and establishments for consolidation on the field of service have been multiplied. The late Mr. Stewart, the secretary of the London and North Western Company, stated the gains derivable from unity at 10 per cent. on the gross expenses, which would be 20 per cent. on the working expenses. The other day, Mr. Laing, the chairman of the London and Brighton line, in apologising for paying only 10s. per cent. of dividend, stated that if Parliament had allowed them to amalgamate with the South Eastern Company, the result would have been that the shareholders would have added 20s. to their dividends, and that it would have added more than a quarter of a million to their stock; and that was only in one corner of the field of railway service. Moreover, by the change contended for, a saving would be accomplished of exemption from local and general taxation. When you see such things as three trains running from the same place, to the same place, with through passengers from the same place to the same place, and with the trains only one-third full; when you see trucks only part filled on each line, it is then you have visible evidence of Mr. Stewart's foundation for what he said as to the great gains derivable from unity of management.

The vote of thanks having been passed unanimously,

Mr. Jones, in responding to the compliment, said he had not time to reply to all the observations which had been made, but he must make a remark or two on what had fallen from Mr. Allport. He could not believe that whatever the number of trains run, the cost per train mile would still remain 2s. 4d., since taking as his authority the report of the Royal Commission, that figure was partly made up of cost of management, stamps for debentures, bad debts, rates and taxes, miscellaneous taxes, fire insurance, and other matters which would not be at all increased if ten times the number of trains were run.

Mr. Allport asked what proportion these things bore to the gross working expenses.

Mr. Jones said he had not taken that out, but the figures given by Sir Daniel Gooch before the Royal Commission were—Fuel, 1·71d.; wages of engineman and fireman, 1·49d.; wages of cleaners and coke-men, 0·43d.; oil, tallow, and sundry expenses, 0·28d.; water, including pumping-engines, 0·18d.; making together, 4·09d., which, he said, was the cost of running a Great-Western engine. A great deal had been said about the cost of the railways in the first place, but that, as having any bearing on the question of fares, was absurd on the face of it. The manufacturers who sold their goods the cheapest were those whose establishments cost most to build. As he had stated in his pamphlet, some of the large drapery establishments in St. Paul's-churchyard would let for £13,000 per annum, and yet the proprietors sold calico at a less price than small shopkeepers who paid only £50 a-year. And it would be the same with railways; whereas at present

they had all the appliances of the wholesale trader, and were doing the business only of the retailer. If they would adopt the wholesale rate, they would get the wholesale profit, while the expenses of plant and management would remain much the same. As to the assertion that the cost per train mile would be the same if three times the number of trains were run, he could adduce the evidence of several railway managers before Parliament, Mr. Stewart amongst others, to show that were the number of trains increased, the cost would be materially diminished. With regard to the profit attending on a reduction in price, it was only necessary to instance the case of the gas lighting. Some years ago the price charged was 12s. per thousand, and at that rate a dividend of about 4 per cent. was paid, and of course they said they could not reduce the price on account of the enormous capital they had sunk in plant, machinery, mains, &c. Now, however, the price was brought down to 4s., and the shareholders were getting 10 per cent. instead of 4, and it was expected that before long the price would be 3s. 9d., and the dividend still further augmented. He could only repeat his decided conviction that if the railway companies did not make a large reduction in their scale of fares, some other mode of travelling would be adopted, which would be a matter of regret to all parties concerned.

ANNUAL INTERNATIONAL EXHIBITIONS OF ART AND INDUSTRY.

The following is a list of the trades connected with pottery, woollen, and worsted manufactures, each of which is eligible to exhibit productions in the first Exhibition, in 1871:—

List of Trades in the United Kingdom connected with the Manufacture of Pottery.

MANUFACTURERS.

Brick and tile makers.
Brown stone potters.
Chemical potters.
Chimney-top manufacturers.
China and earthenware manufacturers.
China gilders.
China menders.
China riveters.
China and porcelain door furniture makers.
China and porcelain manufacturers.
China drillers.
China figure manufacturers.
China ornament makers.
China painters and gilders.
China toy makers.
Drain-pipe and tile makers.
Earthenware figure manufacturers.
Earthenware manufacturers.
Egyptian black-ware manufacturers.
Encaustic tile makers.
Fancy jug manufacturers.
Fire-brick makers.
Jug manufacturers.
Melting-pot and crucible makers.
Muffle manufacturers.
Parian manufacturers.
Plumbers' pottery makers.
Porcelain letter makers.
Porcelain manufacturers.
Potters.
Potters' engravers.
Rockingham ware manufacturers.
Stone-bottle makers.
Stone mortar and pestle manufacturers.
Stone potters.
Stone ware manufacturers.
Terra cotta manufacturers.
Tobacco-pipe makers.
Vase manufacturers.

PRODUCERS AND PREPARERS OF MATERIAL.

Ash merchamts.
Chert stone dealers.
China clay merchants.
Clay merchants.
Flint millers.
Manganese merchants.
Marble clay merchants.
Pipe-clay manufacturers and merchants.
Zaffre refiners.

MAKERS OF MACHINERY.

Brick-makers' implement manufacturers.
Brick mould makers.
Grinding mill makers.
Kiln builders.
Machinists in general.
Pug mill makers.
Potters' wheel makers.

List of Trades in the United Kingdom connected with the Manufacture of Woollen and Worsted Fabrics.

(*a*) WOOLLEN TRADES.

Army cloth manufacturers.
Baize manufacturers.
Beaver cutters.
Billiard table cloth manufacturers.
Blanket manufacturers.
Blanket yarn spinners.
Cloth dressers.
Cloth drawers.
Cloth embossers.
Cloth factors and merchants.
Cloth finishers.
Cloth frizzers.
Cloth fullers.
Cloth manufacturers.
Cloth millers.
Cloth printers.
Cloth waterproofers.
Cloth workers.
Cold pressers.
Doeskin manufacturers.
Domett manufacturers.
Drugget manufacturers.
Drugget printers.
Dyers and scourers.
Felt makers.
Felt printers.
Flannel agents.
Flannel factors.
Flannel manufacturers.
Flannel printers.
Flock manufacturers.
Flushing manufacturers.
Fulling millers.
Horse cloth manufacturers.
Hot pressers.
Ironing cloth manufacturers.
Kersey manufacturers.
Machine cloth manufacturers.
Mantle cloth manufacturers.
Mourning hat band makers.
Mungo merchants.
Navy clothiers.
Painted baize makers.
Pianoforte hammer and damper cloth manufacturers.
Plainback manufacturers.
Printers' blanket manufacturers.
Pulp cloth manufacturers.
Railway wrapper manufacturers.
Regatta manufacturers.
Roller clearer and ironing cloth manufacturers.
Saddle cloth makers.
Scribbling millers.
Shag manufacturers.
Ship felt makers.
Shoddy manufacturers.
Table cover manufacturers.
Tweed manufacturers.
Upholsterers' woollen manufacturers.
Vesting manufacturers.
Wool carders.
Wool sheet manufacturers.
Woollen agents.
Woollen carpet manufacturers.
Woollen carpet yarn manufacturers.
Wollen cashmerett manufacturers.
Woollen cloth manufacturers.
Woollen cloth waterproofers
Woollen dyers.
Woollen factors.
Woollen flock manufacturers.
Woollen flushing manufacturers.
Woollen listing manufacturers
Woollen manufacturers.
Woollen rug manufacturers.
Woollen spinners.
Woollen stripes manufacturers (Spanish).
Woollen tweed manufacturers.
Woollen waistcoating manufacturers.
Woollen waste dealers.
Woollen weavers.
Yarn manufacturers.

(*b*) WORSTED TRADES.

Alpaca manufacturers.
Alpaca spinners.
Band and galloon makers.
Bell rope makers.
Berlin wool manufacturers.
Bombasin manufacturers.
Braid makers.
Bunting manufacturers.
Carpet manufacturers.
Carpet pattern designers.
Carpet planners.
Carpet weavers.
Carpet yarn manufacturers.
Cashmere manufacturers.
Cashmerett manufacturers.
Challis manufacturers.
Chenille manufacturers.
Coach lace manufacturers.
Coach trimmers.
Coach upholstery and trimming manufacturers.
Damask manufacturers.
Fringe and lace makers.
Galloon and double makers.
Girth web manufacturers.
Hearth rug makers.
Lamb's wool manufacturers.
Lasting manufacturers.
Lindsey manufacturers.
Livery lace makers.
Machine combers.
Merino manufacturers.
Merino spinners.
Military embroiderers.
Military sash makers.
Mohair manufacturers.
Moreen makers.

Mousseline-de-laine manufacturers.
Poplin manufacturers.
Railway woven badge manufacturers.
Rug manufacturers.
Satteen manufacturers.
Serge manufacturers.
Shalloon manufacturers.
Shawl, border, and fringe manufacturers.
Shawl cleaners.
Shawl darners.
Shawl manufacturers.
Stuff finishers.
Stuff manufacturers and agents.
Tassel manufacturers.
Trimming manufacturers.
Upholsterers' trimming manufacturers.
Waistcoat manufacturers.
Web and webbing manufacturers.
Wool combers.
Woollen cord manufacturers.
Woollen stuff manufacturers.
Worsted dyers.
Worsted manufacturers.
Worsted spinners.
Worsted waste dealers.
Yarn manufacturers.

NOT CLASSIFIED.

Blackwell-hall factors.
Calenderers.
Embroiderers.
Embroidery designers.
Fent dealers.
Gunney bag makers.
Listing manufacturers.
Machine habit manufacturers.
Plush manufacturers.
Stripes manufacturers.
Zebra dress manufacturers.

Trades engaged in the Production or Preparation of the Materials used in the Manufacture of Woollen and Worsted Fabrics.

Alkali manufacturers.
Alpaca wool merchants.
Alum manufacturers.
Ammonia manufacturers.
Annato manufacturers.
Aquafortis makers.
Arsenic manufacturers.
Bleaching liquid makers.
Bleaching powder makers.
Blue manufacturers.
Blue verditer makers
Camel hair merchants.
Carmine makers.
Chemical colour makers.
Chloride manufacturers.
Cobalt refiners.
Colourers.
Colour manufacturers.
Copperas manufacturers.
Creosote manufacturers.
Cudbear makers.
Dye manufacturers.
Garacin manufacturers.
Goat's hair merchants.
Indigo blue manufacturers.
Indigo extract manufacturers.
Indigo manufacturers.
Indigo refiners.
Manganese merchants.
Merino wool merchants.
Mecklenburgh blue makers.
Mohair merchants.
Mordant makers.
Ochre manufacturers.
Oil of vitriol manufacturers.
Orchil and cudbear manufacturers.
Smalt manufacturers.
Soda ash makers.
Soda crystal manufacturers.
Soda merchants.
Spirits of salt manufacturers.
Sulphate of ammonia manufacturers.
Sulphate of barytes manufacturers.
Sulphate of copper manufacturers.
Sulphate of soda manufacturers.
Turpentine distillers.
Ultramarine manufacturers.
Vitriol manufacturers.
Washing compound makers.
Washing crystal manufacturers.
Wool factors.
Wool merchants.
Wool staplers.
Zaffre refiners.

Trades Engaged in the Production of Machinery and Apparatus used in the Manufacture of Wool and Worsted Fabrics.

Bobbin manufacturers.
Bobbin turners.
Card machine makers.
Card makers.
Card teeth makers.
Cloth press makers.
Flyer makers.
Fork manufacturers (weft)
Gear and slay makers.
Hackle and gill pin manufacturers.
Hackle makers.
Heald and slay makers.
Heddle makers.
Jacquard card cutters.
Jacquard harness mounters.
Jacquard machine makers.
Loom makers.
Loom mounters.
Loom passers and twisters.
Machine joiners.
Machine makers.
Reed and slay makers.
Shuttle makers.
Shuttle tip makers.
Spindle makers.
Spinner flyer makers.
Tassel and fringe mould turners.
Teazle rod manufacturers.
Weavers' harness makers and enterers.
Weavers' joiners.
Weavers' leash makers.
Weavers' loom makers.
Weavers' mail makers.
Weavers' turners.
Winding frame makers.
Wool burring machine makers.
Wool card makers.
Wool comb makers.
Woollen card makers.
Wool drying machine makers.
Woollen machine makers.
Wool scouring machine makers.
Woolley teeth makers.

EDUCATIONAL NOTES.

The Central Executive Committee of the League have published the following amendments, which they believe to be necessary in order to render the Education Bill a complete and satisfactory measure:—

1. School Boards to be established in all districts, instead of only in those districts in which education is declared to be unsatisfactory after inquiry by the Privy Council.

2. Such Boards to be elected immediately on the passing of the Act, and to be required to provide, without delay, for the educational necessities of their districts.

3. In districts not included in boroughs, School Boards to be elected by the ratepayers generally voting by ballot.

4. Compulsory attendance of children at school to be made imperative, instead of being left to the discretion of School Boards.

5. Admission to schools established or maintained by School Boards to be free.

6. No creed, catechism, or tenet peculiar to any sect, to be taught in schools under the management of the School Boards, or receiving grants from local rates. In all other schools receiving government aid, the religious teaching to be at a distinct time, either before or after ordinary school business, and provision to be made that attendance at such religious teaching shall not be compulsory, and that there shall be no disability for non-attendance.

The Committee has drawn up a form of petition to Parliament in accordance with the above amendments, which they hope all branches of the League will adopt.

Various meetings of the League have been held in the provinces. The Devonport branch, at a recent meeting, while recognising the great merits of the Government Bill, unanimously came to the conclusion that it ought to come into operation sooner than proposed, and that school boards should be established in every district, with power to compel attendance. Every school supported by rates, it was urged, ought to be free, and the clause giving power to boards to decide the religious teaching to be adopted was condemned. At Tipton and at Leicester public meetings condemned the provisions for permissive compulsion, school fees, and denominational instruction. At Chester, a meeting, at which clergy of various denominations were present, passed resolutions approving the machinery and many provisions in the Government Bill, but adverse to the conscience clause and in favour of making compulsory attendance imperative and not permissive, and the teaching absolutely undenominational; and meetings at Leeds, Carnarvon, and Brighton expressed similar opinions.

Mr. George Howell has been addressing a conference of Trades Unionists at Halifax, at which it was resolved that no scheme would be satisfactory to the people unless it was compulsory, unsectarian, and free.

An important meeting of representative Nonconformist ministers and laymen, held at Birmingham, was unani-

mous as to the objectionable character of the clauses relating to religious education, and resolutions were passed specifically condemning the proposal to entrust to local boards the power of deciding whether any and what religious teaching shall be given in a rate-aided school, and also the examination of schools in religious knowledge by a government inspector.

Lord Shaftesbury, in a recent address at the Bermondsey Ragged Schools, spoke favourably of the Government Bill, which he thought had been framed in an excellent spirit. He very much feared, however, that it would dry up the sources of voluntary contributions. He hoped it would never be declared by any school board that the Bible should not be admissible. He believed it to be the wish of the government that the Bible should be introduced; at any rate, he knew it to be the wish of Mr. Forster, who had told him he would rather cut off his right hand than be a party to the Bible not being admissible into such schools.

The clause in the Bill which seems to have provoked the most criticism is that for "permissive compulsion." The views of Mr. Fawcett on this point were quoted last week. Canon Girdlestone, in a letter to the *Daily News*, after arguing generally against permissive legislation, says:—"If the adoption of the compulsory principle be left, as Mr. Forster proposes, to the decision of the very parties who up to this time have, with a view to their own gain and convenience, in some instances forced—in all encouraged—the parents to send their children to work when they ought to be in school, what prospect is there of its being adopted at all? There are always enough people interested in keeping things as they are, and in maintaining abuses, to make permissive legislation inoperative. If every child of proper age to be at school were compelled to be there, our school-rooms would be well filled, our school funds much replenished, the working classes, who, in self-defence, desire compulsion, greatly pleased, and education universal. Indirect compulsion, by means of a certificate of attainment before license to work, would, to a certain extent, produce the same effect. But permissive compulsion, or, if such a term be admissible, non-compulsory compulsion, is a delusion and a snare."

A correspondent of the *Pall-Mall Gazette* says, on the same subject:—"How many members of the educational boards will have the courage, how many the wish, to compel the attendance at school of boys between nine and twelve, when they are both free not to compel the same and are also inclined to add to the wages of their own *employés* the two or three shillings a-week which a boy can earn? It must be borne in mind that this bill is the last (and best) hope of improving the condition of the agricultural labourer; and this has to be done, not only by excluding the ruinously cheap labour of half-grown babies, but by making the rising generation of farm-labourers worth—what the present very possibly is not—wages which will support a family."

The mode in which the Bill deals with the religious difficulty is naturally another subject for comment. The *Times* forcibly puts the objections to the power granted to the school boards to set up denominational schools; not "a separate denominational school for every denomination, but to choose one or two of the strongest, and give them the whole education of all the children in the district," and compares this plan to "a system under which each of our parishes was to be put under an elected board, who should give the pulpit to any denomination they liked, provided only that nobody was excluded from the worship; and the sacraments were free to all denominations. If Mr. Forster can picture to himself the sectarian strife which such an arrangement would cause, he will have a pretty vivid notion of what will take place all over England if the national school is to be the school of a sect, and the sect that is to have the school is to get it by fighting for it." "A Radical Squire," writing to the *Daily News*, maintains that in country parishes, Mr. Forster's plan, which will practically leave education in country parishes in the hands of the ministers of religion, who he maintains are the "only people in such parishes who care for promoting education," will be found to be the best, and he thinks "that the machinery of boards of farmers and government inspectors is a miserable substitute for that of the parish clergy and their families."

It is remarkable how decidedly the secular system finds approval in most of the colonies. The *Times* correspondent in New South Wales, says:—"So far as the rival claims of secular and denominational education are concerned, the result of the elections is decisive. Not a single candidate has ventured to claim support on the ground of his preference for denominational education."

It is reported that the establishment of classes for girls at Cambridge has proved remarkably successful. Upwards of fifty daughters of local tradesmen have availed themselves of the opportunity of receiving instruction from the most distinguished professors at the University. The lectures are a repetition of those which are delivered as part of the University course. It is probable that several scholarships for girls will be established at Cambridge.

PAYMENT OF SCHOOL FEES.

The following are extracts from the Report of the Select Committee of the House of Commons on the state of education in 1834. Unanimous evidence is given by all witnesses in favour of school fees being required from the children.

The Rev. W. Johnson, Superintendent of the National Society's Central School, states:—

"197. You have stated that in some of the schools a payment is made by the parents of the children. Do you happen to know that those schools where a payment is made are more popular than the others?—I think that does not affect the number; schools vary in number in exact proportion to the care and pains taken by the master and mistress, and the success attending the instruction given; if the school be neglected, numbers invariably fall off; I could point out some instances of that.

"198. Where instruction is given, is it not more valued by parents where payment is received than where it is not?—I am inclined to believe that it is more valued; and I think if the National Society were to be formed again, it is probable that all children might be required to pay. It is keeping up the honourable independence of the English labourer. The money could be well spared, as the very poorest of the children have been in the habit of spending upon trash and sweetmeats at least a penny a-week.

"199. Therefore you are not of opinion that a small payment of that kind being required prevents the poorest classes from attending the school?—No, the poorest children that I have seen have their spending money; and about eighteen years ago, in Baldwin's-gardens, I made a careful inquiry and search into the habit of spending this money. Our numbers were at that time much larger than since district schools have been established, which have of course reduced them. We had then a thousand children, and each of those children spent a penny a-week, which forms a considerable sum at the end of the year. I have reason to believe that those scholars altogether, on an average, did not spend less than at the rate of £250 a-year.

"200. How did you ascertain that?—By inquiring of them—'How much money did you spend last week?' and they told me.

"201. And you made that estimate?—I followed it up till I saw how much they spent; some spent more and some spent less, and the average was certainly a penny; some had two-pence.

Mr. Henry Dunn, secretary to the British and Foreign School Society, states.—

"285. What proportion of the whole number of schoolmasters are partially paid by the children's pence?—A very large proportion; the number is increasing every day.

"286. Is it found that that plan has ultimately succeeded?—Except in very poor agricultural districts. In the towns it has generally succeeded; but I fear that in some instances it may have shut out the children of those who are very careless as to the instruction of their offspring. We endeavour to guard against this as much as possible, but we think we have observed that, since the pay system has been adopted, while the children have attended more regularly, and education has been more prized, the scholars have rather risen in rank, that they have been a grade higher.

"287. Is the sum required of each of the children a penny or twopence?—In our central school it is twopence a-week for each of the children, but only fourpence is charged when three come from one family. In some schools in the country a penny is received; in others, three half-pence; and, in some few, threepence, but we think threepence too high.

"301. Have you not found, on the whole, that the lower orders are satisfied with the system of contributing weekly for the education of the children?—I think that the more respectable of the lower orders prefer it; they do not like the idea of a charity school.

"302. Have you not, on the whole, found that, since the pay system has been introduced, they have increased rather than diminished in number?—I think the attendance of the children has been more regular; but, as I stated before, I fear that in some instances the lowest grade of the population may have been excluded without our being aware of it.

"303. You know that there are some schools where a penny a-week is contributed?—Yes; but when a parent is very careless as to the education of his child, a very slight excuse will be sufficient for retaining him at home; still, on the whole, I should decidedly prefer a well-regulated pay system to one altogether gratuitous."

Professor Pillans states:—

"448. Do you consider that it is better that education of that kind in the primary schools should be gratuitous, or that there should be a small payment?—I think it decidedly better that there should be a payment.

"449. Upon what grounds?—Upon the general ground that people value little what they do not pay for, and also upon the evidence of experience. The gratuitous system was tried in Edinburgh when the Lancasterian school was first established, and it was uniformly found that, where the attendance was gratuitous, the proportion of absentees was prodigiously increased. At last all those interested in the matter came to the conclusion that payment was indispensable to secure attendance, and if any instances occurred, as happened of course not unfrequently, of parents who were unable to advance even the small sum required, 1d. or 2d. per week, the committee of management issued it to the parents in order that the child might come and pay with the rest on Monday morning. At this moment, the master of the original Lancasterian school at Edinburgh (which is admirably taught, and one of the best examples of popular instruction, well conducted, that I know anywhere), is paid entirely by the contributions of the children; he has no other payment but the 2d. a week, and he is himself the collector of it."

"450. What is the amount of that payment?—His school is frequented by about 300; he makes a tolerable income as compared with others in the same profession; perhaps £100 or £120 a-year."

"451. In the parochial schools in Scotland do they all pay, or are there some that receive gratuitous education?—They all pay; there are certain schools where legacies are left, upon condition of teaching a certain number of scholars; and in all the parish schools, I believe, the clergyman has the power of recommending a certain number of children, whose parents are too poor to pay, for gratuitous instruction."

The Rev. J. C. Wigram, Secretary to the National School Society, states:—

"815. Do the majority of their children pay for their education?—A very great number pay a penny a week in the schools throughout the country.

"816. How long has that system of payments for instruction been introduced?—Upon the paper I laid before the Committee there is a date of the Society's formal recommendation of it. I think it was in 1826.

"817. They do not pay at the Central School?—They do not, because it was originally called a free school, and we proposed to carry it on upon the same principles.

"818. At your school by Golden-square do they pay?—They pay a penny a week for schooling.

"819. It appears that an opinion is expressed by others that the system of requiring small payments is acceptable and useful?—It is so.

"820. Is it your opinion that the system of demanding a small payment from the parents is preferable to gratuitous instruction?—Certainly.

"821. What are the good effects produced by that system?—I think the parents value it more, and I think it places the managers upon a better footing with reference to the parents being obliged to acknowledge some sort of obligation; it also helps out the resources of the school.

"822. Do you find it deters many parents from sending their children?—In my own school, I now and then hear of a case; the parents get a few weeks in arrear, and I generally get some of the parishioners to call and help them if they are deserving persons, and give them sixpence or a shilling to pay up their arrears, not as from myself.

"823. Do you find many instances in which the parents are too poor to pay, and are consequently deterred from sending their children?—It is very rarely that the excuse is made, and I should think it is very rarely the case, if at all.

William Allen, treasurer of the British and Foreign School Society, states:—

"990. Suppose you were to insist that the children generally, with the exception of very few who might be utterly unable to do it, should pay 1d. per week, do you not think it might have the effect of making them wish to go to school, more than when you gave them instruction gratuitously?—I think so, and I have it in contemplation to do that—to say that I will not take them without, even although I give them the money to bring them to the school.

Mr. J. C. Crossley, the Master of the British and Foreign School, states:—

"1104. Have you found the requiring a small payment from the parents to have any effect upon the regularity of the attendance?—I think that has a favourable effect; parents do not like to pay 2d. a-week without having two pennyworth of instruction for it; but in some cases I think that 2d. will exclude children; I think that 1d. would not.

"1105. Would you recommend to increase that as the child advances in the school, and begins to use copy-books?—No; the parents' means should be the standard; the expense to the parents in supporting a boy of 11 years of age is more than a boy of five or six. I may mention that in our school two children of the same family pay, but all beyond that number are free."

Mr. William Cotton, a member of the General Committee of the National Society, states:—

"1897. In the statements that have been made with regard to promoting schools, one difficulty has been said to arise from their maintenance when established. Does the National Society make grants towards masters'

salaries, or how does it recommend that the annual expenses should be made up?—It is one of the great difficulties; the society has, under particular circumstances, assisted in a small degree, and it is stated in the report; but they have also recommended that the children should themselves contribute towards the expenses of education by a small weekly payment, and in many cases the expense of maintaining the school is materially reduced by the schoolmaster being the officiating parish-clerk, and obtaining employment in other ways."

The Rev. Samuel Wood, secretary of the school on the British system in Harp-alley, states:—

"2019. Is any payment required of the parents of children?—Yes; 2d. per week.

"2020. Have you had the means of observing whether that has any effect in increasing the regularity of attendance, or the value that the parents set upon this instruction?—It has had that effect. At first the 2d. per week was taken only from those children who were supposed to be able to pay it, but in the year 1820, in consequence of the very small sum thus collected, and a diminution in the school funds, the 2d. was absolutely enforced from every scholar, and the numbers steadily increased for several years from that time. The master has little or no trouble in obtaining the 2d. I have frequently asked him the question, and he says if a boy does not bring his 2d. on a Monday morning he generally sends him back for it immediately; and the parties, finding that they are subject to that annoyance if they do not send the money with the children on the appointed day, generally pay it on the appointed day.

"2021. Of what class of society are the parents?—The lowest class. In general our boys are well dressed for poor boys; but from the inquiries I have from time to time made into the circumstances of the parents, I believe they are quite of the lower class, with the exception of some few; and I believe I am warranted in stating that the reason why these few parents, who, rather of a superior grade, send their children to the schools is, because they consider that the instruction which we afford is better than what is given in schools where they have paid as much as 6d. or 1s. a week.

"2060. You state that you thought it was a decided advantage to have this small payment to the master from the children?—Yes.

"2061. Do you conceive, from your experience of the description of the class of children who come, that a payment of that kind would not prevent parents of the lowest description from sending their children to school then—do you think there is that desire for education that they would make that sacrifice?—I believe in some few instances the sacrifice is felt; but I am disposed to think the parents do value the education, and that they make an exertion to pay the 2d., for we have no difficulty in collecting it, even from the poorest.

"2062. You extend the remark to the lowest class?—Yes, we find that those whom we have reason to believe the poorest pay as regularly as the rest.

"2067. Have you any children of parents of the very lowest class who are labouring men?—Yes.

"2068. And you find generally that they are equally punctually in their payment with those of a higher class?—Yes.

"2070. You think, generally speaking, for the peasantry and the labouring classes, that 2d. a week would be rather too high?—In some parts it might, but not in many."

The Rev. W. Wilson, Vicar of Walthamstow, states:—

"2189. Do the parents generally find their children benefited?—Yes, I believe so. It is quite voluntary on their part to send the children. In fact, a penny per week on each child has been lately required of them. They would, of course, have withdrawn their children if they had not valued the instruction given to them.

"2190. Since the penny has been charged, has there been any falling off in the attendance?—Not in the regular attendance I think. Of the number on the list there has been a falling off, but I think the number in actual attendance has been as great.

"2191. There is a greater regularity of attendance?—Yes, and there is in the other schools also, where a similar change has lately been made.

"2192. Did you receive complaints from the parents?—In two or three instances, at first, they withheld their children from school, hoping that some alteration would be made; but they have now almost universally sent them again."

The Lord Bishop of London states:—

"2453. Is it your lordship's opinion that the parents of the children should be required to pay in part for their instruction?—I am quite clear that it is desirable in all cases, and for the following reason, that the poor set a value on that which they pay for; and although, perhaps, a penny or twopence a week may be no exact value of the learning their children acquire, yet they do not like them to lose any part of that which they pay for, and the consequence is, they are much more punctual and regular in their attendance, not to mention the general principle that it promotes a proper spirit of independence in them to let them purchase what is valuable where they can, rather than give it to them quite gratuitously. Where education is given quite gratuitously to the poor, I have almost invariably found that they consider themselves conferring a favour on the clergyman by letting their children go to school; but where they pay for it themselves, they all seem to set a greater value on the education so purchased. Another advantage, of course, is that the payments form a very considerable addition to the funds which are otherwise raised. With respect to the parents' readiness to pay, I find this to be the case, not only with regard to schools for older children, but remarkably so with regard to infant schools."

The Rev. James Carlisle, one of the Commissioners for Education in Ireland, states:—

"2550. Do you think it advisable or otherwise that the parents should be required to pay some small contribution for children who attend the day-school?—My own opinion is that they ought to be required to pay something. There are different practices in that respect throughout the country, and we have not made any peremptory rule upon it. Generally speaking, the Roman Catholic clergy seem disposed to give education gratuitously, and those of other denominations to make some charge for it."

SCHOOLS FOR IDIOTS AND IMBECILES.

THE EARLSWOOD ASYLUM, REDHILL, SURREY.

By George C. T. Bartley.

The training and improvement of those children who by nature are deficient in intellectual power, must always be a slow and difficult task. Schools for this special purpose exist at Earlswood, Surrey, for 291 children; and in Scotland, at Baldovan, for 26 boys and 10 girls; at Larbert, for 25 boys and 23 girls; and at Columbia-lodge, Liberton, for 6 boys of a somewhat superior station in life. Others are in course of formation, one at Lancaster and the other near Birmingham. All establishments for idiots and insane persons in England and Wales are under the inspection of the Commissioners of Lunacy, who report annually to the Lord Chancellor. Those in Scotland are inspected by the General Board of Commissioners in Lunacy for Scotland, who report annually to the Secretary of State for the Home Department.

The institution at Earlswood was commenced in the year 1847. It provides for several classes of patients, a large number being adults, who are placed there by their

relations to be taken care of, their entire cost being defrayed by those who send them; others are partially paid for by private persons; whilst others, who must not be paupers, are admitted entirely from charity, after an election among the subscribers to the institution.

The object of the present paper is to touch only on the institution as a school for the improvement of a certain class of the community, which is unfortunately of formidable dimensions, namely, idiots. The importance of the subject, and the value of a sound system which can in any way alleviate this great evil, may be judged from the fact that no fewer than 60,000 persons in the United Kingdom come under this category.

The Earlswood Institution, in the year ending March, 1869, provided for 291 pupils, that is, 164 boys, of whom 18 were infants, and 127 girls. The greater number of the free cases remain for five years, and are then either re-elected for another period of five years, or for life, or are sent back to their friends, the latter being by far the more numerous body.

The educational system consists of an intellectual, a physical, and an industrial training. To a considerable extent, the half-time method is adopted, a number of the inmates attending school in the morning and industrial work in the afternoon, and *vice versâ*.

Concerning the Boys.—The subjects of instruction are, reading, writing, arithmetic, shopkeeping, drawing, telling the time by the clock, besides speaking, deaf and dumb signs, learning their own names, dressing, finger lessons, &c. The reading, writing, and counting, are, however, subordinate subjects of instruction, as with most of the pupils considerable time has to be devoted to co-ordinating the muscular movements, without which all attempts at industrial work would be impossible. To do this, a number of finger exercises are made use of; the pupils are put through drilling and gymnastic exercises, and other training calculated to bring into use the various muscles of the body, which in many cases have never been developed in infancy, as with ordinary children. When they are a little advanced, and begin writing and drawing, these subjects even may, to a considerable extent, be considered as muscular exercises. It will be seen from the above list the dreadful mental condition of many of the children. In speaking, it is found that, of 164 without any physical infirmity, 16 cannot speak at all; 30 can only utter a few sounds; 36 can speak indistinctly; 64 can speak fairly. In the knowledge of common subjects, such as coins, &c., but 24 know all the coins and weights, and can calculate a little; 23 know all the coins and some weights; 23 know a few coins and weights; 29 know only a few coins; 47 know none at all. As regards reading, 20 only can read fairly; 20 can read by spelling the words; 16 know nearly all the letters; 39 know a few letters; 51 know none of the letters.

In the use of the clock the greatest ignorance prevails. Eight can tell the time to a minute; eight can tell the hours and five minutes; twelve can tell the hours; fourteen can tell some of the hours; five know twelve o'clock; ninety-nine cannot tell the time at all.

The discipline of the school may, perhaps, be regarded as one of the most valuable means of training and consequent improvement, order, regular habits, and systematic obedience having a powerful influence on the weak intellects of the inmates.

Arithmetic is also a subject which presents great difficulty to the students; some, up to eighteen or twenty years of age, after considerable teaching, finding it impossible to add two or three figures together.

The school is divided into six classes, according to the mental attainments of the pupils, and each class receives three lessons a-day. During the time between each lesson, the whole of the pupils receive collective instruction in singing, drilling, and other subjects. The shop lesson is a favourite, though, to see the boys attending it shows how few have any idea of the most common usages of everyday life. The table is arranged with a pair of scales, and a number of drawers, containing a supply of articles in most frequent use, such as tea, sugar, barley, rice, &c., each drawer being distinctly labelled. A number of shillings, half-crowns, pence, and other coins are on the table, and one boy keeps shop. The others come by turn and make believe to buy any article they fancy, which the shopman then weighs out, and receives payment, giving the required change, as in an ordinary transaction.

The industrial training of the boys is commenced as soon as possible after they enter the establishment, that is, when they are physically capable; everyone does at least 2½ hours work a day, the greater number being mat-makers, or employed in picking the fibre for the more advanced mat-makers. Twelve boys are constantly employed on the farm, and many others during the hay-making season. The shoes and cloth clothes are made on the premises; a large part of the washing, baking, gardening, and general house-work is also performed by the boys themselves. In some few cases, sufficient progress is made, particularly among the carpenters, mat-makers, and shoemakers, to enable the child, in a year or two, to earn nearly sufficient to pay the expenses of his keep, though few would be engaged by an ordinary employer, as they generally have some peculiarity which would render them unfit for such employment.

Concerning the Girls.—The general instruction to the girls is, with the exception of industrial training, very similar to that of the boys. Their condition may be judged of from the fact that, of 148, 11 hem and sew well; 18 hem very fairly; 34 hem indifferently; 6 can do fancy work; 76 cannot work at all. 66 can use knife and fork; 24 can use spoon and fork; 48 can use spoon; 7 have to be fed.

The household lessons, as they are called, are looked upon with greater interest than most others. The school-room has the appearance of a kitchen, with dresser, cups, saucers, plates, &c. The girls are then instructed in the way of laying the cloth, waiting at table, clearing away, and washing-up the tea things, &c.

It is found to be more difficult to provide occupation suited to the female pupils than for the boys, and comparatively few are fitted for household duties and needle-work. In all cases where it is possible, the cooking, and ordinary kitchen duties are done by the girls, as also the bed-making and scrubbing of the establishment.

The cost of the school it is not easy to separate from the general institution. The whole expenditure, without any allowance for rent, in 1868, was £22,849 7s. 8d. for the 472 residents. This gives an outlay of £48 8s. per head per annum. Of this sum, no less than £3,000, or £6 7s. per head, is spent in the necessary advertising and collecting machinery, and although this must of course be considered, yet it hardly forms a part of the cost of the educational system. Those who are at school are not quite so expensive as the older patients, many of whom are in a superior position, and pay for their own charges; and it is estimated that the cost of these 291 pupils, not counting the item above for collecting, is about 13s. 6d. per head per week, although it must be borne in mind that mental deficiency implies frequently constitutional debility as well, involving liberal diet stimulants, with frequent medical assistance, yet the cost, even making these allowances, and estimating for he extra supe rintendence required, is considerable.

(*To be continued.*)

CORRESPONDENCE.

CAPTAIN O'HEA'S PAPER ON "SMALL ARMS."

Sir,—I regret not having been able to reply earlier to Mr. Chadwick's clear and pertinent questions, relative to my paper, in the *Journal* of the 18th February. In reply to

the first question, "How much does invention, so far as it has gone, give to offence, and how much to defence?" in my estimation, the present advanced stage of invention in small arms and ammunition gives to defence four, or even five, as to one to offence. I give my reasons for this estimate. An attacking force would have to pass over a certain exposed space, say at least 150 yards, before closing with a defending force. It would take about a minute to do this distance, that is, giving 50 yards for a charge. During the advance, the offensive body could not delay to fire, but would receive at an average ten rounds from the defensive, and that within a distance where the greater number of rounds, elevation only considered, ought to tell. The result is obvious. With such odds in favour of defence, advantage would of course be taken of darkness to make an attack; this might lower the above estimate as regards the effect of the arm. With reference to Mr. Chadwick's second question, "Will charges of cavalry or infantry be any longer practicable?" I consider charges of cavalry or even of infantry no longer practicable, so long as there is a supply of ammunition available; therefore it was for this reason that I advocated in my paper a cartridge-case capable of being repeatedly reloaded by the soldier, with a simple reloading instrument, which would render the use of expensive machinery unnecessary, and by making every soldier his own cartridge maker, ensure an ever-ready supply of ammunition, wherever powder, ball, &c., were obtainable, and obviate the necessity of depending for a supply of ammunition on a distant source.—I am, &c.,

John B. O'Hea.

28th February, 1870.

SATISFACTORY GUNS.

Sir,—In moving the Navy Estimates, on February 28, the First Lord of the Admiralty stated that the service 12-ton and 25-ton guns were "satisfactory." What does "satisfactory" mean? The 12-inch 25-ton gun fires only 67 lbs. of powder, and uses only a 600 lb. shell, because the authorities do not dare to put more work upon it; but if it were as "satisfactory" as science could make it, it ought to fire at least 116 lbs. of powder, and to discharge a shell of at least 730 lbs. Self-satisfied as authority may be, practical science is very far from satisfied.—I am, &c.,

A Gunner.

USE AND ABUSE OF TOWN SEWAGE.

Sir,—I have read Mr. Hope's paper on "The Use and Abuse of Town Sewage" with disappointment, because I expected such an able and zealous advocate of sewage irrigation would have adduced, from his extensive experience, some tangible proof of its great success. It is all very well to look at a sewage farm for the first time with astonishment at the luxuriance of the crops, but an observer who is satisfied with this may form a very erroneous estimate of the profit made on such a farm. It is easy to estimate the value of human excreta at 8s. 8d. per head per annum (the value arrived at by the Sewage Commission was 8s. 4d.), and then to talk of the millions of money thus annually thrown into the sea, but does the author of the paper attempt to prove that this value can actually be secured by sewage irrigation? He has done me the honour to quote my views on the impossibility of extracting this value from sewage by chemical means, by referring to my paper read before the British Association, at Exeter, in which the following passage occurs:— "Engineers have too fondly believed that water is the great purifier, and so they dilute the excreta with 365 times its bulk of water, and reduce its value to 1d. per ton, and then turn round on the chemist and expect him to reverse the process, pick out the penny, and repay the expenditure. Now, if it were a simple mixture—if it were only to separate the grain of wheat from the sack of chaff—the problem would be difficult enough; but we know the case to be far worse than this—it is the handful of yeast in the sack of flour that we are called upon to extract, and the fermentation of which we are expected to prevent after it has occurred. A small portion of dilute sewage, mixed with a large excess of water, soon renders it all equally offensive, and the problem of extracting its value is one which no chemist need ever attempt to solve." *

May I be allowed to add another extract from the same paper on irrigation, which Mr. Hope has not quoted:—"Irrigation, the only method of utilising sewage, puts an amount of money value on the ground out of all proportion to the return obtained by the ratepayers. There appears no doubt that the farmer will not give ½d. per ton for it, delivered free of expense. Where gravitation and open carriers can be employed without pumping, its application is remunerative; but in no case is anything like the full money value obtained to the ratepayer. The cost of transport, where the chemical value of a product is only 1d. per ton, is far the most important item.

"According to Professor Way's estimate, Glasgow would require 10,000 acres, constantly in use, at 5,000 tons sewage per acre per annum, and it would really require 15,000 acres, as one-third must be under root crop.

"Now, in a damp climate like ours, what land would take this extra amount of water? And what farmer would ever dream of top-dressing his grass with manure equal to 3 tons of Peruvian guano per acre, if he had to pay the full market value for the manure? Moreover, what could be done with the grass where, as in our case, it would be impossible to make it into hay?"

Has Mr. Hope shown the fallacy of these views? if so, I have overlooked the proof, and shall be glad to have my omission pointed out. He estimates the number of population required to manure an acre at 40 to 45, which, at his own valuation, is equal to an expenditure in manure of £17 6s. 8d. to £19 10s. per acre, and yet he ridicules the sanguine expectations, and "manurial eccentricities" of a certain market gardener who puts on an acre of his land 40 tons of farm-yard manure, 10 cwt. of guano, and 10 cwt. of bones, which would not cost much more, and would undoubtedly yield a better crop. If Dr. Voelcker's estimate (the usual one) of 100 persons per acre be required, it more than doubles this amount, and proves all I have advanced against irrigation. Moreover, Mr. Latham is undoubtedly correct in describing sewage as deficient in phosphates, and an exhaustive manure if continuously applied.

Then, is irrigation beneficial or prejudicial to health? Before Mr. Hope prepares any plans for the convalescent hospital in the centre of his sewage farm, and surrounded by the balmy air arising from sewage-irrigated fields, I would recommend for his perusal a pamphlet on "A New Entozootic Malady arising from the Utilisation of Sewage," by Dr. Spencer Cobbold, F.R.S. He says:— "The wholesale distribution of tape-worm eggs by the utilisation of sewage on a stupendous scale, will inevitably tend to spread abroad a class of diseases some of which are severely formidable." He states that, in Egypt, one-third of the population suffer from a small parasite in the blood; that this disease (Helminthiasis) is "terribly fatal," and that it has already been found by Dr. Harley in this country. He states his conviction that it is quite possible "twenty years hence, this parasitic malady may be as prevalent in this country as it is now known to be in particular sections of the African continent." Coming from such an eminent authority, the pamphlet presents a sufficiently terrible picture to make any sanitary reformer pause and consider if the

* *Vide Chemical News.* "A Chemist's View of the Sewage Question," by Edward C. C. Stanford.

country should be committed to even the bare possibility of such awful visitations.

I say nothing here of the malaria arising from the sewer gases, because in pumping up the sewage the irrigator leaves these behind in the sewers, from which they rise into the houses, and with the mortality arising from these he has nothing to do, as long as the inhabitants bear the effects without complaint. I cannot, however, agree with Mr. Hope, when he says that the "sewage question," properly so called, "cropped up in the Garden of Eden;" on the contrary, what is now known as the sewage question" is, how to remedy the enormous evils attending the present wasteful system of sewage by water carriage, a modern institution which has radically failed? Can these be remedied, or must we confess that the whole system is wrong, and reconsider our position? To successfully deal with the question we must, sooner or later, go back to first principles and first causes, and no advance will be made as long as we insist on beginning the reform at the wrong end. I again express my conviction that "no system of sewerage is worthy our consideration which does not give back to the soil that which in our food we have taken from it; and I consider the mere ridding ourselves of a valuable fertiliser, simply on account of difficulty in dealing with it, quite beneath the enlightened spirit of our age." I hope the Society of Arts will adopt Dr. Paul's suggestion, and devote an evening to the consideration of this important question from a primary point of view, and really discuss whether the evil cannot be arrested at its source, or if it must always be treated for a chronic attack of water on the brain.—I am, &c.,

EDW. C. C. STANFORD, F.C.S.,
Medalist of the Society of Arts.

Edibarnet, Dumbartonshire, N.B.,
March 1, 1870.

MEETINGS.

Social Science Association.—On Tuesday the first of the series of lectures announced in last week's *Journal* was given by Dr. Hodgson, in the Great Hall of the Society. Sir Stafford Northcote presided, and a large number of persons attended.

GENERAL NOTES.

A Meeting of the Cab Interest of London has just been held, and it has been decided to petition Parliament to reconsider the Act governing hackney carriages.

Decomposition of Sulphurets in Iron and Coal.—M. Grandidier, of Paris, has invented a method of decomposing the sulphurets to be found in iron and coal by subjecting them to the action of steam in a close vessel, the pressure of the steam not being less than 30 lbs. per square inch.

Telegraphic Statistics.—Lord H. Lennox, Chairman of the Council of the Society of Arts, asked the Postmaster-General, in the House of Commons, on Monday last, whether he would have any objection to publish weekly or fortnightly statements of the number of messages sent by the postal telegraph under the government management, so that they might be compared with the number sent during the time the wires had been under the control of the private companies, and how far progress was made. The Marquis of Hartington, in reply to the question of the noble lord, said it was the intention of the department, as soon as the accounts and statistics of the telegraph were in order, to publish—he would not say weekly or fortnightly—but periodical statements of the amount of business, by the aid of which it would no doubt be possible to make the comparison to which the noble lord had referred.

Albumen.—The consumption of albumen, as applied to different purposes, is enormous; in calico printing alone for fixing on cloth the new aniline colours, Alsace, in France, uses 150,000 kilogrammes, or about 330,000 lbs. a-year of egg albumen, representing 37,500,000 eggs, or the product of 250,000 hens.

New Material for Gloves.—The *Bulletin de la Société d'Acclimatation* contains an article on the use of the skins of the kangaroo for glove-making, which seems to promise a successful result in this respect, and as furnishing a new source of animal food, as these animals thrive well in Europe.

International Exhibition at Vienna.—The Vienna International Exhibition Committee have decided that, in the event of the proposal of charging foreign countries with the cost of the buildings in which their productions are exhibited being abandoned, each exhibitor should be required to pay rent for the space he occupies. The probable cost of the undertaking will be 6,000,000 florins (£600,000).

New Style of Cab.—An improved cab has made its appearance in the streets of Edinburgh. The *Scotsman* describes it as consisting of a brougham body on four wheels, but resembling the London hansom in having the driver's seat placed behind in an elevated position, so as to give him full control over the horse. The vehicle is constructed to carry four persons. The front part being entirely of glass, affords those inside a full view of everything in front. In the roof is a small opening with a lid to lift up, so as to give passengers an opportunity of communicating with the driver.

Linen Manufactures.—A return prepared by the Inspector of Factories shows, with regard to factories for flax-spinning and the weaving of linen fabrics, and fabrics mixed with linen, that there were at a recent date, which is not precisely named, 902,944 spinning spindles at work in Ireland, and 61,366 idle; and 12,415 power-looms at work, and 2,094 idle. In Great Britain the numbers are—572,900 spinning spindles at work, and 100,798 idle; and 17,472 power-looms at work, and 2,529 idle. The extensions in progress comprise 2,008 spinning spindles in Ireland, and 690 power-looms; in Great Britain 1,318 spinning spindles, and 755 power-looms.

Sewage. — Vice - Chancellor James on Wednesday granted an injunction restraining the Corporation of Leeds from causing the sewage of that town to flow into the river Aire. The injunction was asked for on the ground that the filth discharged into the river was so great that the fish were killed, the water had become unfit for cattle, and, in fact, the river was converted into a huge sewer. The Corporation contended that an Act of Parliament gave them unlimited powers to pour all the drainage into the river; but the Vice-Chancellor decided that no such right existed, and granted an immediate injunction to stay the nuisance.

Transatlantic Goods Traffic.—The agents of the North German Lloyd have announced that this company, with a view to afford increased facilities to importers of American produce, have decided to start an extra steamer once a fortnight from New York to Southampton, for the conveyance of through goods to London, in conjunction with the London and South-Western Railway Company. Last autumn, they despatched a few steamers on the service as an experiment, and the result has shown that, in consequence of the favourable position of the Southampton Docks, and the facilities afforded there for the unloading direct from the ship's side into the railway trucks, the company are enabled to deliver their cargoes at the merchants' warehouses in London within twelve days from the time of shipment at New York. The new route is likely to be of advantage, not only for the quick transit of provisions, but also to importers of hops, seed, cotton, oil, and tallow. The first steamer of the service will be the *Bremen*, appointed to leave New York on the 23rd of March.

The Ceylon Ruby is never found without a tint of blue. To expel this, when the stone is formed for polishing, it is rolled in a ball of wet lime, and placed in a pan of charcoal, which is gradually raised to a white heat with a primitive bellows or blowpipe made of a tube of bamboo; after being kept at a white heat for about twenty minutes or half-an-hour, the ball is taken out and allowed to cool, and when broken open the stone will have lost the blue tint without injuring the crimson. By the same process, the tint of blue can be expelled from a stone which is nearly white; if, however, there is any crack or flaw in the stone it is liable to fly to pieces.

Labour in Melbourne.—The *Argus* says the following are the rates of wages now ruling in Victoria:—For artisans engaged in the building trade, 10s. per day of 8 hours; cabinet-makers, iron-founders, and mechanical engineers, 12s. and 14s., according to the quality of the work to be performed; builders' labourers receive 7s., and pick and shovel men 6s. per day; good tailors, £3 and £3 15s. per week; tailoresses earn 30s. and 40s., and machinists 20s. and 30s. The wages of farm labourers fluctuate according to the period of the year. During the last month, when the ingathering of the hay and corn harvests have both been actively proceeded with, harvest men have refused to go to work for less than £2 per week and their rations, which means three substantial meals a day, with meat at each, and in some of the remoter districts the farmers have to accede to £3 a-week and rations, or run the risk of seeing the over-ripe corn shed its grain upon the ground before it could be hastily cut and garnered. It must also be remembered that a wage-rate of 10s. per day represents a far greater purchasing power, with respect to all the necessaries of life, than the same sum does in England. The best wheaten bread is 6d. per 4-lb. loaf; beef, 3d. to 6d. per lb.; mutton, 1½d. to 4d.; fresh butter, 9d. to 1s.; cheese, 6d. to 10d.

Iron and Steel Crystals.—M. Schott, of Ilsenberg, has made many microscopical examinations of the structure of steel and iron. He maintains that "all crystals of iron are of the form of a double pyramid, the axis of which is variable, as compared with the size of the base. The crystals of the coarser kinds, as compared with those of the finest qualities of crystalline iron, are of about twice the height. The more uniform the grain, the smaller the crystals, and the flatter the pyramids which form each single element, the better is the quality, the greater is the cohesive force, and the finer the surface of the iron. These pyramids become flatter as the proportion of carbon contained in the steel decreases. Consequently, in cast iron and in the crudest kinds of hard steel, the crystals approach more the cubical form, from which the octahedron proper is derived; and the opposite extreme, or wrought iron, has its pyramids flattened down to parallel surfaces or leaves, which in their arrangement produces what is called the fibre of the iron. The highest quality of steel has all its crystals in parallel positions, each crystal filling the interstices formed by the angular sides of its neighbours. The crystals stand with their axes in the direction of the pressure or percussive force exerted upon them in working, consequently the fracture shows the sides or sharp corners of the parallel crystals. In reality, good steel shows, when examined under the microscope, large groups of fine crystals like the points of needles—all arranged in the same direction and parallel. —*Journal of Applied Chemistry*.

Meat Preserving, says the *Melbourne Age*, is being conducted with vigour, and the total amount sent away every month is large. One or two companies are getting into operation, but at present it pays well to buy sheep for their tallow; the boiling down establishments are still kept going, and more sheep are thus disposed of than preserved. In fact, when meat is the principal object, the legs are almost the only part preserved just now, the remainder of the carcase being boiled down. And as long as tallow pays so well, there will be little trouble taken to perfect any other mode of curing except those already in use. We hear nothing now of the freezing or chilled-air process, about which so many were enthusiastic a short time since. The settlers seem quite careless about it, and as long as they are content to sell fat sheep and cattle at present prices, other people are not likely to be impelled to further action. The public get their meat cheap enough, and would lose rather than gain by a change, and the parties to whom exporting is a business have a fair margin of profit with little risk so long as they can buy at boiling-down prices. Thus the saving of the whole carcase as meat would only benefit the stock-owners directly, and the bulk of their body seem to care more about a new land-law than about securing a better price for their surplus sheep. The further advance in the value of the wool will be material help to many, and perhaps, now that the land question is disposed of for another ten years, they may pluck up spirit enough to aid in improving the source of their income.

A Uniform Railway Gauge.—Inasmuch as five-sixths of the railroads in the United States have a gauge of 4ft. 8½in., it is quite desirable that the remainder should be brought to the same gauge, thereby securing uniformity throughout. In order to obtain this, it is proposed, says a New York daily, by certain railway men and members of Congress, to secure the enactment of a law that, after a given day, no road shall be a post-road that does not conform to this gauge. The expense of changing a 5ft. gauge to conform to this plan will not exceed 500 dollars per mile, and it is believed that most of the roads could make the change at a less expense. As there are less than 8,000 miles of road requiring alteration, the whole cost of the work would not exceed 4,000,000 dollars. As the United States are interested in having the most expeditious transportation of the mails and military stores, the public benefits to be secured, it is claimed, would justify a sufficient appropriation by Congress to compensate the companies required to make the change.

New Thermo-Electric Pile of MM. Mure and Clamond.—This thermo-electric pile is made up of sixty elements. They consist of small bars of lead, or native sulphuret of lead, and of plates of steel. The bars are 40 mm. long by 8 mm. thick, and the plates of steel are 55 mm. long by 8 mm. broad, and 0·6 mm. thick. In these couples galena is the electro-negative element; iron, the electro-positive. The form of the bars is such, that by placing them side by side they form a ring of twelve couples, of which the interior is formed by the extremities which are to be heated. They are united in tension by means of tin solder. They are isolated from one another by thin mica plates. By placing five of these rings in a vertical column a battery of sixty couples is formed. These rings are isolated and separated by washers of asbestos. The whole is firmly held between two iron rings by means of three bolts. The pile thus forms a hollow cylinder, the interior of which must be heated. The cooling of the junctions, whose temperature should be lower, is caused by radiation into the air. The interior cylinder measures 50 mm. in diameter and about the same in height. The heated surface is about 78 square centimetres. The apparatus is heated by a gas-burner, consisting of a steel cylinder, 56 mm. in diameter, closed above, opened below, and pierced with small orifices. This is placed in the centre of the pile. A tube pierced with holes surrounds this cylinder, and distributes the gas uniformly around it. The gas rises, and arriving at the orifices in the burners, meets the air which is escaping from it because of the draught of the tube of steel that surrounds the apparatus. Each orifice in the burner thus forms a blow-pipe, the jet of which strikes the opposite side. Forty couples have an electro-motive force equal to that of a Bunsen element. Its interior resistance to cold is that of a copper wire 9·85 mm. and 1 mm. in diameter. But during its action it increases and becomes equal to 22 mm. The current is intense in proportion to

the feebleness of resistance. Visible sparks are obtained between the two electrodes. The current reddens a platinum wire 0·3 mm. in diameter, a length of 35 mm. It also decomposes water. This pile, acting for ten consecutive hours, consumed 785 litres of gas, at an expense of 2½ centimes an hour. It is, therefore, an economical generator of electricity.—*Le Génie Industriel.*

Australia and America.—The *Sydney Empire* says:—"A line of powerful steamers, combining speed with every comfort for passengers, having large roomy cabins with free ventilation, will connect the continent of America, calling at Honolulu, Fiji, New Caledonia, Brisbane, and Sydney. The route embracing all these places of call we have indicated for adoption, for the sake of performing the whole voyage in fine tropical weather and avoiding the stormy coast of New Zealand. The mails for New Zealand and Victoria will be conveyed thither by a branch line from Viti Levu (Fiji). A subsidy of £120,000 per annum will be required by the company, to enable them to lay on the line a class of steamers sufficiently powerful to maintain a rate of speed to accomplish the distance from Liverpool to Sydney in 49 days. Of this amount the American, French, and Hawaiian governments will contribute a part. The balance, not exceeding £75,000, would be required to be furnished by the Australian and New Zealand colonies. The advantages to these colonies from being in direct and rapid communication with all the places referred to, and their communication with Chili, at present interrupted by the breaking up of the Panama line continued, is of sufficient importance, we presume, to warrant us in asking those colonists to entertain the subject, and to urge upon their respective governments the desirability of considering the matter. If, after due deliberation, we are notified of a view favourable to the proposed route, we will be prepared to enter upon the service four months after we receive such notification."

Wurtemberg Schools of Industrial Art.—After the Great Exhibition of 1851, drawing classes were added to all primary schools in Wurtemberg, in order to furnish manufacturers to compete with those of France. At first these schools were gratuitous, but it was soon found that attendance would be more regular if the parents of the children were required to contribute to the expenses in proportion to their means. The fees imposed vary from one shilling to one pound per annum. One remarkable peculiarity in the Wurtemberg system is, that the teachers are, as far as possible, selected from amongst those workmen and employers belonging to the principal trades in each town who have themselves previously attended similar classes; the workmen thus transformed into teachers do not quit their ordinary occupations, but are paid at the rate of three shillings and sixpence per hour for the lessons which they give. The classes meet generally three times a week, and for two hours each time; they are held between seven and nine o'clock in the morning. At Geisslinger there is a class with 180 pupils, under the direction of a mason or bricklayer. In many towns, employers have so highly appreciated the instruction given in these classes, that they themselves send their young workmen and apprentices to attend them. It has been found that artists of acknowledged talent have not succeeded so well as artisans in the conduct of these classes, proving that there is less difficulty than is generally supposed in providing teachers of drawing for common schools. Great attention has been paid to the provision of copies and models for these special schools, which include lithographs, plaster casts, and wooden models. Collections of these were shown at the universal exhibitions in London in 1862, and in Paris in 1867. The Minister of Commerce has also formed a collection of the best published works on industrial art, from the simplest hand-book of upholstery, cabinet-making, metal-work, &c., to the most elaborate productions, and these are lent to the various schools in the kingdom for certain periods, generally a month. Every second year a public exhibition of drawing from all the schools takes place at Stuttgard, and rewards are given to the producers of the best drawings. The teachers are invited to examine the exhibited works, and assist in the distribution of the prizes; and those teachers who exhibit the greatest talent and produce the largest amount of progress in their schools are appointed inspectors to visit and report upon these drawing schools in all parts of the country. The organisation of these schools of industrial art is said to work admirably, and produce the most satisfactory results.

The Damoodah Canal.—The Government of India has lately sanctioned the commencement of the Damoodah Canal, which is estimated to cost about £540,000. This canal will be taken off from the river Damoodah at a point little above Raneegunge, and passing between Burdwan and the high bank of the Damoodah, will fall ultimately into the Hooghly at Bydahattee Creek, or more probably at Trebenee, as this latter place would better suit the conveniences of the coal proprietors. The total length of the canal will be just 100 miles. During its course it will be kept all the way inside or north of the East India Railway Company's loop line. At the 70th mile it will become a still-water channel. The canal is designed to carry 1,500 cubic feet of water per second when the river is full, but may without difficulty be enlarged so as to carry double that volume. Besides its use as a navigable channel, it is proposed that it shall also be employed for irrigation; and the area of land that may be brought under wet cultivation by its means, with its proposed capacity of 1,500 cubic feet per second, has been calculated at about 200,000 acres. There will be necessarily rather heavy lockage on the canal, which, it is feared, may in some measure interfere with the possibility of using steam tugs; but this is a matter which experience alone can properly test. One end of the canal will terminate in the heart of the Bengal coal-fields, and it will thus be the means of affording a cheap line of transport for carrying coals into Calcutta, relieving at the same time the railway of a portion of that traffic, which, if the coal-beds were fully worked, would soon be sufficient to occupy the entire line, to the hindrance of other and more important traffic. That the railway will be injured by this competitor for a portion of its goods traffic we do not for one moment expect, for the increased means that will thus be afforded of conveying coals to Calcutta, and to the shiping in the Hooghly, will but stimulate the demand for that article, and a considerably increased trade may thereupon be anticipated, sufficient to tax the energies of both enterprises. The estimated net returns from the canal, including receipts from navigation and irrigation, are set down at about ten per cent. on the capital, when the full area of land is brought under irrigation. How soon the canal will be completed it is rather difficult to state, but probably it will take not less than from two to three years. This, however, being a government undertaking, its progress must depend upon the amount which can be annually devoted to its construction. A secondary but very important result of this canal is likely to be the drainage of that tract of land lying between the railway and the Damoodah, which for the last seven years has been desolated by malarious fever.

Effects of the Progress of Machinery.—At the dinner of the Foremen Engineers, in London, on Saturday, February 19th, 1870, Sir J. Whitworth made the following observations:—During the two years which have elapsed since I had the pleasure of meeting you in this room, trade has been in a very depressed state, and both employers and employed have suffered much. I am happy to say that there are now signs of improvement in most branches of industry, and if we are favoured with good harvests this year, the improvement will no doubt go on and increase. The prosperity of England depends, not only on the produce of her soil and her mines, but also

greatly on the number of self-acting machines she keeps at work. In proportion to the increase of the latter, has been her increase in wealth and power. Our ancestors had very rude implements to work with, but since the introduction of the steam-engine the machinists and engineers of England have gone on applying new machines to every kind of industry, until we have arrived at a time when we have an enormous wealth-producing power at our command. The produce of our mines of coal and iron are so abundant, that we can convert the raw material we obtain from other countries into an almost endless variety of things, which add to the comforts of all. The wealth derivable from our mines and self-acting machinery goes on without interruption. The produce of the soil everywhere greatly depends on the seasons. Hence the desirableness of having the most extended area for tho exchange of our manufactures. The progress that has been made by engineers during the last forty years has been very remarkable, particularly in constructing and making self-acting machinery. Twelve shillings per foot has been paid for the labour of chipping and filing surfaces of iron, which is now frequently done on the planing machine for one penny. By Mr. Bessemer's admirable process, the cost of manufacturing some kinds of steel has recently been reduced to one-half and in some cases to one-third what it used to be. The consumption of coal for manufactures has been reduced more than one-half. The saving last year on the English railways by locomotive engineers burning coal instead of coke was one million two hundred thousand pounds sterling. Mechanical and civil engineers, chemists, and scientific men are continually finding out new modes of producing wealth; and the owners of self-acting machinery generally go on improving and increasing their productions, from which those who have fixed incomes derive great advantage. Until the corn laws were repealed, legislation was not in accordance with the proper development of self-acting machinery. The full employment of such machinery requires a free exchange for the produce of all countries. Engineers have so reduced the cost and time of transit, that when we have this free exchange, England will probably be the cheapest country in the world to live in. The taxing of imports has long appeared to me very illogical and paradoxical, seeing that the labour of 1,000 men employed in cultivating the soil in foreign countries could, in many cases, be obtained for the labour of one man in this country employed on a self-acting machine. Under such circumstances as these, a tax on exports rather than imports would seem to have been more logical, but I am against both. I mention these considerations because it is my conviction that, next to the study of those sciences more immediately connected with the engineering profession, that of political economy most deserves the study of engineers. Looking to the immediate future, we may congratulate ourselves on the great opportunities that are arising for the development of engineering enterprise. The cultivation of the land by steam power is greatly on the increase, landed proprietors now seeing tho importance of so clearing and improving their estates as to admit of this. The use of horse tramways is being urgently pressed forward, and a large outlay is contemplated. In my opinion they are not suited to the present times, and mechanical engineers have a right to enter their protest, considering tho many obstructions there have been, for many years past, to the employment of road locomotives. If toll-gates were abolished, and each county had an organised staff for making and keeping the roads in good order, using the steam-roller, steam sweeping-machine, and other necessary appliances, where there is large traffic, mechanical engineers would then, I have no doubt, soon produce a small, light locomotive, that would do its work quietly and most effectively; at tho samo timo pedestrians and those who ride and drive would have the great enjoyment of good and clean roads, instead of tho present badly-paved and rough macadam roads. The broken stones of tho latter are now left for the horses' feet and narrow wheels to consolidate in a way which it is quite distressing to see. The consumption of fuel per horse-power is now so small that road locomotives could be employed at far less expense than the over-worked and ill-conditioned horses we now see, while pedestrians and those who keep animals for pleasure would have good roads, and many gentlemen, no doubt, would have their well-made locomotives. Under any circumstances, good clean roads are the most profitable when everything is taken into account, but, unfortunately, those who make and repair them generally consider only one side of the question. There is one other subject to which I would briefly advert. It is well known to you all that the War Department and the Admiralty of this country exercise control over mechanical operations of the greatest importance. In the Admiralty, at Whitehall, these mechanical operations have always been conducted with the advice of mechanical men; but in the War Department, at Pall-mall, there is not a single person who has had a practical mechanical training to advise the Minister of War. The consequence is, that questions solely and entirely of a mechanical nature are left to the decision of military officers, and conclusions are arrived at opposed to all sound mechanical principles. The consequent waste of public money is truly deplorable, and this waste will continue so long as mechanical questions are settled by military officers instead of by mechanical engineers. In the present Parliament there are several practical engineers and scientific men, and we may therefore hope that these evils will be speedily remedied.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. Benjamin Paul, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light."
R. United Service Inst., 8½. Mr. Charles F. Henwood, "On Iron-clads, Present and Future."
Society of Engineers, 7½. Mr. Peter Jensen, "The Friction in the Steam Cylinder."
Institution of Surveyors, 8. 1. Adjourned discussion on Mr. Squarey's paper "On Farming Covenants." 2. Mr. J. Matthews, "A Plea for Culture in the Profession of a Surveyor."
Farmers' Club, 5½. Mr. J. Bailey Denton, "On Sewage Farming."
Royal Inst., 2. General Monthly Meeting.
Entomological, 8½.
Medical, 8. Annual Meeting.
Victoria Inst., 8. Rev. J. M'Cann, D.D., "A Demonstration of the Existence of God."
London Inst., 4.

Tues ...R. Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. D. M. Fox, "Description of the Line and Works of the San Paulo Railway, in the Empire of Brazil."
East India Assoc., 3. Mr. W. Tayler, "On the True Purport and Practical Effects of Rule 1, Article 1, of the Association."
Photographic, 8.
Ethnological, 8. 1. Col. A. Lane Fox, "On the Opening of a Cairn in North Wales." 2. Mr. Hodden M. Westropp, "On the Earliest Phases of Civilisation."
Royal Inst., 3. Dr. Masters, "Plant Life."

Wed ...Society of Arts, 8. Mr. W. Bridges Adams, "On Tramways in Streets."
Geological, 8. 1. Mr. W. Carruthers, "On the Structure of a Fern Stem from the Lower Eocene of Herne Bay, and on its Allies, recent and fossil." 2. Mr. Samuel Sharp, "On the Oolites of Northamptonshire." 3. Mr. T. H. C. Hood, "On the Geology of the District of Waipara River, New Zealand."
Graphic, 8.
Microscopical, 8. Dr. Carpenter, "On some Microscopic Memoranda."
R. Literary Fund, 2. Annual Meeting.
R. Society of Literature, 4½.
Archæological Assoc., 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
London Inst., 7½.
Royal Society Club, 6.
Mathematical, 8.

Fri ......Royal Inst., 8. Prof. Westmacott, "On Art."
Quekett Club, 8.

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Prof. Max Müller, "Science of Religion."

Journal of the Society of Arts.

FRIDAY, MARCH 11, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

MARCH 16.—"On Surface Decoration." By WILLIAM PITMAN, Esq.

MARCH 23.—Adjourned discussion on Mr. W. Bridges Adams' paper "On Tramways for Streets." On this evening CHAS. HUTTON GREGORY, Esq., will preside.

MARCH 30.—"On Submarine Channel Communication." By THOMAS PAGE, Esq., C.E.

CONFERENCE.

The Council have decided to call a morning conference at an early date* to discuss the question of the "Relations of the State to Science, and the Necessity for Official Inquiry into the subject by Royal Commission." Col. STRANGE, F.R.S., will open the discussion by reading a paper on the subject. Members and their friends are invited to attend.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session, by Dr. Benjamin Paul, F.C.S., was commenced on Monday last, "On the Phenomena of Combustion, and the Chemical and Physical Principles in volved in the Use of Fuel, and in the Production of Artificial Light," The remaining lectures will be delivered on Monday evenings, the 14th, 21st, and 28th of March, at 8 o'clock.

SYLLABUS.

1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat.

2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel.

3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smelting furnaces; means of arresting combustion; extinction of fires.

4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin oil; measurement of light; photometry.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

An abstract of the lectures will appear in the *Journal.*

* Notice of the day and hour, when fixed, will appear in the *Times* and other newspapers.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce, and has been awarded as follows:—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph.

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour, &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce.

The Council invite Members of the Society to forward to the Secretary, on or before the 25th of April, the names of such men of high distinction as they may think worthy of this honour.

NOTICE TO LOCAL BOARDS.

Secretaries of Local Boards are requested to notice that candidates desirous of being examined in Musical Composition, holding the Tonic Sol-fa Association Certificate of "Honorable Mention" in Musical Composition, and the Member's Certificate of "General Musical Culture," need *not* undergo the Preliminary Examination.

COMMITTEE ON DRILL.

The Committee appointed last year, and subsequently re-appointed in the present year, to "consider how drill may be introduced into all schools throughout the United Kingdom," consisted of T. D. Acland, M.P.; the Right Hon Sir C. B. Adderley, M.P.; Lieut.-Col. Edward Akroyd, M.P.; G. C. T. Bartley (Auditor of the Society); Edgar A. Bowring, C.B., M.P.; Field-Marshal Sir John Burgoyne, G.C.B., M.P.;

the Hon. and Rev. Francis C. E. Byng, M.A.; Edwin Chadwick, C.B. (Member of Council); the Dean of Chester; Capt. Lardner Clark; Henry Cole, C.B. (Vice-President); Admiral Collinson; the Rev. Canon Cromwell, M.A.; Capt. Donnelly, R.E. (Member of Council); Capt. Ducane; Lord Elcho, M.P.; the Rev. the Head Master of Eton; General Sir De Lacy Evans, G.C.B.; Bishop of Exeter; W. S. Fitzwilliam; Earl Fortescue; Colonel Lane Fox; Douglas Galton, C.B.; the Rev. D. Harper; the Head Master of Harrow; T. Hughes, M.P.; Professor Huxley, F.R.S.; Rev. Canon Kingsley; Major-Gen. Lefroy; Lord Henry G. Lennox, M.P. (Vice-President, and Chairman of Council); R. R. W. Lingen, C.B.; Archibald MacLaren; Rev. W. M. Mitchell; A. J. Mundella, M.P.; the Right Hon. Sir John S. Pakington, Bart., M.P., F.R.S. (Vice-President); Dr. Lyon Playfair, C.B., M.P.; Samuel Redgrave (Vice-President, and Vice-Chairman of Council); the Rev. W. Rogers, M.A. (Member of Council); Admiral Ryder, C.B.; Capt. Toynbee; the Hon. R. Hanbury Tracy; E. C. Tufnell (Member of Council); Capt. Tyler; Sir Joseph Whitworth, Bart., LL.D., F.R.S. (Vice-President); and the Archbishop of York (Vice-President). The Committee was summoned, and met on Monday, the 7th inst., for the first time. Their attention was drawn to the following passages of the speech of the Right Hon. E. Cardwell, Secretary for War, on moving the army estimates, in the House of Commons, on Thursday, the 3rd instant. Mr. Cardwell said:—

I look forward to seeing the broad line of demarcation between the army and civil life in some way diminished. We have adopted the system of allowing soldiers to learn trades—of permitting them to spend their spare time in some useful labour—and I think we may expect to see many of the young men of this country passing through the army learning trades in it, and afterwards returning into civil life, to be ornaments and advantages to those around them, and, at the same time, to be ready to contribute to the defence of the country in case of emergency.

* * * * * *

During six years of actual service in the army, they will have learnt sufficient to do them good for the remaining six years of their engagement. We propose that, after leaving their regiments, they shall have the same sort of training as the volunteers—drill in the evening—which will not oblige them to leave their ordinary employment.

* * * * * *

I speak of the man who does not now join the army, but whom we wish to induce to join it; of the young man who is reluctant to spend all his life away from his own village; who may wish to contract marriage, but who would give a good deal for the advantages of training in the army for a few years.

* * * * * * *

Of experiments in spade drill, military labour, and many other matters, I could speak at length. I will only say that when it was likely the telegraphs would be taken by the government, I proposed to my noble friend at the head of the Post-office that we should train for the telegraph service at Chatham a number of engineers and officers, and the proposal was acted upon. I look with great interest upon every attempt to find civil employment for any branch of the army. We have provided in the estimates a small sum for experiment with torpedoes, which seem likely to make a great revolution in warfare. Spade-drill has been very much cultivated during the year by soldiers. These are defensive rather than offensive operations; and the defence of our commercial harbours may be wonderfully facilitated by the introduction of torpedoes. I think it is clear that, in the controversy that is now going on, scientific defence is gaining upon scientific attack. I believe that in this country, if we educate and arm our population in the way we propose to educate and arm them, and if we avail ourselves of our natural means of defence, by placing torpedoes in our rivers and harbours, and our rifles behind our hedges and ditches, the time has arrived when we need no longer give way to panic or the fear of invasion.

In order to direct public attention to this important branch of education, and to show with what success drill has been already introduced into some schools, and to show what proficiency can readily be obtained, the Committee resolved to recommend to the Council to invite the managers of the various army, navy, marine, district, and other schools, in the neighbourhood of the metropolis, where drill forms part of the system of education, to send their boys to take part in a review to be held at the Crystal Palace in June next.

The Committee recommended that a special fund be set on foot by subscription, for the purpose of providing prizes to be awarded at such review, and also for the general expenses connected with it; and that the Council contribute a donation to such fund. The Committee recommended that the Council should also invite the great public schools—such as Eton, Harrow, Christ's Hospital, and others—to be present at this review, in order to witness it.

The Council have confirmed these recommendations, and directed the necessary steps to be taken for carrying them out.

EDUCATION.

The Council have decided to present the following Petition to the House of Commons, and have placed it in the hands of the Right Hon. Sir J. Pakington, Bart., for presentation:—

To the Honourable the Commons of Great Britain and Ireland in Parliament assembled.

The Humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, incorporated by Royal Charter,

Sheweth,

That your Petitioners have seen with thankfulness the introduction of a Bill into your Honourable House, intended to place elementary education within the reach of every child, and for the first time making Her Majesty's Government responsible that such education should be provided.

That your Petitioners observe with regret that there is no provision in the Bill to ensure undivided attention to the promotion of national elementary education by a Department of Education undisturbed by the various functions charged upon the Lord President and the Vice-

President of the Privy Council, such as those of a Board of Quarantine, a Board of Health on the occasion of extraordinary epidemic disease; those in relation to cattle plague; those on Colonial matters regulated by order in Council; those relating to the granting of municipal charters; those of a judicial character; and those under various Acts of Parliament, by which the Queen in Council is empowered to make orders and regulations which have the force of laws.

Your Petitioners are fully convinced that, unless a Minister, of equal rank with the Secretary of State, be charged with the sole responsibility of giving effect to the measure proposed—so difficult and complicated as it is—the intentions of the Legislature and the just desires of the people will be frustrated.

That it appears of the greatest importance to your petitioners that a clause should enact that, in all public elementary schools created by the Bill, the means of instruction in reading, writing, arithmetic, geography, drawing, singing, and drill, with moral training, should be provided; and that encouragement should be given to subjects of general culture, and those specially bearing on health, and to science and art necessary for the industrial progress of the country; and that all classes of the community should, by payment of fees, be enabled to avail themselves of such instruction.

Your Petitioners therefore pray your honourable House to make provision for the appointment of a responsible Minister of Education, so that the education of the people of this country may be rendered at least as complete as that which is afforded in Prussia, Saxony, Holland, Switzerland, and other countries, and thus remove that ignorance which must retard the progress of the British empire.

Sealed with the seal of the said Society, this seventh day of March, 1870, in the presence of (L.S.)

P. Le Neve Foster, Secretary.

CHANNEL STEAMERS COMMITTEE.

The Committee on the models sent in competition for the prizes offered for improved Channel steamers—consisting of Lord Henry G. Lennox, M.P., Chairman of the Council; Rear-Admiral Erasmus Ommanney, C.B.; Capt. Boxer, R.N.; Capt. Tyler; Henry Cole, C.B.; C. W. Merrifield, F.R.S.; E. J. Reed, C.B.; and Seymour Teulon, Vice-Chairman of Council—have presented the following report to the Council:—

Your Committee, having carefully considered the designs for Channel Steamers submitted in competition for the gold and silver medals of the Society, have the honour to report as follows:—

The models received are 17 in number, but your Committee regret to state that three only conform to the conditions, laid down by the Council in their public announcement, with sufficient closeness to enable your Committee to consider them as entitled to compete.

After considering all the points in which these three designs differ from the existing vessels, your Committee have come to the conclusion that no one of them presents such features of originality, or such improvements upon the accommodation of the existing vessels, as to justify them in recommending it for either of the medals.

The Council are aware that, in inviting ship designers and others to furnish these models, the draught of water and the tonnage of the vessels were limited to suit the conditions of the present harbours, which preclude the resort to a draught of water much exceeding seven feet, or to a tonnage materially exceeding that of the present vessels. It was unquestionably very desirable, as a first step towards the solution of the great question of Channel traffic, to ascertain whether it was possible to give the public the benefit of greatly improved accommodation subject to these conditions, because the necessity for improvement is very urgent, and this would obviously have been the readiest method of obtaining it.

The result of the present competition shows that no substantial improvement is to be expected from the voluntary production of designs, even under the stimulus of the offer of the gold medal of the Council, with all the advantages which the award of that medal would, in many cases, bring to the designer.

It does not necessarily follow that it is impossible to improve the accommodation of the existing boats, and to this point your Committee have given careful consideration. They are of opinion that no such change could be made in the existing boats as would carry with it a large improvement in the accommodation.

To the adoption of deck houses there are weighty objections, relating chiefly to the navigation of the vessels in stormy weather, and to the entering of the existing harbours under certain circumstances of wind and tide. For these and other reasons, your Committee are satisfied that it is not desirable for the Council to take further steps in seeking to effect any substantial improvement in the Channel vessels, while limited to the tonnage and draught of water of the present boats. Minor improvements might be made if the boats were used for passenger traffic only; but your Committee do not understand that it falls within the scope of their duty to offer detailed suggestions of this nature, or to seek to extract them from the various designs which have been submitted, as they take it for granted that the object which the Council has in view is of a much more important character.

Among the 17 designs which have been submitted, some exhibit features which would deserve consideration, in determining the best kind of boat to be built for the Channel service, provided the limitations of tonnage and draught of water were removed; but as by the terms of the Council's invitation these designs are excluded from the competition, it was considered undesirable to discuss their details, especially as none of them present any improvement at once so novel and so important as to deserve especial mention in this report.

The inquiries and investigations which your Committee have made have impressed their minds more strongly than ever with the urgent necessity that exists for some large measure which shall improve the means of communication between this country and the Continent. At present, the enforced smallness of the boats, consequent upon the small area and limited depth of water of the harbours and their approaches, results in extreme discomfort to passengers.

It cannot be for a moment doubted that the engineering skill of England and France is perfectly competent to construct, in a comparatively short time (provided the necessary capital were found), vessels capable of crossing the channel without the excessive discomfort which is now experienced, and also to construct piers or harbours capable of receiving such vessels under all circumstances of wind and weather, and at all times of tide. In so far as your Committee can ascertain, there is absolutely no practical impediment to these works being undertaken with every prospect of success, provided only the necessary co-operation of the French government can be obtained.

The Council have adopted the foregoing report, and directed a copy of it to be sent, with the thanks of the Society, to each of the competitors. The Council have also directed copies of the report to be sent to the Emperor of the French, and to the French Minister of Agriculture and Commerce, and also to the President of the Board of Trade.

ART-WORKMANSHIP COMPETITION, 1869-70.

The following is the Report of the Judges, appended to which is a catalogue of the articles received in competition, with the list of prizes awarded:—

In submitting our list of awards for the competition amongst the art-workmen for the session 1869-70, we desire to congratulate the Council of the Society of Arts upon a more worthy response to their liberal invitations to the workmen, to forward good specimens of their handicrafts, than was made last year.

This improvement is manifested rather in the absence of the very bad than in the presence of the very good. In the second division, however, comprising the application to ordinary industry of prescribed art-processes, we have met with several works of conspicuous excellence. Foremost in the list of these, we must place the ornamental ironwork for the balcony of a window, executed by Mr. William and Mr. Henry Robson, a work uniting three special merits — elegant and not overloaded design; masterly technical execution in forging, twisting, &c.; and moderate price. We are fully aware of the high position occupied in metal working generally by this country at the present time, but we look upon this work of the Messrs. Robson as an especially good example. We have, therefore, awarded to it the North London Exhibition prize for the best specimen of skilful workmanship at the Society's exhibition, in addition to a premium of £10.

In several other instances the exhibition contains good evidence of excellence in metal working, and the Messrs. Emms' balcony and wrought-iron bannister are very satisfactory.

In metal working in other divisions we have to commend highly the "Virgin and Child," worked in low relief in iron, after an example in the South Kensington Museum, by Mr. A. Dufour. In this case we have also to notice excellent work combined with moderate price. To Mr. A. Dufour we have awarded a premium of £10, while, for a corresponding work, executed by Mr. Adolf Ostertag, we recommend that a prize of £5 should be given.

The hammered iron knocker, executed by "A. S.," is large in style, and well and simply treated.

In coppersmiths' work, the repoussé mask wrought by Mr. G. Deere is well "bossed" out, and may be regarded as a skilful piece of workmanship. Mr. A. Millward has forwarded a good specimen of the inlay of German-silver in copper, and a still better circular ornament pierced in metal; the latter is agreeable, and characteristic in design, and is worked with a cleanliness of cutting and truth of figure highly to be commended.

It is to be regretted that, in working in the precious metals, in which at the present time the art-workmen of Paris and Vienna are so superior, the Society's Exhibition should contain nothing worthy of notice.

In the second division, however, we are glad to recognise, on the part of Mr. Alfred Gray, a power to execute enamelling on metal in the style (a novelty in this country) which has gained so much reputation for the houses of Christofle and Barbedienne, of Paris. We have awarded Mr. Gray, for his miniature frame, a premium of £7 10s., and shall hope to see him, on some future occasion, displaying his command over the various processes of enamelling upon a more elaborate and important scale. The application of enamelled colours on ceramic bodies, so as to form elegant commemorative tablets, has been fairly shown by Messrs. Evans and Griffiths, of the Potteries, to whom we have awarded a premium of £5.

We are further pleased to be able to remark that the Society's invitation to workmen to compete under their second division has succeeded in eliciting marked novelty and excellence in English glass-working. Mr. Joseph Leicester's three champagne glasses, with filigrani in the cup, stem, and foot, fairly rival the products of Venice. The works of Mr. Barnes, though not so elegant, display command over several difficult processes in glass-blowing. In the same division, Mr. Charles Pfander contributes various agreeable specimens of painted book-covers of a more or less novel character; and Mr. E. T. Grove an envelope case, in various woods, enriched with carvings in low relief, and marquetry, of neat execution, and marking progress in the application to ordinary industry of an art-process hitherto comparatively little used in this country.

In the classes of carving in wood, carving in ivory, painting on porcelain, and modelling in plaster, there is little call for remark, although a fair average has certainly been maintained.

In cameo cutting, we remarked an excellent portrait of Dr. Billings, for which we have given a premium of £5.

Among the works of exceptional merit, not previously referred to, should certainly be noticed Mr. H. J. Hatfield's beautiful bronze missal cover, pierced, and chased with great truth and taste.

In etching and engraving on metal, the works of Mr. S. Gill and Mr. J. Gittins were of such equal merit in our eyes, as to entitle each of them to a premium of £5.

The embroidery executed by the Misses Pfänder reflects credit upon those ladies.

We noted the contributions to the exhibition of the veterans, Mr. Louis Genth and Mr. Mark Rogers, whose works we have commended.

A decided novelty in marquetry, contributed by Mr. W. Clayton, to which we have awarded the premium of £7 10s., appeared to us likely to be valuable for purposes of internal mural decoration.

Upon the whole, and in conclusion, we have to express our conviction that the Society of Arts, should it see fit to continue its liberal invitations to art-workmen to compete for prizes, cannot do better than offer a somewhat similar programme for the ensuing year to that of 1869-70, varying, however, some of the prescribed designs, the repetition of which has now become monotonous.

Signed,

Richard Redgrave,
George Godwin,
M. Digby Wyatt.

FIRST DIVISION.

Works executed after Prescribed Designs.

Class. No. Carving in Wood.

1 (*d*)— 1. Panel carved in oak, after a work in the South Kensington Museum; by Frederick Moutrie, 219, Stanhope-street, Hampstead-road, N.W. Price £12 10s.

2. Panel carved in oak, after the same design as the above; by Mark Rogers, jun., 111, Tachbrook-street, Pimlico, S.W. Price £10 10s. **PRIZE** of £7 10s.

3. Panel carved in oak, after the same design as above; by W. T. R. Price £12.

4. Panel carved in oak, after the same design as the above; by J. Osmond, 5, Featherstone-street, Bunhill-row, E.C. Price £14. **PRIZE** of £10.

1 (*e*)— 5. Carving in wood, after an entablature of a chimney-piece in the South Kensington Museum; by C. H. Lino, 41, Prince of Wales-crescent, N.W. Price (when finished with enriched moulding) £14. **PRIZE** of £7 10s.

1 (*f*)—5a. Ditto, after a frame in possession of Henry Vaughan, Esq.; by Thomas Wills, 15, Anglesea-villas, New-road, Hammersmith, W. Price, when completed, £17.

Class. No.

REPOUSSÉ WORK IN ANY METAL.

2 (*a*)— 6. Work executed in iron, after the *Martelli* bronze mirror-case, in the South Kensington Museum; by A. Dufour, 10, Cranbourn-street, Leicester-square, W.C. Price £15.

7. "The Virgin and Child," iron panel in low relief, after an example in the South Kensington Museum; by A. Dufour, 10, Cranbourn-street, Leicester-square, W.C. Price £9. 1st **PRIZE** of £10.

8. "The Virgin and Child," iron panel, after the same example as above, by Adolf Ostertag, 24, High-street, Bloomsbury, W.C. Price £15. 2nd **PRIZE** of £5.

9. "The Virgin and Child, copper panel, after the same design as above; by W. Holliday, 14, Nailour-street, Islington, N. Price £15.

2 (*b*)—10. Repoussé work in silver, after a tazza in the South Kensington Musuem; by A. Clark, 29, Gloucester-street, Hoxton, N. Price £5. **PRIZE** of £3.

HAMMERED WORK IN METAL.

3 (*a*)—11. Hammered iron knocker, after an example in the South Kensington Museum; by A. S. Price £6. **PRIZE** of £5.

12. Hammered iron knocker, after the same example as the above, by John Wilkins, 15, De Beauvoir-crescent, N. Price £8.

13. Hammered and chased iron knocker, after the same example as the above; by Thomas Bayley, 45, Lower Camden-street, Birmingham. Price £5 10s.

CARVING IN IVORY.

4 (*a*)—14. Plaque executed in ivory, after one of Silenus and Amorini, by *Fiamingo*, in the South Kensington Museum; by H. Godart, 1, Hargrave-park-terrace, Junction-road, N. Price (when finished) £30. **PRIZE** of £2.

CHASING IN BRONZE.

5 (*b*)—15. Work executed after a missal cover in the South Kensington Museum; by H. J. Hatfield, 3, Great Pulteney-street, W. Price £18. 1st **PRIZE** of £10.

ETCHING AND ENGRAVING ON METAL.

6. —16. Niello work, engraved on nickel silver, after an arabesque by *Lucas Van Leyden*, in the South Kensington Museum; by James S. Gill, 26, Moreton-street West, Pimlico, S.W. Price £2 10s. **PRIZE** of £5 for the exhibit of this and No. 17.

17. Niello work and inlay combined, after the same example as the above; by James G. Gill, Moreton-street West, Pimlico, S.W. Price £3 10s. 6d.

18. Engraving on metal, after the same example as above; by George P. Smith, 19, Guildford-street, Wilmington-square, E C. Price not stated.

19. Engraving on copper, after the same example as the above; by Walter James Dyer, Falkner-street, Ryecroft, Gloucester. Price £5 5s.

20. Engraving on copper, after the same example as the above; by John Gittins, 9, Angela-gardens, Hackney-road, E. Price £4. **PRIZE** of £5.

PAINTING ON PORCELAIN.

8 (*a*)—21. Painting on porcelain, after a drawing by *Raphael*, in the South Kensington Museum; by John Slater, Field-place, Stoke-on-Trent. Price £5 5s.

Class. No.

8 (*a*)—22. Painting on porcelain, after the same example as the above; by Thomas Stanway, Bovey Tracey Pottery, Bovey Tracey, Devon. Price not stated.

23. Painting on porcelain, after the same example as the above; by W. J. W. Nunn, 10, Grafton-street, Globe-lane, Mile-End, E. Price not stated.

24. Painting on porcelain, after the same example as the above; by Herbert Simpson, 6, Queen's-road, Bayswater, W. Price £3 3s. **PRIZE** of £2.

25. Painting on porcelain, after the same example as the above; by Miss E. Henwood, 18, Craven-terrace, Bayswater, W. Price £3 3s. **PRIZE** of £2.

26. Painting on porcelain, after the same example as the above; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £4 4s.

8 (*b*)—27. Painting on porcelain, ornament after *Aldegrever*; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £6 10s. **PRIZE** of £2.

28. Painting on porcelain, ornament after *Aldegrever*; by W. H. Slater, 7, James-street, London-road, Stoke-on-Trent. Price not stated. **PRIZE** of £3.

29. Painting on porcelain, ornament after *Aldegrever*; by Miss E. Henwood, 18, Craven-terrace, Bayswater, W. Price £6 6s. **PRIZE** of £2.

DECORATIVE PAINTING.

9 (*a*)—30. Ornament, after *Aldegrever*; by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £7.

31. Ornament, after *Aldegrever*; by Walter T. Morgan, 41, Pelham-street, Brompton, S.W. Price £3 3s.

32. Ornament, after *Aldegrever*; by Charles Hardgrave, 14, Bloomfield-terrace, Pimlico, S.W. Price £3.

CAMEO CUTTING.

11 —33. Head, after the bust of "Clytie," in the British Museum; by (name not stated) 37, Mornington-crescent, N.W. Price £10 10s.

DIE SINKING.

15 —34. Die, sunk after a Wedgwood medallion, in tho South Kensington Museum; by A. Walker, 19, Alexandra-cottages, Penge, Surrey. Price £7. **PRIZE** of £3.

BOOKBINDING.

16 (*a*)—35. A Writing Case, Mosaic pattern; by Louis Genth, 90, High Holborn, W.C. Price not stated. (Commended.)

EMBROIDERY.

17 —36. Work executed after an Italian altar frontal in the South Kensington Museum; by the Misses Emma and Henrietta Pfänder, 28, Bayham-street, Camden-town, N.W. Price £7. 1st **PRIZE** of £5.

ILLUMINATION.

18 —37. Ornament Border on Vellum, after *Guilio Clovio*—Miniature, "Christ in the Garden of Olives;" by Chas. Pfander, 28, Bayham-street, Camden-town, N.W. Price £9 10s.

38. Ornament Border of MS., after an original in the South Kensington Museum—Miniature, "Birth of Christ;" by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £9 10s.

SECOND DIVISION.

Specimens of the Application to Ordinary Industry of Prescribed Art Processes.

Class. No.

A.—39. Clock Dial, enamel painted, in colours and gold; by James Thwaites, 25, St. John-street-road, E.C.

40. Do. do., enamel painted, white ground and black ornament; by the above. **PRIZE** of £2.

41. Do. do., face decorated and painted in enamel, on iron; arabesque; by Charles W. Pfänder, jun., 28, Bayham-street, Camden-town, N.W. Price £5 6s.

B.—42. Frame for a miniature, engraved and enamelled on metal; by Alfred Gray, 41, Brooksby-street, Islington, N. Price £8 8s. **PRIZE** of £7 10s.

D.—43. Earthenware slab, suitable for insertion in the frieze of a stone or marble chimney-piece; by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries. Price £5.

E.—44. Tablet, painted with enamel colours; designed and painted by J. B. Evans, Howard-place, Shelton, Staffordshire Potteries; modelled by James Griffiths, 14, Hartshill, Stoke-on-Trent. Price £5 5s. **PRIZE** of £5.

G—45—49. Champagne glasses, with filigrani in the cup, stem, and foot; by T. C. E. Barnes, 135, Camden-street, Birmingham. **PRIZE** of £3 for the exhibit of these and No. 121.

118—120. Three champagne glasses; by Joseph Leicester, 13, Tenison-street, Lambeth, S.E. **1st PRIZE** of £7 10s. for the exhibit.

H.—50. Pair of book covers, decorated by painting and varnishing on both sides, china tints on black ground; and gold ornament, on chromatic ground; by Charles Pfänder, 28, Bayham-street, Camden-town, N.W. Price £10 10s. **PRIZE** of £7 10s. for his exhibit, Nos. 50—53.

51. Ditto, decorated on one side, ornament in box-wood tints and gold on crimson ground; by the above. Price £6 10s.

52. One specimen of book-cover, ornament on black ground; by the above. Price £4.

H.—53. Ditto, ornament in gold, on green and red ground; by the above. Price £3.

54. Pair of book-covers, strap-work, on vermillion ground, with green and gold; by C. W. Pfänder, jun., 28, Bayham-street, Camden-town, N.W. Price £6 12s.

I—55. Set of fire irons; by E. Millward. Price not stated.

J.—56. Silver drinking cup, executed in the Italian style; by Alex. Crichton, 16, Southampton-buildings, Holborn, W.C. Price £20.

L.—57. An envelope case in sycamore and ebony woods; by W. M. Holmes, 101, Dean-street, Soho, W. Price £7.

58. Do., in various woods, enriched with carvings in low relief; by Edward T. Grove, 14, William-st., Regent's-park, N.W. Price £5. **PRIZE** of £7 10s.

R.—59. Design for balcony; by G. Emms. Executed by J. Emms and Sons, 3, Prince's-street, Union-street, Boro', S.E. Price, when finished, £12. **PRIZE** of £7 10s. for the exhibit of this and No. 75.

60. Do.; by William Robson and Henry Robson, 6, Park-terrace, Battersea-park, S.W. Price £7. **1st PRIZE** of £10, and "North London Exhibition Prize."*

* This prize consists of £4 18s., the interest of £167 7s. 3d. Consols, invested in the name of the Society of Arts, to be awarded by the Council "for the best specimen of skilful workmanship" at the Society's Exhibition of Art-Workmanship.

THIRD DIVISION.

Articles sent in for Exhibition, in addition to those in accordance with the Prescribed Designs and Processes.

METAL WORK.

No.

61. Mask, repoussé in copper, of one of the Laocoon Group; by G. Deere, 11, Hermes-street, Pentonville, N. **PRIZE** of £5 for the exhibit of this and No. 62.

62. Sleeping child, repoussé in copper; by the above.

63. Grotesque mask in copper; by Robert Tow, 36, Aldenham-street, St. Pancras-road, N.W. **PRIZE** of £3 for the exhibit of this and No. 64.

64. Group of horses, in copper; by the above.

65. Clock case, design from natural ferns, to form a family portrait stand; by G. Berry, 31, Brewer-street, Golden-square, W. Price £16 16s.

66. Cigar case, engraved; by the above. Price £3 10s.

67. Portrait of His Royal Highness the Prince of Wales, in silver; by W. Holliday, 14, Nailour-street, Islington, N. Price £25.

68. "The Crucifixion," repoussé in silver; by E. Richards, 29, Myddelton-street, E.C.

69. "Hercules and Omphale," embossed in copper; by Joseph C. Day, Church-road, Tottenham, N. Price £10. **PRIZE** of £2 for the exhibit of this and No. 70.

70. "Solitude;" by the above. Price £6.

71. Group of flowers embossed in copper; by J. R. Godfrey, 20, Chatham-road, Wandsworth-common, S.W. Price £6.

72. Entablature and upper portion of pilaster, and repoussé work, showing the introduction of wrought metal in furniture; by the above. Price not stated.

73. Inlay of German Silver in Copper, centre embossed in sheet copper; by A. Millward, 7, Hanover-street, Long-acre, W.C. Price not stated. **PRIZE** of £7 10s. for the exhibit of this and No. 74.

74. Circular Ornament, pierced in metal; by the above. Price not stated.

75. Wrought-Iron Banister, designed by T. Anson for grand staircase of British and Foreign Bible Society's new building; executed by J. Emms and Sons, 3, Prince's-street, Union-street, Borough, S.E. (See No. 59.)

WOOD CARVING.

76. Inlay in various woods, "Moses;" by W. Clayton, 125, Wardour-street, Oxford-street, W. Price £10. **PRIZE** of £7 10s. for the exhibit of this and No. 77.

77. Ditto, "Elias;" by the above. Price £10.

78. Walnut-wood Clock Case; by Mark Rogers, 111, Tachbrook-street, Pimlico, S.W. Property of, and lent by, Messrs. Trollope and Sons, Halkin-street, S.W. (Commended.)

79. Clock Case in wood; by P. Meur, 138, Drummond-street, Hampstead-road, N.W. Price £10.

80. Ditto, by E. T. Grove, 14, William-street, Regent's-park, N.W. Price (when finished) £16.

81. Carved Frame in lime-tree wood; by G. H. Bull, 16, Millman-mews, Millman-street, Guildford-street, W.C. Price £18. **PRIZE** of £3.

82. Conventional frame, for gilding (unfinished); by C. McKenzie, jun., 1A, Bishop's-terrace, Walcot-square, Kennington-road, S.E. Price £5. **PRIZE** of £3.

83. Panel in oak, for jamb of chimney-piece represented in the drawing accompanying it; by T. Fernee, 22, Werrington-street, Oakley-square, N.W. Price £4 4s.

84. Oak bracket; by R. A. Brangan, 54, Foley-street, Portland-place, W. Price £30. **PRIZE** of £5.

No.

85. Panel in birch-wood, for a side-board door; designed and executed by William Matthews, Manor-street, Chelsea, S.W. Priee £10 10s. **PRIZE** of £5.
86. Panel in oak; by James Minns, Mariner's-lane, Norwieh. Property of, and lent by B. E. Fletcher, Esq.
87. Ditto ditto
88. Ditto ditto

Modelling in Plaster.

89. Bust of Rt. Hon. W. E. Gladstone, M.P.; by John Long, 24, Stangate, Westminster-bridge, S.E. Price not stated.
90. A Patera, modelled from nature; by the above. Price not stated.
91. Bust, "Esperance;" by W. Matthews, 79, Manor-street, Chelsea, S.W. Price, in box-wood, with ebony pedestal, £10; in statuary marble, £15.
92. Ditto, after a head in terra-eotta, in Royal Academy; by the above. Priees as above.
93. Medallion (original), "Cardinal Wolsey;" by G. Morgan, 41, Pelham-street, Brompton, S.W. Price £1 1s. **PRIZE** of £1 for the exhibit of this and No. 94.
94. Medallion, modelled from life; by the above. Price £1 1s.
95. Medallion, portrait of Arehbishop Manning; by Albert Heness, 3, Egbert-street, St. George's-road, N.W. Price £1 10s.
96. Medallion Portrait of Prineess Louise, to be made in Jasper or Wedgwood ware, for cabinet decoration; by W. Wright, Mrs. Wallis, St. Martin's, Stamford. Price £1 10s.
97. Bust, modelled from life; by E. Renversez, 6, Castle-street East, Oxford-street, W.
98. (See "Carving in Marble.")
99. Model of the Florentine Boar in the South Kensington Museum; by W. Marshall, 3, Smith-terrace, King's-road, Chelsea, S.W. Priee £2.
100. Wreath of Flowers; by T. Godfrey, 21, Chatham-road, Wandsworth-eommon, S.W. **PRIZE** of £2.
101. A North Amerieam Indian; modelled by A. Dufour, 10, Cranbourn-street, Leieester-square, W.C. Price £7. **PRIZE** of £3.
102. Ornament; by James Frampton, 10, Prospeet-terrace, Britannia-road, S.W.
103. Bracket; by the above.
104. Ornament; modelled by W. Edge, Park-street, Stoke-on-Trent; and designed by J. B. Evans, Howard-plaee, Shelton, Staffordshire Potteries; unfinished through aceident in the oven.

Modelling in Terra Cotta.

105. Braeket, after original by *Donatello;* by W. Wright, Mrs. Wallis, St. Martin's, Stamford. Price £5.

Modelling in Wax.

106. Ornament; by C. Jahn, 3, Egbert-street, St. George's-road, N.W. **PRIZE** of £1 for the exhibit of this and No. 107.
107. Ditto, by the above.
108. Medallion from cameo of *Savonarola;* by G. Morgan, 41, Pelham-street, Brompton, S.W. Price £1 1s.

Carving in Marble.

98. Medallion Portrait of the Duc de Lianeourt Rochefoueauld, modelled after the photograph accompanying it; by the above. Priee £12.
109. Bracket; by Samuel Moutrie, 219, Stanhope-street, Hampstead-road, N.W. Priee £6. **PRIZE** of £3.

No.

110. Boy and Grapes; by W. R. Barrett, 2, Alma-terraee, Fentiman-road, S.E. Price £3.
111. Girl's Head; by the above. Priee £2 10s.
112. Flower tablet; by J. Welch, 10, Doddington-grove, Battersea-park, S.W. Priee £4.
113. "Boy's Head;" by the above. Priee £2.
114. Keystone, with head earved in marble; by the above. Priee £3.

Carving in Stone.

115. Vase for flowers; by Owen Thomas, 66, Harwood-street, Camden-town, N.W.
116. Study in Tisbury stone, "May;" by J. R. Heath, 2, Tenison-street, York-road, S.E. Priee £7. **PRIZE** of £5.
117. Corbel, in stone, with inlay of marble; by T. E. Jago, 122, Vauxhall-bridge-road. Priee £2 10s. **PRIZE** of £1.

Glass Blowing.

118—120. (See "Seeond Division, G.")
121. Cream jug; by T. C. Barnes, 135, Camden-street, Birmingham.
122—123. Two plain champagne glasses, with twisted stems; by Elijah Barnes, 135, Camden-street, Birmingham. **PRIZE** of £1 for the exhibit of these and No. 124.
124. Vase; by the above.

Painting on Porcelain.

125. Tea serviee designed and exeeuted by Isaae Wild, at Sutherland Works, Longton. Price £13 10s. **PRIZE** of £5.
126. Children playing with a dog; by H. Brownsword, 48, Salem-street, Etruria, Staffordshire Potteries.
127. Portrait of Tennyson; by the above.
128. Head; by W P. Rhodes, Newcastle-under-Lyne, Staffordshire. **PRIZE** of £2.
129. "The First Lesson on the Flageolet;" by Robert Williams, 10, Bethesda-st., Hanley, Staffordshire.
130. "The Lost Boat;" by the above.
131. Slab, "The Burning Heart;" by Miss L. Leila Hawkins, Fossil-villa, Belvedere-road, S.E. Price £5 5s. **PRIZE** of £2.
182. Do.; by J. B. Evans, Howard-plaee, Shelton, Staffordshire Potteries. Price £3.
133. Do.; by John Eyre, 14, Camera-square, S.W.
134. Tray, subjeet, "David the Psalmist;" by the above. **PRIZE** of £3.
135. Fruit, after Hunt; by William Slater, Field-place, Stoke-on-Trent. Price £4 4s. **PRIZE** of £1.
136. Slab; by G. F. L., 104, Great College-street, Camden-town, N.W.
137. Do., with figures, after work exeeuted by *Guerin* on the ceiling of the Saloon of Laocoon in the Museum of Antiques, Paris; by W. G. Fenton, 10, Chatham-street, Howard-plaee, Shelton, Stoke-on-Trent. Price £5.
138. Do., after a pieture by Gerard, "Belisarius;" by the above. Price £6.
139. Do., an original design; by the above. Priee £10. **PRIZE** of £2.

Cameo Cutting.

140. Portrait of Dr. Billing, F.R.S., exeeuted from life; by (name not stated), 37, Mornington-erescent, N.W. Price £15 15s. **PRIZE** of £5 for the exhibit of this and No. 141.
141. Portrait of an Italian lady; by the above. Priee £15 15s.

Design.

142. Design for an embroidered table eover; by W. Percivall, Polygon-street, Ardwick, Manchester. Price £5 5s.

LIBRARY.

The following works have been added to the Society's Library :—

Railway Facts and Lower Fares, by F. J. Haggard.
A Mile of Railway, by F. J. Haggard.
Katalog der Werkzeug Sommlung au der Königlichen Polytechnischen Schule za Hanover.
On the Constitution of Hospitals, by Captain Douglas Galton, C.B., F.R.S.
Some Account of the Town of Zanzibar, by Edward Steere, LL.D.
A Scheme of Emigration, by Edward Wilson.
Synopsis of the Charters, Constitutions, and Privileges granted to the Channel Islanders, by John Sullivan.
Jersey, la Constitution, &c., by John Sullivan.
Etude sur le Système des Contributions Directes et Indirectes de l'Ile de Jersey, by John Sullivan.
Elegie sur la morte de Lord Palmerston, by John Sullivan.
Address of C. B. Vignoles, F.R.S., on his Election as President of the Institution of Civil Engineers, 1870.
The Study of the English Language, by A. J. D. D'Orsay, B.D.
The Prison Character of London and Middlesex.
La Suppression des Grièves, par Charles Robert.

*** The above-named works have been all presented by the authors, to whom the thanks of the Council have been awarded.

A Practical Treatise on Concrete, by Henry Reed, C.E.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 9th, 1870; Charles Hutton Gregory, Esq., in the chair.

The following candidates were proposed for election as members of the Society :—

Brunton, John, C.E., 19, Phillimore-gardens, Kensington, W.
Crawley, J., 23, Thavies-inn, E.C.
Edwards, Frederick, 49, Great Marlborough-street, W.
Gay, F. W., F.R.M.S., 113, High Holborn, W.C.
Hamilton, Rowland, Oriental Club, Hanover-square, W.
Lever, J. O., 18, Palmerston-buildings, Old Broad-street, E.C.
Welch, Stanley Kemp, 9, Christchurch-road, S.W.

The following candidates were balloted for, and duly elected members of the Society :—

Arkwright, Augustus Peter, M.P., 15, King-street, St. James's, S.W.
Baggallay, T. W., 5, Love-lane, Aldermanbury, E.C.
Bamber, Henry K., 5, Westminster-chambers, Victoria-street, S.W.
Bartlett, Frederick, Dunsbee-house, East Croydon.
Bateman, Arthur H., 41, Seething-lane, E.C.
Boyd, John, 85, Gracechurch-street, E.C.
Brooke, Charles Langley, 7, Gresham-street, E.C.
Denny, Jonathan, Holly Cottage, East-hill, Wandsworth, S.W.
Francis, Henry, 17, Gracechurch-street, E.C.
French, John M., 12, Commercial-st., Whitechapel, E.
Goodyear, Charles, 19, Northumberland-st., Strand, W.C.
Gordon, Alexander, The Brewery, Caledonian-road, N., and 10, Holland-park, Bayswater, W.
Hillel, Jules, 14, Palmerston-buildings, Old Broad-st., E.C.
Holdsworth, John James, 13, John-st., Minories, E.C.
Holloway, George H. Hughenden, 31, Soho-square, W.
Hunt, Horatio Nelson, 2, Montague-place, Russell-sq., W.C.
Latchford, Benjamin, 11, Upper St. Martin's-lane, W.C.
Milner, William, 211–213, Tottenham-court-road, W.
Pollard, Joseph, Highdown, Hitchin.
Tallerman, D., 31, Norton Folgate, N.E.

The Paper read was—

TRAMWAYS FOR STREETS AND ROADS, AND THEIR SEQUENCES.

By W. Bridges Adams.

Crowded cities were originally a result of walled defences, inclosing narrow streets and lanes, and lofty buildings, such as London exhibits up to the present day, the practices generated by necessity being continued in the pursuit of gain in special localities, where a square yard of land exceeds in value an acre, or many acres, elsewhere. London within the walls had to be extended to London without, and the aggregation went on, like the cells of a beehive, all round the City, every separate interval being filled up, and gradually absorbing all the surrounding villages. Healthy sites and unhealthy, all were occupied; and more especially along the course of the river, the great highway of former times. The Bedford estates became mines of wealth; and in our own days we have seen the eastern border of the great Chelsea swamp converted into a palace-bearing Belgravia. Thicker and faster grew the crush towards the great centre of wealth from all outlying districts, and the conditions of health were disregarded, even if understood. Wealthy men lived over their shops and stores, and poor men in hovels in every nook and corner; and no doubt it was considered a great achievement when houses were erected on London-bridge, in the full current of healthy air pumped up and down by the rise and fall of the tides, overlooking the market-gardens of the river levels. But these gardens were doomed, and the sites prepared by nature for the growth of wholesome vegetation gradually became the sites of unhealthy dwellings, for the growth of an inferior staple of humanity, with water lying within a foot of the ground-floors, and water and sewage overflowing them from time to time, as is still the case when a higher tide than usual raises the river level. We take considerable pains, in the growth of our cattle, to surround them with all favourable circumstances to convert them into the best quality of food, and we forget that we cannot produce the finest physical qualities, and, *à fortiori*, mental qualities, in human beings, if we persist in surrounding them with a poisonous atmosphere.

Were we to begin *de novo* with setting out a city for this great nation of three million souls constituting the metropolis, it would no doubt be upon a very different plan from the no-plan at present existing. No better site exists in the world than this of London, with its broad river and slopes rising to the heights north and south, and with fertile low lands lying between for the growth of vegetable food, lands capable of solving that great sewage question pressing so heavily upon us, by being a near receptacle, night by night, for the excreta of all the food consumed day by day. Beginning *de novo*, we should limit our City nucleus of business holdings to a circle of about two miles in diameter, and then interpose a zone of trees and cultivated land, and then a zone of buildings, and so on as the population increased. The obvious objection to such a system is the increase of

distance. But for this, land in Belgravia would have remained in the condition of garden ground, and if distance could have been lessened practically, the hilly lands ten miles round London would all long ago have become building lands. The enclosed squares in various parts of London are signs and tokens of attempts, from time to time, to reconcile free air and pleasant aspect with the absence of distant transit; and in all directions it is curious to trace the process by which London increases in radiating roads. Take the City-road and New-road as an example. With a sufficient width of road and footway, rows of houses were built on each side, with a garden in front and a garden behind, and this appears to be the almost universal system of extension. Gradually, a dwelling house is converted into a shop, and the front garden ceases to exist, unless as a depôt for goods. Some enterprising individual in the middle of a row will then cover over and enclose his front garden as a special and remarkable shop, shutting out light and view from his neighbours on each hand. Gradually they also build out shops and restore the equality. Then some one builds up his house over the projected shop, and the same process goes on again, and thus the road with a continuous range of gardens is converted into a street without any gardens at all, and, if business becomes thriving, the back gardens also are built upon. A solitary house in its primitive condition sometimes remains for years, indicating, between two dead walls enclosing unhealthy trees, that the owner continues to protest against the perversion of the original design.

Difficulty of transit to more distant localities was the cause of this. The earlier business men, who took to dwelling in country and suburban residences, amidst trees and gardens, were the wealthy who could keep horses and carriages. Their clerks and assistants found it more healthy to walk to brick and mortar "Wildernesses" and "Groves" and "Paradises," up and down the outskirts of the town, rather than to live in city lanes, while lacking the means of getting backwards and forwards to Hampstead, Highgate, Hackney, Camden-town, Somers-town, Kentish-town, and all the other villages supplementary to London. For the rich, not rich enough to keep their own carriages, hackney coaches, the cast-off vehicles of the wealthy, were established; the cab on two wheels followed, and then the four-wheel, a sort of wooden box, invented to carry four persons instead of two, with the economic use of a horse with two legs instead of four. A four-legged horse was wanted to the two-wheeled cab in case of stumbling, to prevent over-setting; but the four wheels enabled the cabman to use "the two-legged horse" without risk to his fare, and with a smaller outlay of horse capital.

Then came the short stage-coaches, running to Paddington, and Bow, and Stratford, and Hampstead, and the foot of Highgate-hill, Hackney, and elsewhere, but the shilling outside, and eighteen-pence in, did not supply the wants of the many. They were a luxury and a necessity for emergencies, but not the constant supply of a daily recurring want at uncertain intervals, and professional men, whose business required frequent locomotion, had of necessity, if not rich, to maintain a vehicle then called a "pill-box," largely used by medical men; and which is now known as a Brougham, or the open vehicle known then as a Stanhope, and now almost laid up in the limbo of things that were. One day I was driving to town in a very small Stanhope, drawn by a very small cob, and was stopped by a crowd at the intersection of Gower-street and the New-road. The cause of the crowd was the first omnibus introduced in London on the line of the New-road, and people had not yet understood that its object was to carry chance passengers for long and short distances along the line of route. The conductor was touting for custom, in the mode now grown common, but people did not understand the then new process. Gradually I drew nearer and caught the conductor's eye, which instantly lighted up with mirth, as he pointed to his large but empty vehicle. "Drive in, sir; there's room for all three on ye—you, and the 'oss, and the shay."

How these omnibuses increased in number, from the first lumbering French pattern, is well known, but we scarcely reflect on the large part they have played in civilisation. For the first time, poor and well-to-do men and women sat down side by side, and looked inquiringly into each other's faces, making the discovery that humanity dwelt equally under the coarse garb and the more expensive clothing. Classes, first, second, third, and parliamentary, were invented for the railroad, but there was no class, save all classes, in the omnibus. The chief distinction was between dirty and clean classes, and the dirty soon began to learn the lesson that dirt was not in itself desirable, but the contrary; and many began to imitate, as far as in them lay, the habits and customs of the cleanly. There was one favourable condition which descended from the stage-coaches; the smoking tribes were rigidly excluded from the interior, and took to the outside—a common-sense arrangement. But there was no assumption of superiority amongst the riders, and the lesser educated could listen to the conversation of the better educated, while they in turn could feel curiously interested in the language, habits, and customs that were new to them in their freedom and quaintness. The result was analogous to that of the dwellers in Paris houses, where all classes are gathered under one roof at various elevations, the middle-classes in shops and lower stories, the working-classes in attics and cellars, and the easy and fashionable classes at the mid-height between, meeting one another on the common stair, and exchanging kindly greetings without any intimate communion, but with mutual respect. A very large part have our omnibuses played in thus assimilating the London population. Time was, that the West was, as it were, cut off from the East; the denizens of Poplar and Rotherhithe were as separate tribes from those of Paddington; and a working man who had been as far as Gravesend was looked on as a species of traveller. His conveyance was a tidal or sailing-boat, and his needful maintenance could not spare the time required for his transit there and back or the cost of the fare by stage-coach. The omnibuses carried twelve or fourteen persons inside when the stage-coach carried only six, and this was a considerable advance in the accommodation of those who did not like exposure to all weathers, but it was not cheap enough for large numbers. In cotton mills, with several stories, it is found to be cheaper to lift the work-people up and down by steam machinery than to allow them to walk up and down stairs, and so also it should be cheaper, in a national point of view, to carry working people along roads by horse or steam power than to waste time and muscular power in walking to and from their work. This has given rise to our suburban metropolitan lines of railway, and also to the subway lines under the streets, called the Metropolitan. But these lines do not fulfil the required conditions, other than at their various stations, and along the new streets bordering their course. The omnibus supplies another condition, taking up and setting down passengers near their own dwellings, entering from the ground level without walking to and from stations, and going through the time-losing process of taking and giving up tickets. But the omnibus does not supply the condition of travelling so cheaply or so rapidly as steam, though it does supply the condition of going in any direction past the exact spot where passengers wish to alight, or to depart from. What, therefore, is most needed is, to combine all the advantages we obtain by the railroad system with those we obtain by the omnibus system, albeit at a lessened rate of speed, through streets and crowded roads, with possibly double or treble the omnibus speed when the roads are not crowded, or when other vehicles disappear by reason of the greater cheapness of the improved system. It is the growing perception of

this possibility that has raised the general outcry for tramways.

But, supposing we obtain tramways in their most perfect condition, what will be the first result? Undoubtedly the extension of building, and the filling up of all open spots and spaces, till London becomes a more solid block than ever, and streets are increased in number with a prescribed Parliamentary width, but with unlimited height to the houses therein. In very hot countries, narrow streets and lofty houses are useful for shade. In cold and moist countries, air and ventilation are needed. A good Building Act should have stipulated for such a proportion of width of streets to height of buildings as would have secured abundance of light and air, sunlight and free oxygen, proportioned to the climate. The time will come when wealthy merchants will feel ashamed of poisoning the lungs of their clerks and assistants, and burning away their eyesight, packing them, like herrings in boxes, in flats one above another, in a fetid atmosphere sometimes lighted only by gas.

We boast of our freedom, each man the lord of his own castle; and surely London, with all its defects, yet retaining much of the individuality of its denizens, is preferable to Paris, with its ranges of barrack-like streets, all built to the order of a single individual. Nature exhibits her taste in variety, and the like freedom should be allowed to humanity. But we must interfere with individual will when it is exerted to the damage of the general community, as in the case of health; and the State has just as much right to interfere for the purposes of general ventilation as of general drainage. The time will no doubt come when builders will be prohibited from erecting human dwellings on swamps, even if the general perception of the community does not grow up to make it an unprofitable speculation. Proprietary rights in land must be respected, or we should fall into savagery, but proprietary uses must not endanger the general welfare.

The larger a city becomes, the less pure is the general atmosphere, and especially in moist, warm weather; and it requires almost a storm of wind to clear away the breaths of human bodies from amidst enclosing walls, for there are cisterns of dirty air as well as of dirty water, and vegetation is therefore an important element in sanitary operations. Common-sense would therefore dictate not merely wide streets, but also a limitation to the area of the city. It has been calculated that another forty years, at the present rate of increase, will give us six millions of population in the metropolis—a population nearly equal to all Ireland crowded into a space of some 108 square miles; and, supposing the area not extended, giving about eighty-seven to the acre. And the greater the populated mileage, the greater becomes the difficulty of dealing with the drainage and sewage question, as well as ventilation.

There might be one mode of increasing the space of breathing mileage. An Act of the Legislature to limit the building area to a circle of say fourteen miles diameter, and decree that a belt of five miles in breadth beyond that shall be preserved in perpetuity, for purposes of woodlands, farms, gardens, orchards, and recreation grounds. This would reduce the future numbers to some twenty per acre, and the present to ten per acre, and it would provide for the utilisation of all the sewage of London, easily transported in radial lines to every part of the circumference, giving a return of fruit, vegetables, and milk up to the consuming power of the population, a thing that has not yet been done. Half-an-hour's ride by railway, or say three-quarters of an hour by tramway, would suffice to convey London denizens to this belt of health-ground from all parts of the metropolis. From this belt should be exempted the land lying in the direction of foreign commerce and manufactories down the course of the river.

Would the proprietors of the land complain of this, as taking away their improvable proverty? We may ask, how improvable? Not by their own efforts, but simply by train and rail making their property accessible. The property would be considerably increased in value by its accessibilities for food-producing purposes, and the owners might very well be content with increased rents thereby, as a sufficient reason for complying with the Act of Parliament, rents rising considerably by a certain and increasing market for the produce of green food. Refusal would entitle the State to purchase the land compulsorily at its market value, just as much as if it were for the purposes of ports, or harbours, or arsenals, or railways; and the State could lease it at a good profit to responsible farmers, and we should then probably behold some of the wonders that have yet to blossom out of agricultural skill and mechanism. No doubt, it would be a large sum to lay out, to purchase some 300 square miles of land, but probably the proprietors would prefer to keep them, by complying with the conditions of public health, and if not, the State would reap a large revenue very easily collected.

And a new London beyond the belt would begin to grow up. The belt would represent the fields of Hampstead, Highgate, Copenhagen, Islington, and elsewhere, as they were in the last century, with the difference that they would be permanent fields, and not subject to constant inroads of the speculative builder, frequently building houses more for his own profit than for the tenants' convenient and healthy use. And the new London beyond the belt would be constructed on better conditions than at present obtain. It would have the benefit of all the knowledge now growing up, a beginning at the beginning, with old bad practices abolished.

Is this necessarily a dream? Will it not bear logical examination? Can it not be confirmed in every particular by analogical evidence? Can we not, with our wealth and our power, and our chemical and mechanical knowledge, and our magnificent site, build us up a city that shall be a marvel to all the earth, till such time as other nations shall go and do likewise; doing for the great masses of our people that and more than was done in the old times, by Red-haired William and other tyrannous despots for their own personal aggrandisement. We have a large field for the employ of idle capital at our own doors. It would no doubt be for the benefit of our posterity, but ought it therefore to be objectionable, considering the large benefit we ourselves may reap from it.

The *laissez-faire* principle is a very sound one for a sparsely-peopled country, where men can do what is good in their own sight without affecting their neighbours at a distance; but as population thickens the conditions change, and the general welfare requires the restraint of individual actions affecting the mass. Even nations must be subjected to this, analogous to the conditions of neighbouring parishes. It would not be endured that one parish should breed up thieves and paupers to prey on their neighbours, reckless of consequences. Inland countries, with snowy mountains, such as Switzerland, have large pine forests shutting out the sun's rays, and storing up the snow as a perennial spring to supply the rivers. Thus the Swiss mountains are the source of the Rhone, which runs through France. Time was that the Rhone was a navigable river nearly the year through. The environs of the city of Lyons were largely covered with houses built of unburned brick, and that fact is evidence of their being beyond the then reach of inundations. But the river changed its habits; navigation became limited to a few months in the year, and floods and inundations were of frequent occurrence, melting down the lines of unburned brick houses like rows of sugar-loaves. The reason was a plain one. The forests on the mountain slopes, that sheltered the snow from the sun's heat, gradually disappeared—probably burnt as fuel—and as the snow fell it slipped down, forming avalanches and floods. Practically, this changed the French Rhone from a useful river into a scourging flood, with considerable tracts of land lost to agriculture, showing the necessity of inter-

national laws, to prevent people from damaging their neighbours as well as themselves. On the same principle, we must consider how the maximum of good, and the minimum of evil, may be extracted from improved town and suburban transit.

The earliest form of road for heavy continuous transit was called a tramway, some say after an inventor named Outram, but more probably from being a trammelled or guiding way, enforcing the vehicles to a specific path, and preventing the wheels from running off the bearing metals. Passing through various changes, these roads finally culminated in the high-speed railway, the mode of guidance being varied by removing the guiding flanges from the rails and applying them to the wheels, converting the tram-rail into what is called an "edge rail," with the advantage of lessening the rubbing friction of the flanges, and keeping the rails freer from dirt and obstacles. Without this change, the impediments to high speed would have been considerable. The two elements, without which the highest speed railway could not exist, are, first, the smooth, hard, even surface, and secondly, the automatic guidance. With the most perfect level and hard smooth surface, and an indefinitely large level, the skill of the best driver would fail to maintain or shape a true course without the automatic guidance. And railways are, therefore, good or bad in proportion to the perfection of their construction. But the best railways and the worst are alike tramways in the sense of their automatic guidance.

The old term is now once more revived in application to our rails in streets and common roads. But it is a misnomer in its application, as the wheels used are flange wheels which enter grooves in the rails, the running surface rising on either side the groove to the road level, so as not to impede the transit of ordinary vehicles crossing the road. The term tramway is kept up as indicating horse transit instead of steam. The desirability of this for improved town and suburban transit had been impressed on my mind from the outset of the Liverpool and Manchester; and in September, 1844, I wrote an article of some 73 pages in the *Westminster Review*, entitled "Railway Administration and Improvement," dealing with the question politically, commercially, and mechanically, pointing out that, theoretically, the railways ought to be the property of the State, were it not that individual energy, backed by self-interest, was essential to rapid progress, difficult to be obtained by a general government, always better adapted to stereotype than to originate a new system. In a dialogue between a railway director and a member of the Board of Trade, the whole question was discussed. A plan of railway carriage was also shown, with a central passage throughout, and compartments open or closed at pleasure. Passing through this question, I pointed out the necessity for street and suburban rails worked by horses, proposing a series of lines to be called the "Metropolitan Junction Tramway." A woodcut was also given of the plan of rail, level with the road, and with a groove for the flange of the wheels. A central terminus was proposed in Smithfield, with the lines radiating in various directions towards the railway termini, and the advantages accruing were pointed out; but the profits accruing from the making of large railways forbade any of the business people from turning their attention to small ones at that time.

It may be remembered that, some thirteen years afterwards, February 13, 1857, I read in this room a paper on "Horse Transit by Rail for the Streets and Suburbs of London, and for Railway Branches." Various questions of the mechanism of wheels, axles, and rails, were discussed therein, and routes pointed out, and amongst them the lines which have been lately conceded by Parliament. The groove rail was also shown, and it was pointed out, and shown in the woodcuts, that upon this plan flange wheels were only required to the wheels on one side of the vehicle. At the reading of this paper, Mr. Bennock took objection that the routes did not provide any approach to the Bank. This was quite true, and at that time I purposely avoided sinuous lines and narrow streets, because I had not then considered the mode of avoiding obstacles or hindrance to the general traffic.

In December, 1864, I read a paper on the "Permanent Way of Railways, and their Rolling Stock," pointing out the sources of frictional resistance and destructive wear, and the necessity of radial structure, by which these difficulties might be avoided, making the rolling-stock flexible instead of rigid, a process that that has since come largely into use.

Another thirteen years have passed away since the reading of the paper in 1857, and we are now arrived at a period, that in the absence of any main railway work, turns the attention of contractors and others to what may be done in supplementing railways. Two lines have been passed for London, one along the Mile-end-road, from Whitechapel, the other from Brixton to Greenwich, and in the present session a number of Acts are about to be applied for. The only lines commenced are from Whitechapel and Brixton. With an amply wide road and a double line, the former is practically a double-line of railway with a continuous "level crossing," to be worked by horses, the arrangement of the rail and timber below resembling the woodcut in the *Westminster Review*. The rails are laid with continuous paving-stones on both sides, and are grouted in with lime at the sides and bottom, on the supposition that they will need no packing with the wear. Of course the carriages, as constructed, can have no means of getting off the line, unless by sidings and turntables, as on all railway lines. Whether the rails will maintain their level without packing is yet a problem, and also whether the timber, not being creosoted, will rot, as is the case with wood paving. The structure consists of longitudinal timbers, six inches deep and four inches wide horizontally. The joints of the timbers meet in cast-iron shoes about eight inches in width. Intermediate chairs, about five inches in width, are spaces five feet apart, and tie-bars of wrought-iron to keep the guage are dovetailed into the chair-jaws between. Apparently to keep down the weight, the chairs are of a weak pattern, and the tie-bars may break them if not carefully packed. Time will show whether the timber is apt to rot, and if so the replacing will involve much trouble. The iron rails are four inches in width and an inch and a half in vertical thickness; they are spiked down to the timber sleepers in the grooves, and the joints are underlaid with a short length of flat plate, half an inch in thickness; they are very safe from damage by the wheels of heavy road vehicles of the ordinary class.

It is obvious that such a system would be impracticable in comparatively narrow and crowded streets, and can only be fitted for wide suburban roads, wide enough for ordinary railways and their appliances, and their advantages over the ordinary roadway is their smooth surface and automatic wheel guidance. But their special wheel guidance prohibits any traffic save that of vehicles running one behind the other, and all stopping whenever an obstacle occurs. The difficulty is the flanges of the wheels and the grooves they run in. It is essential, absolutely essential, to rail transit in narrow, sinuous, and crowded streets, that the vehicles should be able to run on the rails and off, at the will of the drivers. But human beings, whether engineers or others, are very like sheep in their imitative habits. Tramways proper had no means of allowing the waggons to run off and on the rails, except at special places, and the railways proper of the last forty years have all had flanged wheels, *ergo*, they must continue to have them. But if we examine into the matter, we find that flanges are made deep for the rate of security in keeping on the rails at high speeds. As speed lessens, the necessity for depth in the flange ceases, and with fitting mechanical form, the flanges may be dispensed with altogether. With good springs to the vehicles, a flange half an inch or five-eighths in depth is as good as an inch.

The objection to the tram-rail was its flat, horizontal surface, without any guidance save when the wheel approached the rising flange inside. But there is a process for guidance without flanges, indicated by nature. The cross-section of a river and its bed gives us the mechanical form. The bed is deep in the centre, and rises in a gradual curve to each edge or bank. If, therefore, we construct a rail with a channel top four to five inches wide, and half an inch deep, struck from a radius of about four inches, and use wheels with tires two to three inches broad, struck from a radius of about two inches, it is obvious that these wheels, if set to the right gauge, corresponding to the centres of the two rails, will infallibly keep that centre, by the action of gravity, as surely as the water of the river keeps to the centre of the bed, unless the wheels are purposely drawn out by the horses at the will of the driver, in which case a comparatively slight force will suffice, leading the vehicle up the lateral inclines of the rail curves. And in the running of these wheels there will be no flange friction, as there are no flanges to rub, and the vehicle will run as easily on the common road as on the rail, less the obstacles by irregular surface. There is a certain amount of objection which may be raised to this system. Stones or dirt may roll into the curved channel, which is lower than the road surface. But this objection is more apparent than real. Loose stones are not prevalent in the streets, save when fresh macadam is laid down, and in that case the modern arrangement for rolling them flat with a steam roller gets rid of the difficulty. In any case, spring brooms and scrapers applied to the front of the vehicle gets rid of the difficulty, which is really less in the case of the open channel than of the groove rail. Moreover, in such case, the rails would, every morning and evening, be cleaned out under inspection by regular attendants, as the grooves must be. Nor could the wheels leave the channels, but would simply spring over the obstacles as on a common road, unless purposely drawn out. To lift the vehicle out of the groove, there must be an obstacle in each rail at the same time. The tendency of the cross curved tires is to throw dirt or stones out of the rail channels, the depth not being more than that of paving stones out of level.

Rails laid on streets or roads are simply strips of harder, and straighter, and more level surface than the ordinary paving or macadam composing the general surface. It is obvious that paving stones laid level with the rail edges will preserve an even surface with the iron, and prevent danger by vehicles crossing over. But if laid on macadam, the ordinry vehicles will be very apt to form grooves by running alongside the rail, in which case water will get in and spoil the road. Therefore, some provision must be made to prevent this, either by paving the road, or covering it with hard asphalte along the rail edges, and also in the horse tracks, which will else be rapidly destroyed by the horses' feet, and which, and not the wheels, are the great source of paving wear.

It must be obvious that, on the edge rails of ordinary railroads, the guidance either to right or left can only be by one flange of the wheels of each axle. If the one flange gets off the rail, the other wheel must immediately run off by the action of the conical periphery. With two flanges, one in the groove of each rail, both wheels operate in each direction, and therefore the safety is much greater. Moreover, with a hard road and rails, all at the same level, even the getting off does not involve risk, as on the railway proper when the rail is considerably elevated above the ballast, and the ballast slopes away from the sleepers on each hand, either in a cutting or on the more dangerous position of an embankment. But while the grooved rails are safer, operating on two wheels at once, there is also a great evil. Of necessity the grooves must be narrow, and this narrowness will involve great friction of the flanges, with great wear and tear, and resistance to haulage. The carriages constructed with the wheels fixed, on the ordinary railway system, to the frames or bodies, have no side yield or instantaneous spring resistance, and the result is considerable jolting and vibration, with very violent strains when the slightest cause exists. The wheels and rails on railways proper have an inch clearance between the flanges and the rails, but the grooved rails will not admit of half the amount, and every irregularity in the guage of way induces great friction.

The channel rails before described, with a channel four to five inches in width, and wheel tires less than three inches in width, will have ample clearance, always tending to run on the exact centre by the action of gravitation, with scarcely any friction, running, as the old stage coachmen were accustomed to phrase it, "on the nail." And the channel rails will not impede the free movement of other vehicles running across them or along them.

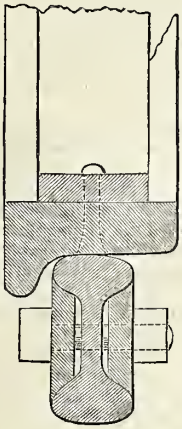
But there is yet more than this. Ordinary wheels running on rough roads are very apt to have their peripheries, even when truly circular, out of plane, so as to describe a sinuous track in their revolutions over the road. Wheels confined to rail tracks must run as true circles with the peripheries true planes at right angles to the central line of the axis. Therefore, a rail which is not a straight line must, with wheels out of plane, involve a series of lateral blows and grinding, as travellers who ride on railways out of order well know.

A man who has lost a leg, and wears a supplementary one of wood, knows that the natural leg involves very little jarring, while the wooden leg shakes him excessively. The reason is, that the former has a yielding ancle-joint, kept in position by ligaments and springs in the calf, yielding to irregularities, while the wooden leg is rigidly solid, and gives and takes blows.

Looking at the diagrams, Fig. 1 represents the full-sized section of an ordinary railway tire and rail. Fig. 2, a full-sized section of a grooved rail and wheel-tire, such as is at present laid down on the common roads. Figs. 3, 4 and 5, sections of curved channel rail, of double the real size, such as I propose to lay down for streets and roads, with a portion of the periphery of an ordinary wheel held in an elastic tire, analogous to an ankle-joint. Fig. 3 is a deep T girder of rolled iron with side timbers bolted to it. Fig. 4 a flat rail spiked down on timber similarly to the groove-rail. Fig. 5 is the best mode, wholly without timber, the granite, or concrete, or macadam, resting in the side channels, and always preserving an even surface with the rail, which makes the blocks as it were continuous; the rail-head lies in asphalte, run in, and thus the wheels of vehicles running alongside will produce no alteration of the surface or admission of water. The elastic fishes, secure against any loosening of the bolts, form the rails into continuous bars. The tire is light and narrow, and is formed into a rigid circle by two light side rings, bolted through, and holding all three together. Within the tire, and between the side rings, overlaying the bolts, is placed a continuous band of elastic rubber faced with a thin ring of tempered steel, on which the wheel rests, the periphery being curved, to allow the tire to rock on it. In the manufacture of these wheels, one side ring, with the rubber and steel ring, are placed *in situ*, the wheel slid in, followed by the other side-ring, while the bolts and nuts are screwed up, and the whole is complete—a very easy process of manufacture.

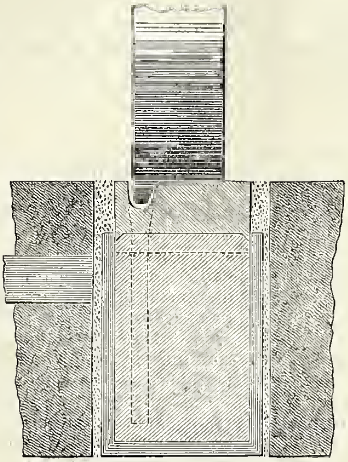
It is obvious that, when these wheels are moving in the channel rails, they will act as continuous ancle-joints, yielding to every lateral pressure or irregularity, and keeping the tires in constant contact with the rails, without the possibility of blows, preventing, at the same time, all noise and vibration, lessening wear and tear, and rendering far more perfect the lubrication of the axle, and while rendering the movement in the channel far more safe and secure against escape, facilitating also the movement off the rails, when the hauling power is purposely applied with that object.

FIG. 1.



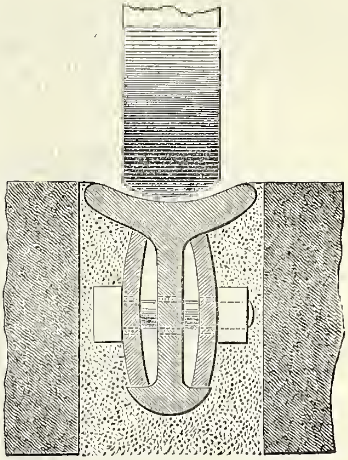
Ordinary rail fishes and wheel tire.

FIG. 2.



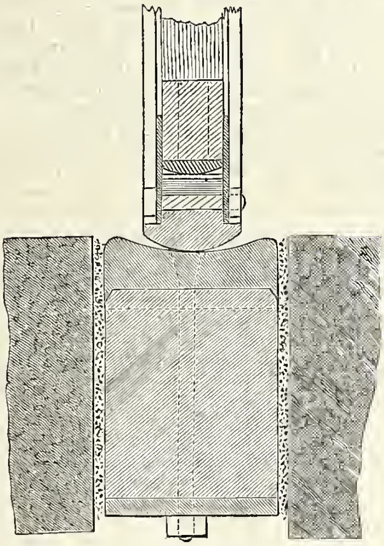
Grooved road rail and tire.

FIG. 3.



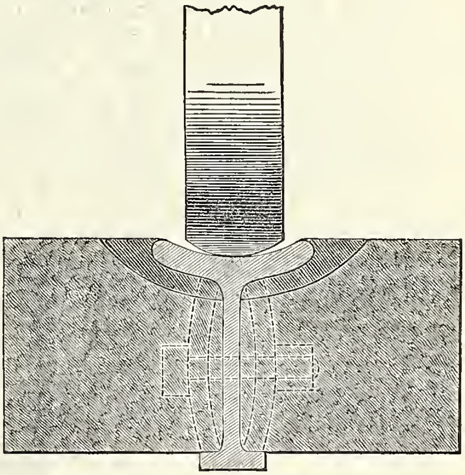
T Channel rail in ballast groove and convex tire.

FIG. 4.



Flat channel rail on timber with spring tire.

FIG. 5.



T Channel rail with granite paving resting on lower flange on each side, and packed in asphalte, all keyed together.

But much more is required. The vehicles are required to run on rails, not in one particular line of road, but on many side and parallel streets, and in streets at right angles, and on the rails and off, and each wheel should turn separately on its own axis independently of the other wheels. An ordinary omnibus turns corners by virtue of its two front wheels swivelling round horizontally on a pivot, called, from its use in former vehicles, a "perch bolt." If this pivot were screwed up tight to prevent all movement, the omnibus would become as a railway carriage, only adapted for straightforward movement with the two axles constantly parallel, and the departure of the two axles from their parallelism with each other is an essential movement for running round corners.

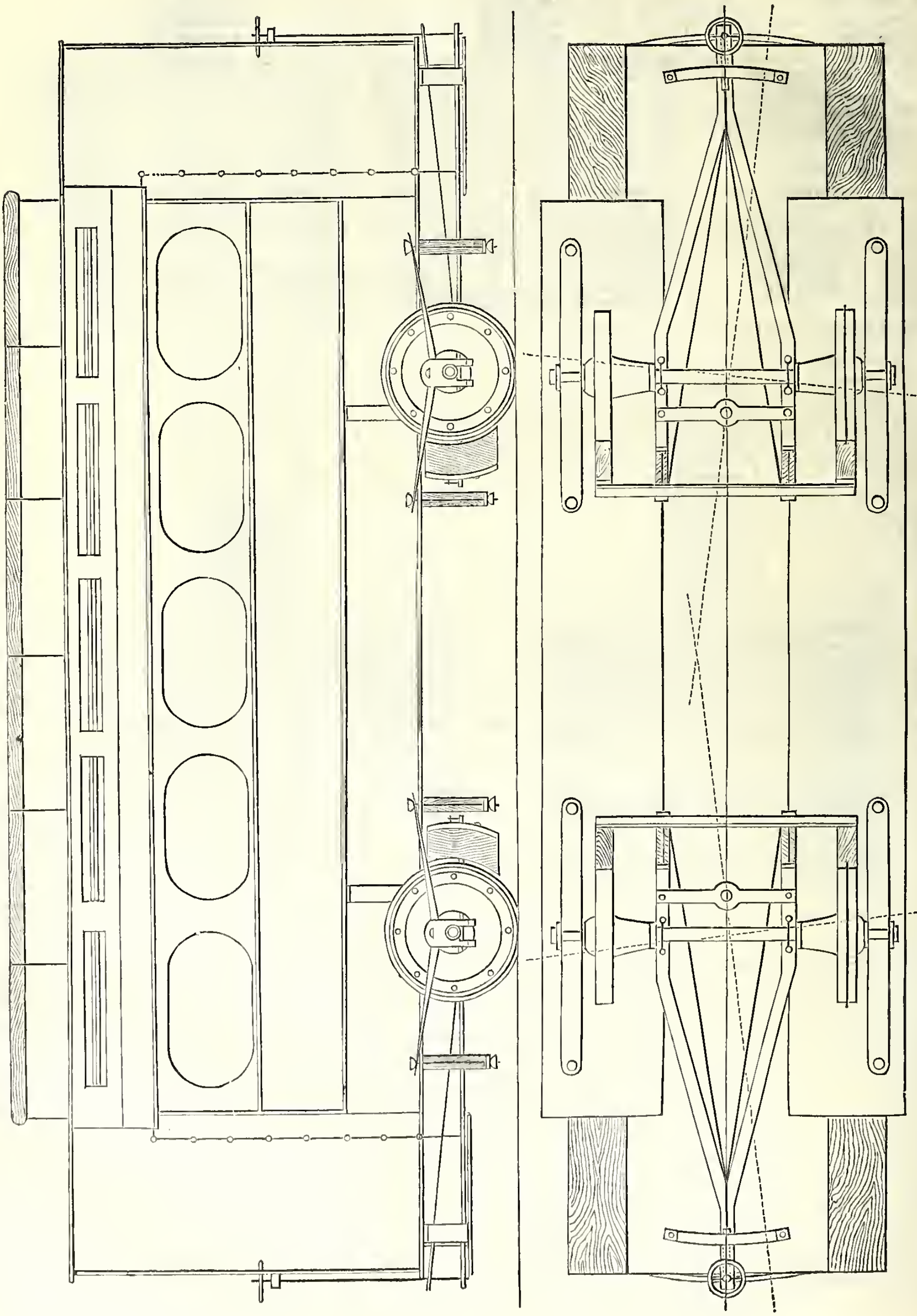
American street rail carriages have eight wheels to a body of about 40 feet in length. Each pair of wheels is grouped together, in what is called a truck or bogy, and the body rests on a central pivot of each truck, which swivels round in a similar mode to the two front wheels of an omnibus, but with considerable friction. In each of these trucks, the axles are fixed permanently parallel to each other, and in going round corners they are guided by the wheel flanges against the rails. But if the distance between the axles be not in excess of the width of the gauge, the wheels will infallibly drag, the wheels recoiling and placing the axles or positions abnormal to the curves instead of being truly radial. Extending the axles of each truck farther apart modifies this difficulty, but involves another, in the increased friction arising from two axles fixed permanently parallel.

For street uses and the near suburbs, very large vehicles are not desirable, but rather frequent departures. Practice has developed this in London in two sizes of omnibus—the smaller size with two horses, the latter with three—adapted severally to the average numbers of passengers collecting in a given time on a

given route. The advantage of the rail over the paving consists in the cheapened haulage, the diminished concussion and wear and tear, and the absence of vibration and its concomitant, noise. Every one knows that, at a very low rate of speed, a railway train moves without noise; and with improved structure the same result would be obtained with higher speeds, while with street vehicles the noise might be wholly absorbed. One result of this may be judged of from the fact that, in the days of wood paving, the rents of lodgings rose in all the main streets where it was laid down.

The diagram (Fig. 6) illustrates a four-wheel vehicle,

Fig. 6.



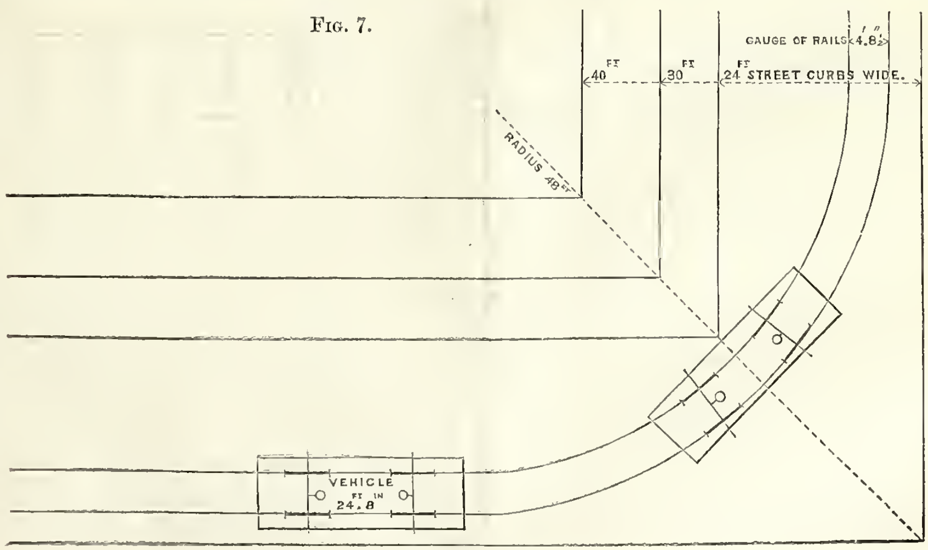
Elevation and plan of a railway carriage.

adapted to work equally well either end foremost, on straight lines and round curves of 50 feet radius, without flange friction. The vehicle is 18 feet in length, by 6 feet 6 inches in width; the length increases to 24 feet by the projection of three feet at each end, for standing room for the conductor, and to give entrances from the ground level, two on each side. The body is suspended, by cross-bars fixed to the bottom, from side springs bearing on the axles outside the wheels, by long swinging shackles, permitting the axles to take any position, rectangular or diagonal, each one independently of the other, to suit irregular or reverse curves. The wheels are of the ordinary omnibus construction as well as the axles, revolving each independently of the others. It is evident that, without guidance, the pressure of the wheel flanges or curves would cause the axles to assume an abnormal position, as described in the American Bogey action. To prevent this, and to ensure true action, a longitudinal frame is attached transversely to each axle, with the outer end projecting beyond the carriage end, and with a cross-bar forming a centre towards the middle of the carriage. In this cross-bar there is a pivot-hole about 8 inches within the axle, and through this passes a pivot firmly attached to the body. The wheels thus acquire a caster movement, determining the inclination of the axle on curves. As the outer wheel presses against the rail, it cannot recoil to place the axle abnormal to the curve, on account of the eccentricity of the pivot, and therefore the outer wheel, instead of revolving, presses over towards the inner rail, giving the axle a true radial position by automatic action. And even supposing this not to take place, the horses, being attached to the front end of the frame, draw it to the centre line between the two rails, and enforce it to the true position without automatic action. The two tail ends of this frame carry brake-blocks, one to each wheel, kept off the wheels by spiral springs, till put in action by the conductor, with a winch-handle attached to the same frame, and moving with it to either side according to the curves. The vehicle carries twenty-four passengers inside and twenty-four out, with occasional supernumeraries on the end platforms. The entrance is easy, even when the vehicle is running, by the projecting side steps, and there is no risk from the wheels, as they are covered in by the overhang of the body. A fender bar of iron is carried along the frame at each side on the seat level, to prevent any damage from carelessness in the drivers of passing vehicles. Two horses will be ample for working this vehicle, and of course a vehicle carrying half the number, equivalent to an ordinary omnibus, might be drawn by one horse with speed greater than is attained on the common road. As the vehicles can be drawn on and off the rails at pleasure, of course a single line of rails may be available. The full-sized vehicle will pass freely round the rectangular corners of streets 20ft. to 24ft. in width, and the smaller vehicle round street corners 15ft. in width, or 20ft. radius. In this mode the whole of the streets and roads of the metropolis could be made available for rails, and the connection might be broken off at greater or less intervals, as no mechanical arrangements are needed to pass from one line to another. Fig. 7 shows a vehicle turning a corner of a street at a right angle 24ft. in width. I designate these vehicles as caster carriages, the principle being that of the mechanism used for heavy household furniture, to facilitate movement, the vertical axis being behind the horizontal axis.

In working the traffic over London-bridge, a great facility has been found by dividing it into fast and slow, two lines for each. Bat in this case there are no houses and shops, with vehicles drawn up at their doors. It is shown that in laying down rails in narrow streets they must either form one line in the centre, or two lines, one on each side, and these latter would prevent all vehicles from stopping in front of the shops. With a single line in the centre, the difficulty might be got over by one line in each of two parallel streets, one for going and one for returning. Or stoppages might be prohibited in the day-time, and reserved for the night, as in the transit of goods, and in such cases special stopping-places might be reserved for the rail vehicles by day.

There is then no difficulty in the mechanical arrangements of working; and there are at least 200 miles of streets and roads in and out of the metropolis that might at once be advantageously laid down with rails; the cost should certainly not exceed £1,000 per mile, or £200,000 for the purchase of rails and laying down, and many of the existing omnibuses might be converted for rolling stock. But who is to make these lines—to find the capital? As usual, the State, regarding them as experimental, though demonstrably clear in their advantageous result, has so far determined to let individuals or companies try the experiment, first to a small extent, but

FIG. 7.



Vehicles on a radial curve.

probably increasing. And though the State has taken pains to hedge roun l the company or individuals with conditions, as to buying them back, it will turn out a profitable job for the individuals before the State obtains them back again, which it must do, sooner or later, with all wasted costs added. And no one can blame the companies or the individuals. If they take the risk and have the foresight to see that there is no risk. they are as much entitled to a profitable result as were the telegraph companies. In the construction of tramways there is really no skill required beyond the perception to determine on the right plan. It is simply a paving or macadamising the general surfaee with a strip of iron between, and if done by a company, there is no reason why it should not be done by one company instead of many. But there is no reason why the parishes which can pave in stone should not also pave in iron, and do it, too, without jobbing, if the rails be rightly laid down for them. If £200,000 be needed to lay down the first batch of tramways for the metropolis, it could be got on easier terms by the State, or the Board of Works representing the State, than by a private company.

There can be no doubt that the general roads of the country belong to the public, and to the State as representing the public, and that they have been put out, from time to time, in private hands beeause the State has not set itself to work to understand their management. It is not a question of centralisation or interference with local government. There may be a limit to local authority, but to roads there is no limit; they must provide circulation without termini, and therefore the true mode of dealing with them is by a central authority, with local authorities as lieutenants, under a general law. We need, therefore, a General Board of Roads more than a General Board of Works for this especial business, and the General Board of Works would be the true body to deal with it after the most efficient and economic methods. More than this, the roads might be efficiently made a large source of public and municipal revenue, and the most easily collected.

Taking the average length and breadth of London at ten miles, and multiplying them by ten intersecting roads, we should get 200 miles; doubling them for going and returning, we should get 400, which for rails, at £1,000 per mile, would be £400,000. Of course this does not include numerous Acts of Parliament, unlimited promotion, opposition, law-suits, joint-stock company expenses, and the hundred nameless items belonging thereto, but simply the rails and laying down. The interest on this outlay would be £14,000 per annum. The rolling-stock and horses to work theso 400 miles, would cost about £200,000, a very odd kind of stock for the State to deal with, it may well be supposed. But the old practice of the days of mail coaches make it very simple. The only object then was to get the mails carried gratuitously, and they were put up to auction, and the turnpikes were granted as monopolies in consideration that no transit-charge or toll should be required for either, from the State. The profits to the proprietors were from passengers, and tolls by individuals. In the case of street rails, the repairs of these rails, as compared with paving, would effect a very large saving, and their annual cost to the State or municipality might be estimated at the interest paid on the capital. The working could be put up to auction, to be let to the highest competent bidder. We may roughly calculate this by tho returns of the General Omnibus Company, by which it appears that 590 vehicles ran during half a-year 6,056,084 miles, about 42 miles per day each. The passengers carried during this period, were 26,313,821; the total expenses, £252,435. There can be littlo doubt that, in changing tho ordinary road for the iron, the saving in working expenses would amount to one-half, or at the rate of £250,000 per annum for 400 miles, reckoning only the existing number of passengers. But with the probable lowering of fares the revenue might be largely increased. With this same amount of stock the mileage might be doubled, and with each mile doubled the number of passengers might be quadrupled. The General Omnibus Company earns about 10d. per mile with three passengers per mile, or 3d. per head. It would appear practicable, with improved stock and rails, to carry 160,000,000 of passengers over 48,000,000 miles per annum; and at ¼d. per head per mile, and four miles each, they would yield a return of half-a-million sterling per annum profit—fifty-three times the metropolitan population travelling four miles each per annum, or three millions 53 miles each per annum. It is simply a question of the working population riding instead of walking.

Thus far, we are dealing with only the horse traffie of the metropolis, but there is a yet wider field, dispensing with horses. The vehicles described are capable of being linked into trains, and worked by engine-power. The hollow-topped rails are admirably adapted to induce "bite" for engine driving-wheels. One serious objection to horse-traction is the rapid destruction of the road under the horses' feet, in addition to the dirt. The objection to engine-power is the steam, smoke, and noise. There is a power now getting into use which promises to beeome very valuable for traction purposes in streets—the hot-air engine. It is practicable, with engines such as those of Mr. Wenham, to obtain a traetive force of 1,000 lbs. at the rail, with an engine weight of about three to four tons. The disadvantages of steam-carriages on common roads is the difficulty of carrying a sufficient water supply, and also the absence of handy watering stations. With the rail, and stations along the rail, this difficulty ceases, and a steam-engine can be worked on the more perfeet roadway. If the hot-air engine be used with efficient liquid fuel, there will be neither smoke nor steam, and it is likely that the noise of the exhaust may be dealt with effieiently by acoustic processes. In such case, it is probable that the hot-air engine on rails will supersede horses in the streets, as a mode of traction quite incapable of danger, the elastic force being only produced in the exact quantities required at the moment of use, and capable of working round street curves as sharp as those before described. In such case there would be neither mud nor splashing of foot passengers, and the absence of the horses would remove a great source of uncleanliness.

One strong objection that has been raised to the use of steam traction in streets and on highways is the startling of horses, and, in their interest, legislation has been onesided. The steam-engine knows no fright, though it may explode by ignorant carelessness, but on the other hand the ignorant ill-trained horse takes causeless fright. The startling horse is simply a wild beast, and no one has a right to bring a wild beast into the streets or roads; and if a fine is to be levied, it should be on the owner of the wild beast, and not on the well-behaved, orderly engine. Horses that go into the army are not addicted to taking but rather to giving fright, and it should be simply disreputable to bo the owner of a wild beast. The horse should be as noble in his qualities as the gentleman who owns him, gentle, and brave, and intelligent. What grooms call a "fool of a horse" is not worth keeping, and every horse worth keeping is capable of education; and we may be very sure that when our Fifth Harry "witched the world with noble horsemanship," it was on an educated charger, "a fiery Pegasus that could turn and wind," and not on a wild beast. He must be a man of very limited taste who could wish for the extinction of horses by utilitarian engines, but in truth the engine is the friend of the horse, redeeming him from mere drudgery for the purposes of pleasure. We may take it as an axiom that every horso worth keeping is capable of education.

I once, in a foreign land, had a young horse, whose only experience of life was on mountains, and forests, and farmhouses. One day I rode him to a seaport town, where an elevated road, cut in the rock side, overhung a patch of sea-beach perpendicularly, without a fence. At this point, just at the entrance of the town, an unlucky

urchin put fire to a cracker. At the first note of the cracker, my horse made a single side leap, and we both landed on the beach several feet below. The sand was soft, and after shaking himself, we waded through the sea, round the point, and regained the road. The following day I returned home, and resolved on the education of my horse; so instead of letting him loose in the pasture, I shut him up in a courtyard between four walls, without anything to eat for several hours. I then went in, with a bundle of lucerne grass under my arm. Up came my horse, but I drove him away, and went out again. Soon I returned with a pistol, and when he came up to me again, flashed a pinch of powder at him, and he started away, but instantly came back after the grass. He got a mouthful and another flash of powder, with a start, but not leaving off eating. Another flash and he scarcely heeded it; and then I fired the pistol with some loose powder, which had scarcely more effect. Then a loud explosion, repeated again and again, quite unheeded, and before half an hour was over there was a fixed association of ideas in his horse-mind that eating lucerne grass was a natural sequence of burning powder. From that time he became as pleased as a sporting dog at the sight of a gun, and his great docility soon made him as companionable as a dog, and as his education went on he learned to prefer bread and fruit to barley and chopped straw, and whenever he could he visited the dining-room at dinner time.

There are few horses that could not be thus trained; and were the carriage horses used about London to be kept without food for a day, near a puffing locomotive, before the day was over they would be glad to eat hay and corn from the buffer, and would associate the blast with the manger.

Another bugbear in street-rails has been the fear of horses slipping on the rails. With a view to prevent this, some of the rails are corrugated on one edge, about as usefully as the famous "chip in porridge." And the groove for the guiding flange is made as thin as possible, to prevent wheels getting fast in it. The result leaves a broad, flat, surface at the road-level, the most favourable condition for slipping. The channel rail may be regarded as a gutter, and its sunk surface will afford a better foot-hold for the horse than the flat surface. As to the transit of carriages over these rails, there would be no more difficulty than there is in getting in and out of the side gutters of the streets. Omnibus drivers know that the gutter is practically a rail for the wheels of the near side, which retains the hind wheels with sufficient resistance to require a good angle to take them out. With a better formed gutter rail, made purposely and not hap-hazard, and firmly fixed at the joints, and a corresponding rail to the off-side, we should obtain the condition of effective guidance, with less likelihood of ordinary carriage drivers seeking to appropriate it.

There is another enormous advantage in tramways, which must not be overlooked. In case of digging up the streets to repave or get at the sewers, the transit by street rails might be entirely unimpeded. Temporary transverse sleepers placed under the rails to support them would carry the traffic till the street surface were replaced, an advantage to be readily appreciated by London passengers.

There is a prevalent horror of petroleum, on account of accidents arising from its ignorant use. Every powerful agent for producing heat is subject to accidents if misused; but it is the misuse that involves the risk. Petroleum may be put in a condition as inflammable as gunpowder, becoming gas very rapidly under a very small degree of heat; but there are also some qualities of coal that generate gas, and induce explosions. And steam boilers would burst were they not provided with safety-valves. If, therefore, gas for heating steam-boilers were only generated in the exact quantities required, at varying intervals, and safety-valves provided, there would be as little risk with liquid fuel as with solid, and dirt and smoke would disappear.

The hot-air engine has the advantage of safety against explosion, by reason of generating its power only as wanted, but it has the disadvantage of working with only 5 lbs. per inch available duty pressure on the piston, while the steam-engine may work up to 125 lbs.; and with careful arrangements to ensure true circulation, the risks arising from unequal wear of the boiler and heating-surfaces may be avoided.

It is, therefore, a practicable thing to work hot-air engines in the streets, where great speeds cannot be used, to the outskirts of the town, running round corners of 40 feet radius on hollow-topped rails, in any direction, and in the outskirts to couple the vehicles together in small trains, carrying, if required, 250 or more passengers, and attach them to steam locomotives capable of describing curves quite as sharp, and running on roads where the traffic is free, at a speed of from 20 to 25 miles per hour, and capable of arrestation, by efficient brakes, in as short a space as an ordinary omnibus.

With this power at command, building land seven to ten miles distant, in a circle from the Central Post-office, becomes as available as, and far more desirable for the generality of London occupants, than Belgravia or Bedfordia. A supplementary London might thus be built, free from all the evils of existing London, with prohibition of those conditions from which the evils arise. We want a supplementary town, free from smells and smoke; a town of intermingled trees, and dwellings, and gardens; a town not necessarily of rectangles, but of curved lines presenting varying landscapes; a town in which horses would not be needed for purposes of transit, and with street railways, neat as garden paths, giving access to all the dwellings.

On the question of fuel, the convenient use of mechanical power in general haulage largely depends. The value of all fuel, or burning material, consists in its facility of rapid conversion into gas, the first process in combustion, and liquid material is more easily converted than solid. Moreover, the liquid material, in the form of petroleum, is free from sulphur and other substances damaging to the fire-box and boiler. And lambent flame, impinging on the heating surface, is effective over the whole surface it touches, in raising steam rapidly, while the heat of red-hot fuel is only available so far as its actual contact extends, the reason being that hot-air does not contain heat enough for steam-producing, but rushes away rapidly through the tubes and chimney. With lambent flame covering the whole surface of the fire-box and tubes, much smaller steam generators would suffice. It is the question only of a huge paraffin lamp, capable of instantaneous adjustment, to raise or lower the steam without need of opening the fire-door.

Nor do we want dwellings merely for a single class of wealthy people. We want people of leisure and cultivation, as well as working men and their families, not roughs, but such as grow out of roughs under favourable circumstances, a process that will go on till the localities producing roughs shall be extinguished, and roughs shall be no more. As the facilities grow for removing surplus populations from the interior of the metropolis, their localities will become improved, and far better fitted for human abodes. But we may trust that in such an extension of the metropolis, the hills, and heaths, and commons, and open spaces will be preserved, for they are the spots consecrated by nature, and fitted to bring forth the higher feelings of man's inner being, and we do not wish to see them cut, and carved, and enclosed, and made into rectangular working grounds for the growth of corn. Those hills and heaths are the fitting places to breathe into man's nostrils the breath of life, for the gladdening of all his senses; to pour into his ears the words of religious poetry, and create a soul from under the ribs of the moral depths into which he has been plunged amidst the reeking stews of corruption.

"God made the country, and man made the town." And now that man has practically annihilated both time and space, by the spirit within him that has taught his

right-hand the cunning whereby he may achieve his escape from darkness into light, let the country be devoted once more to the many instead of being confined to the few. They who would blot out the face of nature, and make the whole land artificial would destroy one of man's noblest faculties—the power of appreciating nature. They would destroy God's handwriting, and substitute for it artificial signs. We hope, and trust, and believe that this shall not come to pass. We trust that the wild lands of England—the Mount Horebs of the soil—the spots that nature hath made difficult of cultivation, as though she had said, "These are reserved"—the wild gardens of the poor man, on which the purple heath and the yellow gorse flourish—the old forest patches, the Charts and the Commons, the Combes and the Hursts, the wilderness of the land—we trust that the plough of the cultivator shall not pass over these, the poor man's inheritance.

The great work is approaching, the solution of the problem whereby the natural man and the artificial man may become one; whereby the city may be rescued from its squalor, and field and forest from their ignorance. The yearning for this has always existed in men's minds, and it is within reach of remedy as the uses of rail transit become more developed.

In England, there are 22,000 miles of turnpike roads, saying nothing of highways and parish roads. They could probably be purchased by the State for the amount of their mortgage debts, about £9,000,000, or an equivalent amounting, at $3\frac{1}{2}$ per cent., to £315,000 per annum. To lay this mileage down with single lines of channel rails would cost £22,000,000; at $3\frac{1}{2}$ per cent., £770,000 per annum; say repairs, £363,000—making a total of £1,448,000 per annum. Supposing a receipt of only £2 per mile per week, that would amount to nearly £2,290,000 per annum, giving a profit of about one million and a quarter. The present cost of maintenance is about £33 per mile per annum, and it would certainly be less with the iron than with the stone road. But supposing the net income of £10 per mile per week, that would be £11,440,000 per annum, and a probably clear revenue of £7,000,000 to the State. And the parish officers, and surveyors and contractors for the engines and vehicles would be competent to the whole business, without any vested interests in opposition, or privation of work, but the contrary. The contractors must not be merely suppliers of engines and vehicles at a mileage. They could contract for the privilege of working the line, paying a revenue to the State on the same system that the tolls of turnpike roads were contracted for. Vehicles of similar mechanism to the passenger vehicles could be constructed for the transport of provisions by night. No city yet has ever been supplied with green vegetables, summer and winter, to the extent of its consuming capacity; yet it is not a difficult thing to provide for this want, were it gone about in earnest.

It is quite clear that in working street tramways, a code of regulations will be required, very distinct from those now governing the cabs and omnibuses. A maximum and minimum speed must be defined, otherwise crawlers would disjoint the whole traffic. Those who dissent from it must draw off. And specific stopping-places must be arranged for the same reason. The facility of starting or stopping, by means of brakes, will render this easy. The numbers of the vehicles running on these tramways must also be limited to the amount required, and they must have free circulation over all tramways. In private hands, this would of course be a monopoly, but controlled by a State Board of Works, it would be a monopoly only like that of the Post-office, for national service and national revenue, and controlled by a State Board of Works.

It is quite possible that in time the keepers of private vehicles will adopt wheels and axles to the gauge to run on these trams, as are proposed, and they would thus become almost the only roads of the country. In such case, their speeds would be guided by the general regulations, and they would pay an annual license, making them free of the roads. But the controlling board would take care that the guage and structure of the wheels and axles should be of a class not to damage the rails. It is worth consideration whether the question of peculation in the fares could not be met by the same processes that the cab proprietors have adopted, leasing out the vehicle by the day. If the Omnibus Company lose, as has been stated, £8,000 per annum by peculation, it would argue either that the men are insufficiently paid, or that they need a stimulus of profit. A man will always work harder with a chance of profit than at mere wages, and competition would soon find out the most intelligent men. It would appear that the amount of peculation is about half-a-crown per man per week. This would be well laid out in stimulating them to do more business.

And it may be taken for granted that the utilisation of the turnpikes would make them the most profitable of all feeders to the main lines of railway. With trains on the turnpikes the whole of the roads would become populated along their borders.

It is evident that the economy of transit which is desirable at home would be equally available for India and the colonies generally.

SUMMARY OF THE PROPOSITIONS LAID DOWN IN THE FOREGOING PAPER.

1. That iron rails, as an improved mode of partially surfacing roads and streets, are desirable, as diminishing traction resistance, wear and tear, dust, mud, and nuisance.

2. That the surface of the rails should be of hollow or channel form, more or less transversely curvilinear, sufficiently deep to retain the wheels under the ordinary conditions of running at the required speed, and sufficiently shallow to enable the wheels to be drawn out, when required, on the ordinary road surface. The depth of the channel being so small as to permit the wheels of ordinary vehicles freely to cross them or run along them.

3. That the special vehicles fitted for use on these rails, whether for passengers or for goods, should be provided with elastic tires, yielding between tire and wheel, to prevent all noise, jarring, or vibration, and to run over the common surface as well as on the rails.

4. That the vehicles should have their wheels and axles so arranged as to work round the corners of very narrow streets.

5. That the rails should be so laid that the vehicles can pass from one wheel tract to another, on level surfaces of the road, and preferably of iron without timber.

6. That it is desirable to use hot-air engines instead of horses for traction, when practicable, to draw or propel street vehicle on rails, to economise the wear of the roads, and get rid of dirt and muck; such engines being free from smoke, steam, noise, and all risk of explosion.

7. That the vehicles used in the streets should be capable of coupling into trains on the outskirts of towns, and attaching to small locomotive engines without nuisance, working round curves as sharp as those in the streets, on channel rails.

8. That those trains should communicate by the ordinary roads laid with rails, with building land all round the metropolis, traversing up and down any sharp curved roads of new localities.

9. That, except in the direction of foreign commerce, and for its purposes, a belt of land, from five to seven miles in width, except where already built on, round the metropolis, should be reserved, only to be used by the proprietary for woodlands, fields, gardens, orchards, and recreation grounds, having in view the health of the metropolis, and the economical and sanitary disposal of the excretæ.

10. That the whole of the street and road rails of the metropolis and other towns and city suburbs should be-

long to the municipalities, subject to the supervision of a general Board of Works, and that the turnpike roads laid down with rails should belong directly to the State, represented by the general Board of Works.

11. That the working and repairs of these lines should be let by competition to contractors for given periods, the maximum rates and fares being specified, but leaving it open to the contractors to lower the fares, the rents payable by the contractors becoming revenues to the municipalities and the State.

As regards the metropolis, two of the most important street lines to commence with would be from the Marble Arch and over the new viaduct to the Bank, and from Westminster-bridge, along the Thames Embankment, to the Mansion-house. On the Embankment, which is still guiltless of noise and vibration, it would be most important to public comfort to keep it so, while providing for the annual transit of probably eleven millions of passengers over its surface, who, at one penny per head, would give a return of some £45,000 per annum, a probable net revenue of £28,000 on two miles of line, for the benefit of the Metropolitan Board of Works, and relief of metropolitan tax-payers. Or, if the rule of public companies is to obtain, with the object of getting rid of government responsibility, shareholders will no doubt be readily found to take the responsibility with a division of profits. It is possible that private companies making the lines and working them, and dividing the profit with the municipalities and the State, would, on the whole, in the present condition of commercial ethics and governmental perceptions, be productive of the least waste, and, consequently, the largest profit both to the public and the companies. It is occasionally argued that no profit should be made from transit, but this would probably soon involve a condition of debt, in the absence of stimulus. It would be better to go on lowering the fares in proportion to the increase of profit by good management. The calculations hitherto made in this paper assume a reduction of fares to one-fourth the existing tariffs.

DISCUSSION.

Mr. John C. Wilson said there was one point connected with tramways which had not been touched on in the paper, but which was of considerable importance, especially to London, and that was the width of gauge. Although the ordinary gauge of 4ft. 8½in. might not be considered too wide for Manchester, Liverpool, and other places, he believed a less one would be far preferable in the metropolis. In the case of omnibuses, it was found that a size which could be used with advantage in some cities was impracticable in London, and probably the same thing would be found to apply to tramways. He believed that 3ft. or 3ft. 6in. would be found the most convenient; in fact, handiness was the term which best described what was required in London, and if this was not kept in view he feared tramways would not be so successful as they would be otherwise. A narrow gauge would facilitate turning, the plant would be lighter and cheaper, and the vehicles would be more easily stopped, and thus would interfere less with the ordinary traffic.

Mr. Lloyd Wise said it would be useless having a narrow guage unless the body of the vehicle were made narrow also, and in that case he feared it would not contain sufficient passenger accommodation.

Mr. Gore said that as he was connected with several of the schemes now before the public, and in connection with which there were at the present moment bills before the House of Commons, he was placed in a somewhat difficult position for speaking on some parts of the subject before the meeting, but on the question of practical construction he might venture to offer a few remarks which his experience in the matter might render acceptable. He had investigated the working of the tramways in most of the cities in America where they were in use, and also in many places on the Continent, and would, therefore, offer a suggestion on the plan propounded to-night. Mr. Adams had suggested a departure from the principle of the automatic guiding of the wheel, and the adoption of what was now known as the "on and off" system. Some ten years ago he held the position of engineer to the gas company of Valparaiso, and had also, to a certain extent, to advise on matters connected with the municipality generally. They had granted a concession for laying down street tramways; but there was this peculiarity about Valparaiso, that the city was divided into two distinct parts, the business part, containing the custom-house, wharves, &c., and the residential part, the two being connected by a narrow gut or street, called the Calle del Cabo. It appeared to him at first sight practically impossible for a rail to be laid along that narrow street with any chance of its being successfully worked. In fact, so convinced were the authorities of the impracticability of having any stoppage of traffic in that street, that they had refused to permit omnibuses to run there. However, on visiting certain cities in the United States where tramways were laid down, especially in New York, where the streets were very narrow, he was compelled to come to the conclusion that his previous objections were no longer tenable; and in that street, the Calle del Cabo, which was only twenty-five feet between the kerbs, there were now two lines of tramways, upon which carriages ran at intervals of 1¼ minutes throughout the day, from seven in the morning until eleven at night, and through that street the whole traffic of a city of 75,000 inhabitants had to pass. That experiment satisfied him that it was quite possible to adopt tramways on the fixed system even in the narrowest thoroughfares. He had made very careful inquiries as to the result of the "on and off" system, and in the result he had come to the conclusion that it destroyed to a considerable extent the advantages of the tramway. The construction of a carriage which should run on a tramway as on an ordinary road necessitated, as a matter of course, a different arrangement of the springs and of the under-carriage, and thereby occasioned disadvantages which would not occur in the case of a tramway carriage proper. And one great advantage of the fixed system was this—that if you kept carriages constantly moving in one direction, it practically gave a direction to the other traffic; and, in fact, you did for the whole traffic of the town through which the tram-road passed what was done by the police for the traffic over London-bridge, dividing it into two classes, the slow, heavy traffic running in lines parallel with the quicker traffic which ran along the roadway. This was found to be the practical result in Valparaiso during the four years he remained there; and he heard from his son, who still remained in Chili, and who was connected with these tramways, that every day illustrated these advantages. It would be interesting to many persons to know that the pecuniary results had been so far successful that, in Valparaiso, the fare for a route of three miles was 1¼d. second class, and 2½d. first, which rate of fares paid a dividend of 14 per cent. on the capital invested in the undertaking. This proved what could be done with tramways when they ran at low fares, which he believed was one of the chief requisites for success. He feared that the "on-and-off" system would have rather a tendency to continue and even to create that erratic kind of traffic which was so inconvenient in the streets of London. If the traffic could be analysed, and the number of vehicles and width of streets ascertained, he believed it would be found that the "blocks" which were continually occurring were not due so much to the number of vehicles as to the mode in which they were made to traverse the streets. The most important point was the maintenance of the tramways; and he was afraid, speaking from experience, that the form of construction recommended would be liable to disarrangement, not

from the tramway traffic, for it was found that even where the rails were laid down in a comparatively light manner the tramways suffered not from its own traffic, but from that which was attracted to it. Those who had been connected with tramways knew that not a vehicle passed down the street but would get on the track if possible; and in thousands of instances he had seen illustrated the truth of what Mr. Adams had said with reference to the education of horses, for in South America the mules were so alive to the advantages of the tramroad that they would always choose it of their own accord if possible. He agreed with Mr. Adams that, in London, exceptional circumstances had to be dealt with, and it was just possible that preconceived notions with regard to the form of the carriages, the rails, and the arrangements generally might have to be modified, but still at the outset they should, as far as possible, divest their minds of all those prejudices which had been too long prevalent on the subject, especially that which regarded tramways as detrimental to the general traffic; and any modifications which were introduced into the systems which had worked well together elsewhere should be in the direction of insuring safety and success to the tramways themselves, rather than in that of trying to meet any possible danger to the ordinary vehicles in the streets, for he was satisfied that there was not a class of vehicle which could not make use of a tramway with much greater advantage than they could even of the best constructed ordinary road without it. With regard to the construction of American tramway cars, Mr. Adams had made a slight mistake. The original ones were made as described, with eight wheels, on bogy carriers, but now they were made with four wheels only, the distance between the axles being from 5 ft. 6 in. to 5 ft. 9 in., the length of the whole vehicle being from 15 to 18 ft. They were very much reduced in size from the original pattern, as it was found more advantageous and more convenient to the public to run smaller carriages at shorter intervals.

Mr. Willoughby Hemans said that no one could look at the present state of the traffic in London without seeing that a system of tramways, on the principle of which an illustration was shown in the Brixton-road, must produce a complete revolution in the streets of London, and must, to a certain extent, annihilate the traffic as now carried on. If they had tramways in the main streets, he thought it would be impossible to adopt the ordinary class of carriage; but at the same time, when they considered the enormous improvement and diminution of friction in carrying a number of people along smoothly, easily, and without friction upon a continuous rail, as compared with tho rough jolting over the pavements of our present streets, it was evidently highly desirable that something of the kind should be adopted, and, therefore, he had no doubt that, in some shape or other, tramways would find their way all through London. But they ought not to be made patchwork-like. It was not at all advisable that a street, paved at an enormous expense, which belonged to the gas companies, the water companies, the telegraph companies, and to the Metropolitan Board of Works, should again be divided into longitudinal sections, and handed over to private companies for the sole purpose of their own profit. This great benefit should be allowed either on the principle of making them undertake the construction and tho whole services of the streets, reserving power of repairs to the gas and water companies for their mains, or the work must be done by the public at large. With regard to the mechanical question, in his opinion Mr. Goro was correct; and if they substituted for the right system a kind of compromise, as Mr. Adams had ingeniously suggested, the whole thing would requiro a different arrangement, but he believed tho rigidity of the system and the training which it afforded to all the rest of the traffic was one of the greatest benefits to be expected from tramways. He quite concurred in Mr. Adams's views with regard to the substitution of steam or hot-air engines for horses. Great improvements had been recently made in this matter; and he understood that a "road-steamer" in Edinburgh was working noiselessly, moving equally well over the roughest roads and over the softest surfaces, and giving the greatest satisfaction. Something of that sort, worked either in the same way or by a hot-air engine, would soon, he believed, be working in the most crowded streets of London, without noise, with very little friction, and without frightening horses. But he believed that unless the fixed system were adopted tramways would be comparatively useless.

The Chairman said that, having carefully read Mr. Adams's paper, he wished to correct what seemed a little misapprehension as to that gentleman's views with regard to a fixed system. As he understood him, he intended the vehicle to always keep the rails except in case of emergency, when great facilities were offered for leaving it.

Mr. Adams said that was his intention decidedly.

Mr. William Morris said that having taken a somewhat active part in the conduct of the case which occupied the committee of the House of Commons ten days last session in the first serious investigation of the subject of tramways, he might be allowed a few remarks on the political and administrative side of the question. It was but a very short time since an enormous amount of prejudice against tramways existed in London, so much so that one could scarcely allude to them without exciting laughter. Having been brought, under somewhat exceptional circumstances, in contact with tramways on the Continent, and having had some experience of those at Copenhagen, Geneva, Brussels, and other places, some of the prejudices which before existed were brushed away, although a good deal remained behind. When the matter came before the House of Commons, in the session before last, it was considered too ridiculous to discuss, and the second reading was negatived without a division. Last year, however, the public mind having been somewhat educated in the meantime, the subject assumed a different aspect. Then came the ten days' investigation by the committee, and the result, he believed, was that the case for tramways was fully made out on the rigid, and not on the "on and off" system. The latter plan was much discussed on that occasion, and he believed tho general opinion was that it was a failure, and that if it were adopted large deductions from the advantages of tramways must be made. It was fully established by the evidence of the witnesses from Copenhagen, from America, South America, and all parts of the world, that a well-managed rigid system would help the ordinary traffic to an enormous extent—to such an extent as no one who had not seen it in practice could imagine. Notwithstanding all this, however, it had been suggested that trams were still an experiment, but in this he could not agree, as their advantages had been fully proved. He had lately had occasion, in connection with tramways, to wait upon nearly every vestry in London, and he was bound to say that in no single case had the necessity for tramways been at all seriously questioned. The only question which had been raised was whether they were not being proceeded with too timidly, and whether or not they should be laid down and maintained by the authorities, and the profits dealt with for the benefit of the public or for the benefit of tho parties who risked their capital in the undertaking. This was a fair question for discussion, and tho points into which it divided itself, and which wero of great public interest, were these—Were tramways to bo laid down by tho authorities or by private persons, and wero they to bo maintained by these private persons, or by the authorities. That tramways wero no longer considered an experiment was fully proved by the statement in the House of Commons only a few nights ago by Mr. Lefevre, Vice-President of the Board of Trade, on the second reading of the government Bill, when he said

distinctly that the question of tramways had been treated by the Committee not as an experiment, but that they had dealt with every case upon its merits, and as any other case would be dealt with. They were reduced, therefore, to the question, how were tramways to be laid down, by the authorities or by the capitalists, and in that was involved the question, were the public to be sharers in the profits? He quite agreed with what had been said, that one object was to get cheaper and better means of locomotion which the mass of people might avail themselves of; in fact, what was desired was, some system by which four persons would ride for every one who rode now, and that was about the result of the experience where anything like cheap fares were adopted. However, they must take care that while they were discussing these points tramways were not indefinitely postponed, for they had been postponed already too long. They must therefore approach the subject as practical men, and see what arrangement would be best for all parties. The President of the Board of Trade had suggested a plan, and he would not say whether the terms were fair or not, though probably the promoters of tramways would think they were not, but certainly it was worthy of serious consideration. There were two ways of dealing with tramways in the public interest. One was to allow the parishes on the one hand, and the public on the other, to share the profits, either by taking a proportion of the profits directly, or by providing for a reduction of fares. Upon that question he believed they correctly interpreted the views of men in high position, that parishes had no right to monopolize the profits arising from tramways. The roads were the highways of the people, and not the highway of the particular district in which they happened to be; therefore, on the abstract question, it was right and proper that any benefit to be obtained by a connection between the tramways and the public should be reaped by the public, speaking in its largest sense, and not by that limited portion represented by the particular parties living in a particular district. Being agreed, then, that some arrangement was proper by which cheap fares should be insured, the next question was, should that be based upon a perpetual arrangement, or upon what had been suggested by the government, that there should be no limitation of dividends, but that, at the end of twenty-five years, the authorities should have the right to claim these tramways, which were to be constructed at the risk of capitalists, without paying anything for goodwill, but simply on a fair valuation of the thing as existing at the end of that period. That was a compromise suggested by the Bill, but whether that or some modification of it would be accepted by the promoters of tramways who invested their capital in them, was a question hardly yet ripe for discussion. However, whichever form it took, whether as a dividation of profits with the parishes, either in the form of a proportion of a dividend, or by giving the public a share of the profits by reducing the fares, in either way it came to the same thing. The end to be obtained was that the public must reap the benefit of this new mode of locomotion upon fair and proper arrangements. Then the next question was, how were the streets to be maintained? The parishes were merely trustees of the streets for the public. They had the duty cast upon them of keeping them in order, and he was not aware that the laying down of tramways at all added to that duty. Therefore, upon the abstract question, there was no more reason why parishes should be relieved from repairing the streets because of the existence of tramways, than because of the traffic of the omnibuses, which had now succeeded in being relieved even from the payment of turnpike tolls, although it was well known that they were very greatly instrumental in destroying the pavement. If, therefore, the authorities were mere trustees for the public, why should the tramway companies repair any portion of the road all? The reason was this. All experience had shown that the roadways were kept in much better repair by the tramway companies than by the authorities, and therefore it was that the companies offered to do it, not because it was their duty, but because it was their interest to do so, inasmuch as being the largest users of the road, by having it in good repair they lessened the risk and expense to themselves. There was thus an enormous saving to the parishes, simply because the companies found it better worth their while to do these repairs themselves, than to leave it to the chance of the authorities doing it improperly. When a tramway was once opened, however, it was impossible to divert the traffic; they must keep the road open, and therefore it was looked after with much more vigilance than was bestowod by any public authorities. Another reason for placing the roads under the control of the company was this, that in case of any accident there would then be no division of responsibility, which would inevitably arise if the tramways themselves were managed by one body, and the roads kept in order by another. To sum up, he would say, in conclusion, that experience was the great teacher in all these matters, and it had shown conclusively the necessity for throwing upon the tramway companies the responsibility of repairing the roads.

The Chairman said he should like to ask Mr. Morris whether the objections which he had urged against the "on and off system" would apply to such a modified form of it as had been suggested by Mr. Adams, and what was the plan which he had referred to as having failed.

Mr. Morris said he had referred to what he had seen in operation in Salford, and also in Geneva, which was not such a plan as Mr. Adams had suggested, but what was known as the Howard system. It was quite clear that the full advantage of a tramway could not be developed unless the carriages kept the rails, and any plan for allowing them to leave the rails would involve wider carriages, and of a different construction. He might say that the result of a discussion with several gentlemen from Manchster, who were strongly in favour of the "on and off" system, had been to convince them that it was very doubtful whether such a plan could be successfully carried out. It must be remembered that, with the large number of passengers who always rode on the top, it would be necessary to have the carriages much wider, in order to prevent the danger of upsetting in turning. The matter was fully discussed the other day before Lord Redesdale, when the gentlemen from Manchester, to whom he alluded, admitted that all engineering experience showed that such a system would require a wider guage, which was a very serious matter indeed in a place like London.

Sir Walter Stirling asked how it was that no allusion had been made to the introduction of tramways some ten years ago, which he believed had turned out a complete failure.

The meeting was adjourned to Wednesday, March 23rd.

INDIA COMMITTEE.

A Conference was held on Friday, March 4th, Sir Bartle Frere, K.C.B., G.C.S.I., in the chair. The paper read was—

ON THE INFLUENCE OF THE SUEZ CANAL ON TRADE WITH INDIA.

By Sir Frederick Arrow,

(Deputy-Master of the Trinity House.)

The subject of this evening's discussion is one involving so many novel considerations, and is at the present time so entirely speculative, that there is doubtless a margin for much difference of opinion with regard to it.

Many differing views may be and are taken of it, and much sanguine expectation, as well as much reasonable doubt, exists as to the extent of the results which will follow the completion of the Suez Canal. I think, however, that, if only on the general grounds of increased communication, it will be conceded that much benefit must accrue to the great Indian possessions of this country, with the welfare of which the question is associated this evening.

It seems to me that the subject may be conveniently viewed under two heads, the one showing how, by means of the canal, India is brought closer to Europe for purposes of commerce, and how new fields of commercial enterprise may be opened up (which hitherto have been inaccessible, except at great cost and lengthened periods of transit), economising in the same process that most valuable of all commodities, time; and, under the second head, it may be shown that increased communication and rapidity of transit will make and supply increasing wants, and in so doing develope the resources of India, and distribute them for the benefit of the world at large.

I propose to confine my own remarks to the first of these two branches of the subject, leaving other gentlemen, better qualified than myself, to deal with the second.

It will be necessary, in the first place, to see what distances at the present time have to be traversed between ports of British India and ports in Europe, *viâ* the Cape of Good Hope, and then to compare them with those between the same ports *viâ* the Suez Canal, ascertaining at the same time how, if enhanced freights are required for steamers by the latter route, how they will contrast with the loss of time by sailing vessels on the former.

Assuming, then, as a fact, that the Suez Canal is so far successful that there are now no obstacles to its being freely traversed by steamships, as ordinarily used for commercial purposes—a fact, which, if a matter of doubt at its first opening, is now unquestionable from the use that has already been made of it, and the removal of the only serious difficulties to its navigation—one or two general propositions may be laid down for convenience in argument, and for the purpose of saving further reference, viz:—That steamers may be considered to average a rate of eight to nine knots per hour, and sailing ships five to six knots per hour, and that uncertainty as to time of delivery can be brought to a minimum by steamers only. In speaking of sailing vessels, I assume that they will practically be the only carriers on the Cape route, and have purposely excluded steamers from consideration as regards that line of traffic, because at the present time it is well known that the expense of the fuel for the long voyage is so great, and the time saved so trifling in comparison, that steamers are not an ordinary means of transit. As science advances in the economising of fuel, there may be an improvement in this direction, but it will require vessels of great power and speed to shorten the mileage now entailed by the prevalent winds within the tropical belt. With these general propositions, and my own experience to guide me, I have drawn out a table which shows, with sufficient accuracy for the present purpose, the comparative mileage transit between port and port actually traversed, and the time occupied in making the passage. They are, taking the Land's-end of Cornwall as a common point of departure from England, or ports in Europe north of Brest, as follows:—

	Via the Cape.	*Via* the Suez Canal.	Difference.
	miles.	miles.	miles.
Bombay	11,500	6,300	5,200
Kurrachee	11,200	6,100	5,100
Calcutta	13,000	8,000	5,000
Singapore	13,000	8,200	4,800

In point of fact, therefore, to a steamer averaging 8 knots, and to a sailing-vessel averaging $5\frac{1}{2}$, which, considering the area they have to traverse at times to make their course and distance good, is the outside that can be allowed to them in the most favourable seasons, the time occupied will be as follows, omitting fractions of days:—

Port.	Steamer in days.	Sailing ship in days.	Difference in favour of steamer.
Bombay	33 + 3 coaling = 36	87	51
Kurrachee ..	32 + 3 „ = 35	85	50
Calcutta	42 + 5 „ = 47	99	52
Singapore ..	43 + 5 „ = 48	99	51

Having thus disposed of the question of mileage and time, it remains to be seen whether these advantages compensate for the increased cost of navigating a steamer. This is not very easy to arrive at, for there are at present so many varieties of engines and such differences in the cost of the motive power, the principal element, that any sort of average would be fallacious. I propose, however, instead, to take as an example a class of vessel now being built, combining carrying capacity and economy of fuel and wages, which will, I think, be a type for this trade, and to compare it with an average sailing vessel of the class mostly used in the trade, founded upon the experience of actual voyages made, the two vessels being of about equal carrying capacity, say about 1,200 tons burthen each. I find that, as regards times of transit of the latter, they nearly coincide with the calculations I have above made, but independently of them. The steam-ship will carry, in addition to her stores and coal for 28 days, 900 tons of goods; the sailing vessel, 1,200 tons.

The portage bills for both vessels are nearly the same; the canal rate on the steamer is equivalent to about 6s. per ton on 900 tons of freight, say £270. The cost of coal may be averaged at 35s. at all ports, and the amount consumed on a passage to Calcutta would be a little over 400 tons. Taking, therefore, as an example, the voyage in which the sailing vessel would do best, viz., from Calcutta to London, the following would be an approximation to the result:—The steamer would do the distance in 47 days, her expenses being, coal, £700; wages, £300; canal dues, £270; total £1,270; and she would deliver 900 tons of goods, say at £3, £2,700; leaving net earnings, £1,430. The sailing ship would deliver 1,200 tons in 99 days, the wages, steam hire, &c., would come to at least £700, and crediting her with the same rate of freight, would net £2,900, or as near as possible double that of the steamer, and occupying more than double the time. As the steamer, therefore, will make two voyages to the sailing ship's one, it seems to me the case is made out that the canal can compete successfully with the Cape route. I have not attempted to go into minute calculations as to insurance, repairs to vessels, original cost, &c., but I think I have gone far enough to prove that steam can compete, *viâ* the canal, with sailing vessels by the Cape. I have purposely put the case favourably to the latter; I have taken the freight at equal rates; I have not touched on a round voyage, when not only would the outward freights be more against the sailing ships, and the cost of coal more in favour of the steamers, but the loss of time would be still greater, and I have taken the port of Calcutta as furthest to the eastward, and therefore more favourable to the sailing vessel. On the west side of India, the results would be proportionately more in favour of the steamer, as I have stated in a little pamphlet, lately published, a copy of which I had the honour to send to this Society.

Assuming it as proved that the Suez Canal can compete with the Cape route, let us see what further advantages it presents. I think we may say it will probably open a considerable trade between India and Italy, the Morea, Islands of the Grecian Archipelago, and the countries bordering the Mediterranean, including Spain, whose industry, although still undeveloped, is represented by

many cotton and other factories at Barcelona and elsewhere on its Mediterranean shore. It will probably create a direct trade between the coasts of the Black Sea and India, by placing the latter in direct communication with Russia and her teeming population. By the Cape route all these places are excluded from direct communication, except perhaps those immediately contiguous to the Straits of Gibraltar; and we may consider Marseilles as the point at which supply comes no longer from the westward.

On a previous occasion, a remark was made that there was not much credit due in making this canal. It was said that it was simply supplying a want for which the time had come. It struck me then that no greater compliment could be paid to the eminent man by whose perseverance and energy the undertaking has been carried out, and I accept it as conveying what, in my opinion, is the highest praise that can be bestowed on it. I believe it is a real want, and that its supply is another link in the chain which binds mankind together, and in which each successive link of discovery of nature or science is forged with stronger power. It is within my memory, as of many here, when the first steamboats were put on the waters, when the iron horse first traversed the rail; and we have all seen how the necessities of those great advances in communication required still further development. Thought was required to travel faster than locomotion by the very advantages the latter gave, and then came that wonderful discovery of the electric telegraph, now being carried to such perfection that, ere another two years have passed away, we may feel the furthest ends of the world to be as practically familiar to us as are now Paris or Vienna; but this again creates fresh wants, requires greater rapidity, regularity, &c., and in obedience to this law, the Suez Canal has been formed.

I will not pursue the theme—it is as diversified as it seems to be endless; but I claim for the Suez Canal and the enterprise of its great and large-minded author a fair and full recognition. At the present moment its influence is being felt in a decrease of the cost of fuel east of the Isthmus, which certainly will have great effect on the cost of carriage, and therefore in the cost of laying down produce and goods. The existence of this route, it appears to me, will stimulate production not only in India but in the various countries which it brings into the family of commercial relations, and seems to me the natural channel for the produce of India. If so, it must increase that produce, and must benefit India itself. England wants cotton, so do other countries — a want likely to increase — and at the moment that a network of railways has connected the great port of Western India with the cotton districts, comes into being that channel which will most quickly and cheaply take the staple to the place where it is needed. From the north-west by the Indus and the railway system of the Punjaub, another great feeder to it opens, while the rail from Madras to Baypore on the west coast gives a speedier and cheaper transit from the east coast of India, *viâ* the Canal, than by the Cape. These are considerations, however, which come more under the second head of this subject, and I do not propose to enlarge upon them, as they will be, I am sure, done justice to by those better able to handle them than myself.

DISCUSSION.

Capt. Sherard Osborn said he was as firm a believer in the value of this route to India as Sir Frederick Arrow. Since 1859, when he commanded a ship in the Red Sea, he had had occasion to traverse that portion of the route between Suez and India a great many times, on one occasion as often as eight times within three years, and he did so in connection with the great enterprise in which he was now employed, that of carrying out the telegraphic communication between Great Britain and India. He felt so convinced from the commencement that the two things were likely to weave together, that he threw the whole of his attention and professional energy into it, feeling satisfied that the Suez Canal would sooner or later become a great success, and that then it would be more than ever necessary that there should be direct telegraphic communication between Great Britain and India. He agreed with Sir Frederick Arrow, that eventually the Suez Canal route would be the main line for carrying all the most precious produce of the East to Great Britain, but at the same time he did not believe that the transition of one condition of things to the other would come like a change in a pantomime; it would be perhaps years before the advantages of this route would be fully developed, and its importance thoroughly understood. It had been truly said, that so long as the present expensive engines and steamboats were in use, the sailing vessels would still have the advantage; but owing to the extraordinary improvements which had recently taken place, and the vast economy which was being effected in the consumption of fuel, this would not long be the case; indeed, the two things seemed almost providentially to have come together, for whilst the French had been digging this canal, the English engineers had been doing their part in enabling Great Britain to compete with the greatest success in carrying the commerce of Western Europe through that canal, and this was well known to most people who were connected with the carriage of goods in steamers at the present moment. He also agreed that it was principally Western India that would benefit by the opening of the Suez Canal at first, and he hailed this with pleasure, for his lot having been for the most part cast in Western India when in that part of the globe, his sympathies lay more in that direction, and he knew that portion of Hindostan more intimately than the valley of the Ganges. When he was there, at the time the Chairman was governor of one of the largest presidencies, he saw miles and miles of jungle being converted into cotton fields; and to his mind the great question to be considered was, how quickly could that cotton be brought to the English market. The Suez Canal would no doubt be the route by which, in spite of anything that could be done in the United States, the cotton fields of India would be able to compete with the cotton fields of the Southern States, and not only so, but he believed that but for this canal the great American scheme of turning aside the traffic from the eastern shores of China and Japan, through San Francisco, would very probably have been successful; but now the Suez Canal was opened, he believed that not only the traffic to Great Britain, but also a great portion of that to the eastern states of America, would still be carried in English bottoms and under the English flag, for he believed, carrying them by that route, they would be able to compete successfully with their energetic cousins on the other side of the Atlantic.

Mr. George Campbell said he should like to say a word or two upon one view of the subject which had not been touched, but which very much concerned the part of India with which he was at present connected. The public of this country had hardly realised the fact that the opening of the Suez Canal was only one part of the great opening of commerce which was now taking place between this country and Hindostan. It was but one link of the chain which would unite India with Europe, and the opening of the great trunk lines of railway connecting the west coast with the centre, south, north, and east, and with the great populations of the valley of the Ganges and of the Punjaub were equally important. The two would no doubt work in harmony with each other. By the opening of the main line of railway, which Lord Mayo was, he believed, about to open on the 7th inst., they might hope that not only the west of India, but the north and east would be united to Europe by a very short route, by means of the Suez Canal. He made these remarks because he thought Sir Frederick Arrow,

who was in some respects an advocate for the Canal, had put the case somewhat less favourably than he might have done, in taking the case of Calcutta. It seemed to him that they must look not so much to Calcutta as to Bombay, and the other ports of the western coast, for the point of departure for the Suez Canal. The trade of Bombay was already great; but, on the other hand, the population of the Bombay provinces was small in comparison to the great population of the Gangetic provinces. Those were the countries which contained the main population, and which gave rise to the largest trade and commerce of India. He was sorry there was not a map to which he might refer, as it was difficult, except by that means, to make his meaning plain. But probably all present knew enough of the geography of India to be aware that the opening of a railway that ran direct from Allahabad to Bombay would at once put the whole of that great Gangetic plain into communication with Bombay, which would really be as near to the greater part of that district, when railway communication was established, as would Calcutta, and, in the course of time, the communication would naturally shift to that channel, and would come through Bombay, and by the Suez Canal, to Europe; and not only would it come from Bombay, but there were also the ports of Kurrachee, Carnear, and Beypore; and the opening of the railway from the Nizam's country to Bombay would, in a short space of time, lead to great development of commerce in that direction. It was evident, therefore, that the western coast of India must be considered in making calculations with reference to the point of departure for the Suez Canal. He believed Sir Frederick had assumed that beyond all dispute, within certain limits, the canal was eminently successful; he did not know for what size of ship, and whether it could be carried out to a depth of 25 or 30 feet, but they did know that for vessels drawing 16 or 18 feet of water he canal was a certain success, and must be infallibly kept up. With respect to the navigation of the Red Sea, no doubt there were gentlemen present much more competent to speak than himself, but he had travelled that route on many occasions, and had many opportunities of communication with the officers of the Peninsular and Oriental Company and the French Company, and he thought he might take upon himself to assert that the dangers and difficulties of the Red Sea navigation had been much exaggerated. These were sometimes spoken of as very great, but he believed that the exact contrary was the fact. In the Red Sea there were absolutely no storms, and no shoals, and, above all, there were no fogs, whilst the islands all rose straight out of the water, and could always be seen, night and day. He believed there was no instance in which a steamer had been lost in the Red Sea, except from the most gross carelessness, resulting from over-confidence—in fact, he had heard the Red Sea described as being a great canal free from the difficulties and dangers of a narrow canal. Of course he was speaking with deference in the presence of naval men, but he thought they would bear him out in the assertions he had made. Then, with regard to the navigation between Aden and Bombay. He inquired into this subject, and he found that, with the exception of about two months in the year, that navigation was one of the safest and easiest in the world. The monsoon did not commence on the Bombay side until after the 15th of June, and by the 15th of August the whole strength of it was over, for at that time the local steamers from Bombay commenced running, so that, in fact, there were only those two months during which there was difficulty, that was to say, there is a very strong head-wind for vessels coming out from Bombay towards Aden. The result was, that whilst the Red Sea was safely and easily navigable for steamers of moderate power all the year round, that between Bombay and Aden was navigable one way all the year round, and the other way also for ten months out of the year, whilst with vessels with powerful engines, even during those two months, the passage might be made with no great difficulty. One point which seemed to him to be of some importance, was one to which allusion had already been made, viz., that they had not only to consider the existing trade and the effect upon that which the Suez Canal would have, but in all probability an immense new trade would spring up between Southern Europe and India; and those who were interested in India must see that that would be a great advantage to the population of that country, whilst at the same time he had no doubt that English vessels would still, to a great extent, be the carriers of that trade. From an Indian point of view, there could not be any doubt that that country would benefit by trade with the South of Europe, not only in a commercial but also in a social point of view, for those in India would be brought into communication with countries much nearer to themselves in climate, and manners, and customs, and would learn from them many things which they could not so easily learn from this country, the climate of which was so widely divergent, so that its agricultural system was not so readily applied to such a country as India as was that of many parts of Southern Europe, such as Italy and Greece. He believed, that through the opening of the Suez Canal, there would be a new way of civilisation, which would do an enormous amount of good to that great country which was entrusted to English care. With regard to the mercantile view of the matter, he would counsel the merchants connected with Bombay to take occasion of the opening of these great arteries of commerce of which he had spoken—the canal and the railway—to throw a little more energy into their proceedings, for he must say that, with regard to European energy, industry, and enterprise, Calcutta was at this moment very far in advance of Bombay. No one could pass through it without remarking that, with respect to the shops and mercantile offices, and especially the industrial enterprise in the interior of the country, Bombay was ages behind Calcutta, for Calcutta had not only a great European population, which threw out its arms, so to speak, of enterprise in every direction in a commercial way, but also set on foot great industrial enterprises in the interior, in connection with the supply of indigo, tea, silk, and many other things. He hoped there would be a great deal more of this kind of thing in Bombay; and perhaps some speaker who followed him would be able to explain how it was that there was such a difference in this respect in these two localities. There was no doubt, however, that the opening of the canal would not only throw open an easy means of communication by which enterprising English, Irish, and Scotch would find their way to India, but would also be of immense benefit to that country in consequence of the other advantages to which he had alluded.

Sir Thomas Bazley, M.P., congratulated the meeting on the valuable paper they had heard, with the anticipations in which he entirely concurred, for he thought the opening of the Suez Canal would be the beginning of a new commercial career, and he would also say he believed it would begin a course of new civilisation, and that it would become the means of more closely binding together the eastern and western world. Its results must be looked for in the future and not in the present, but so far the experiment had been entirely successful, and he wished the great scheme could be perfected to the full extent of which it was capable. He should like to hear of its being increased in depth to some 25 or 30 feet, and also that it was double in width, for he thought at present there would be scarcely scope for the passage of vessels either way, and therefore he would venture to hazard the suggestion that nothing could be more graceful than for the great powers of Europe and America to contribute each a million sterling, as a donation towards the perfection of this great undertaking, which was yet only begun, and which required

to be completed. In speaking of the Suez Canal, he could not forget the country through which it passed, and if they only thought of this for a moment, they were taken back to ages of which history scarcely revealed the mysteries. If the ancient kings of that great country, the Pharoahs, could come again and witness the changes that had taken place, they would imagine that they were in a new field of existence; and when they recollected that Egypt was one of the first spheres in which civilisation was developed, that there the arts first flourished, and that now by modern agency we were endeavouring to render that comparatively heathen country still subservient to the cause of progress, it was an additional reason for congratulating themselves that the means had been attained of crossing that country, and connecting together the Red Sea and the Mediterranean. Looking to the great fact that 5,000 miles of distance would be saved between this country and India, there could be no doubt that the canal would have the most important result upon the course of British commerce, and that it would also be instrumental in developing the progress of India. He hoped that through the assistance of the Chairman, Mr. Campbell, and others who had great influence in that country, there would be a great impulse given to the cultivation of cotton in British India. Lancashire had been in a very perilous condition for the last seven years, for want of an adequate supply of cotton, and indeed the amount of loss and suffering sustained by the great cotton trade of the United Kingdom, and by the labouring classes, had been estimated at upwards of one hundred millions sterling, or, in other words, the working classes had sustained a loss of 50 millions sterling, and the capitalists an equal amount. Of course, such a state of things was greatly to be deplored, and he believed if they had acted on earlier intimations, they might have been more prepared to supply themselves with the raw material from India, without depending so largely on the United States of America. He had always been an advocate for the development of the resources of India, and therefore he rejoiced to think that the Suez Canal would greatly contribute to this end. He felt that agriculture in India needed great improvement, and he believed that, by the facilities afforded to English agriculturists to visit that country, especially when those railways to which Mr. Campbell referred were constructed, many men might, in the course of their lives, find time to spend a few months in a visit to India which they could not do at present, and he had no doubt that by this means great improvements would be introduced into the cultivation of land into our eastern empire. There was abundant evidence that India was capable of producing as good cotton as America, or any other country. He had been glad to hear it stated that the ryot of India was very apt to learn, and he trusted that there would soon be, in the case of the cultivation of cotton, both increased quantity and improved quality. He had seen it stated that the cotton crop in America this year would probably amount to 60 millions sterling, and if India wished to take up something like a similar position, and reap such a reward as that for its labour and capital, there would be connected with it an immense spread of civilisation and moral improvement, and mankind would be vastly benefited. He could not help remarking what an advantage the growth of cotton had been to the United States of America, and he rejoiced to think that India would participate to an equal degree in these advantages. Some people were apt to attribute the wonderful progress of America to her liberal government, but he did not think that was strictly correct, because a large portion of their prosperity had evidently arisen from the cultivation of this great article of commerce. The wonderful amount of money paid by Europe to America for cotton during the last half-century had enabled the latter country, under all difficulties, to command an almost unlimited amount of capital, and to pursue a course of enterprise and progress which had been unrivalled in the world. However, every effort must be used to induce the government of India to change the present stand-still policy, if any real improvement were to take place. He believed that the material interests of India were involved in the cultivation of the soil, which was capable not only of growing cotton but also sugar, rice, coffee, and a multitude of other articles. The silk trade was now pining for a more abundant supply of the raw material, and its high price retarded the employment of labour in this country. In India, there was an immense scope for the development of this branch of industry, and he hoped now this link of communication had been completed, nothing would be wanting in order that it might be fully taken advantage of, and that increased products might contribute to the prosperity of our dependency and of the empire.

Mr. Dadabhai Navroji said that one point which had specially been referred to in connection with the Suez Canal, was the effect it would have upon Indian commerce. It was an old saying, that the "proof of the pudding was in the eating," and in the present case it was enough to say that the increase of commerce through the Suez Canal was not a mere matter of conjecture of theory, or calculation, but it was a matter of actual fact, for they were even now beginning to receive orders from India to send goods *viâ* the Suez Canal. Goods which they used to send round the Cape, were now beginning to be sent by way of the canal, and this notwithstanding all the drawbacks of the transit, and the canal being yet to a great extent incomplete. They had heard that attempts were being made to build steamers suitable to their traffic, but he had no doubt that it would be still some time before a sufficient number of such vessels would be constructed, but, at the same time, there was no question that, with the engineering energy which England possessed, vessels would be made that would carry not only the precious and costly materials, but even cheaper goods through the canal. Cotton was at present no doubt an article of somewhat high price, but he supposed his Manchester friends were anxious it should come down, and no doubt there would be a fall before long; but even at its lowest price of 3d. or 4d. a pound, he believed it was quite possible for English engineers to build steamers which would at least be equal to transporting such goods through the canal as cheaply as they could be sent *viâ* the Cape of Good Hope, and with a greater economy of time. He believed the cost of transit from England to India would soon be brought to a level in this respect, and even now it was not very different. As he did not know he would have to speak, he was sorry he had not brought some figures with him which would have shown at what different rates they were now shipping goods *viâ* the Cape and *viâ* the Canal.* However, what little experience had already been obtained was quite satisfactory and encouraging, and sufficient to show that the canal would be a great success. No doubt anything that was required with regard to widening or deepening the canal would be done in time, and as the necessity arose. Captain Sherard Osborn had spoken of his sympathy with the Bombay presidency, and as he was a native of Bombay, he also might be excused for speaking with some partiality towards it, and, therefore, when Mr. Campbell had said that the trade of European enterprise in that presidency was more behind than that of Calcutta, he must say that such a general assertion was rather misleading. There were many allowances to be made for the difference of circumstances. The fact was, when they talked of tea and coffee, and indigo, and such articles being largely produced in Calcutta, it must be remembered that there must be land for producing them, and he did not know that the Bombay presidency pos-

* Sometimes the rates of freight are the same by the two routes, and even less by the Canal. My firm has shipped copper at 35s. when the rate by Cape was the same; and on the 2nd instant my shipping agent at Liverpool quoted less rate of freight by Canal than by Cape.

sessed hills and plateaus where such things could be produced. Then, again, the natives of Bombay had been a commercial people from the earliest times, from the time when the trade between the West and East was carried on by this same route which was now opened and restored by the Suez Canal. The people of Western India were especially a commercial people, and they had continued to preserve that character to the present day, so that, notwithstanding the European houses in Bombay, the greatest portion of commerce was still carried on by natives. In Calcutta the case was entirely different. The natives, as a body, were no merchants, and were far more disposed to preserve their money in government promissory notes than to invest it in sugar, coffee, or indigo. The result was that there was a much larger field for European enterprise there than in Bombay; and, again, it must not be forgotten that Calcutta was the seat of government, and that alone gave it many advantages and facilities. Bombay and the other presidencies had always to contend with many disadvantages in this respect. They required this and that, but the Indian government were guided very much by what they saw in Bengal, and the result was that the wants of the other presidencies were sometimes neglected; in truth, India was such an immense country, that special local experience was particularly necessary in order that justice should be done to all places. He did not mean, however, that certain imperial general control was not necessary. Again, could the land system of Bombay allow such large holdings as those of the Zemindaries of Bengal? And the Bombay trade gives ample scope for their enterprise. Besides, where were the facilities of communication to enable them to seek fresh fields? He hoped Mr. Campbell would make these allowances, and would not be disposed too much to blame his countrymen at Bombay. With regard to the Red Sea navigation, he must confess that during seven voyages he had made over it, he had always felt that a sailing vessel could hardly navigate it, for there was no open sea, and in case of a gale or headwind he did not think that a vessel could get on at all without steam. With regard to the effect of the Suez Canal on India, he believed it would be something marvellous. It was perfectly useless at present to attempt to forsee all the benefits which India was likely to derive. There was a common saying that misfortunes came in torrents, and he believe it was also true that fortunes sometimes came in like manner. It appeared to him that India was now being born again. It was in its infancy, whether with regard to intellect, or with regard to its physical resources. At the present time it seemed to be improving in every possible way. A great people, the English, thousands of miles away, had gone there to rule it, and it turned out that they were the best rulers for India. They had conferred the greatest benefits on that country, and from them alone could India hope for the greatest benefits hereafter, and this had been done not only by establishing a new political constitution, and a new political condition, but by introducing new intellectual and social elements. This had aided in developing the resources of the country, and India seemed destined again, under British hands, to be restored to the supremacy which she possessed in ancient times, when she was the country which supplied the most precious as well as the most useful articles of commerce. The whole world was anxious to have the productions of India. Before machinery had made much progress in England, Indian calico was one of the important imports into this country, although now it was one of the most important exports. The case of India was like that of a child. No expense should be spared in educating it, training it, and developing all its powers, and then, when the child was of age, they knew what its capabilities would be. At present, India was but an infant, and, therefore, it is impossible to say what it will be when all its resources are developed, and when this network of railway which was spoken of, was spread over the face of the country. In conclusion, he said, no doubt the Suez Canal was a great success, and would be of the greatest benefit to India, in assisting to develop its commerce, and in affording facilities for communication between it and Europe. Whatever benefit the West might derive from this great work, there could be no doubt that it would be of the greatest benefit to India.

Col. Pitt Kennedy said the Suez Canal was a grand work, and a work he was sorry to say England did not support in its early stages as she ought, though she was very ready to come forward now when its success had been proved. Some time ago they were frightened with phantoms of Russia getting hold of India in some way or other, nobody knew how. Thanks to M. Lesseps and his government, this great boon of communication had now been conferred upon the world, and he hoped England would give it all the support which it needed. It required a lighter tariff which would not crush it; it required, he was afraid, that the poor shareholders who supplied the money should be patient; and it required, as one gentleman said, that the great nations of the world should consider what a great benefit it was likely to confer upon them, and come forward and support those who had produced this grand result. He quite agreed with what had been said by Mr. Dadabhai Navroji that there was a great difficulty in managing the interests of India. There was, unfortunately, a local influence too much prevalent there, and there being four great presidencies, he feared the interests of all were not sufficiently consulted. With regard to the success of the Suez Canal there could be no doubt, for he had heard that day that the largest ship-load of cotton which had ever sailed from Bombay had come through the Suez Canal—a ship-load of 13,000 bales. At the same time, he had heard that things did not go on quite as quickly in India as they ought to, and it was a deplorable fact. Two hundred years ago, a ship-load of Europeans landed on the coast of America, and now that country possessed 56,000 miles of railway. At about the same time the English first landed in India, and that country had now got but 5,000 miles of railway; and it must also be remembered that in America there was hardly any population to commence with, whilst in India there was a dense population of nearly 200,000,000. And there was another fact which should be borne in mind, that whereas in England it cost about 4s. a ton for produce to be conveyed to a railway, in India it cost, on an average, £4 10s.

Mr. J. B. Smith, M.P., said with reference to the statement of Sir Frderick Arrow, that the canal at present was only about 16 feet in depth, he had lately met Sir Arthur Cotton, who assured him that there was no difficulty whatever in increasing either its width or depth, and he had no doubt therefore that, as the undertaking prospered, further facilities for traffic would be afforded. Some friends of his were about to dispatch some steamers from Liverpool by that route, drawing 21 feet of water, but he could not say whether they would be able to get through without lightening their cargo. He could not quite concur in what had been stated as the tonnage-dues; he believed they would come to more like 10s. a ton than 6s. The nominal sum was 8s. a ton, and there were some other expenses besides.

Sir Frederick Arrow said the dues were payable upon the registered tonnage, which excluded engine-room, and therefore he calculated that, although the nominal dues were ten francs per ton, it would not, on the average, come to more than 6s. per ton on the cargo.

Mr. J. B. Smith said there could be no doubt of the great advantages which would follow from the opening of the canal, but there was another point to be looked to. Some efforts must be made by the Indian Government to encourage the growth of cotton if anything like competition with America were to be attempted. The

United States were now turning their attention once more to the growth of cotton, and it was expected that this year America would produce 3,000,000 bales; and in the contest between India and America there was one point to be borne in mind, that whereas in India the weight of produce per acre averaged from 50 to 70 lbs., in the States it ranged from 400 lbs. to 600 lbs. It was clear, therefore, that when cotton was abundant and prices were low, India must be at a great disadvantage, but he believed it was one which could be removed. The soil of India was hard, and the cotton-plant having a tap-root, like a carrot, it could not pierce through and reach the moisture below. He had, however, seen a gentleman who informed him that, by the aid of irrigation and deep ploughing, he had produced a crop of from 300 to 400 lbs. per acre, and from some correspondence he had had with Mr. Carnac, he was quite prepared to believe it. In fact, he had seen samples of cotton grown in India at such a rate of production which were equal to any short American cotton. He was quite satisfied, therefore, that with proper cultivation, 300 lbs. per acre could be produced, and for this reason, he had for years past, in conjunction with others, been calling the attention of the Indian Government to this matter, but as yet without any success. Irrigation would be the only effectual means, and this he hoped would soon be set on foot on an extensive scale.

Mr. Hyde Clarke regretted that he was not in a position from actual experience to give an opinion with regard to the canal, but various reasons had prevented him, when in Egypt, from paying it a visit. He was one of the few who had from the outset maintained the utility of the Suez Canal, and defended it against those in this country who maintained that it was, in an engineering point of view and in a commercial sense, useless. At the same time, he could not but think that, if the undertaking had been advocated on sounder principles, it would have received more support in this country, for many were set against it when M. Lesseps converted it from a commercial enterprise into a political one. In the first instance, there was a disposition on the part of English mercantile men to regard it in the same light in which they did at present, but the introduction of the political question, and the attempt to create a French colony in Egypt, had altered the current of opinion. If Mr. Lesseps had then been successful, so far from giving this country those advantages which she was entitled to, and which she would now possess from this international undertaking, he would have deprived both England and India of those benefits which they were now congratulating themselves upon. It was quite true that it was yet too early to speculate upon the ultimate effects upon either English commerce or Indian progress, but even at the present moment, from what was already taking place, it was easily to be foreseen that great and mighty changes would be effected. Even since the opening of the canal, he had received letters from Aleppo stating that the course of trade there was already affected, for European goods were no longer received in the same quantity, to be carried by caravan to Bagdad. Therefore the elements of revolution were already at work in a part of the world which had not been referred to by Sir Frederick Arrow, and which was little considered. The head of the Persian Gulf appeared to be so remote from the sphere of operations, and the communication with Constantinople was still so circuitous by means of the canal, that it was scarcely possible to imagine that it was already diverting the communication between Constantinople and Bagdad, and yet great political, social, and moral results must be the consequence. But even at the present moment it was found that the destinies of such places as Aleppo and Scandaroon were menaced, and the prosperity of Bagdad affected. But, whatever were the immediate results, there could be no doubt of the ultimate and lasting value of this great enterprise, particularly in promoting direct railway communication with India. It was the opinion of M. Lesseps, and he, as well as many others, had heard him declare that the opening of the Suez Canal would have a great effect in promoting the Euphrates Valley Railway, and that these two enterprises were in no way inimical, but would work harmoniously together. As the Suez Canal would become the great channel for conveying the commerce of this country to India, so would the railways which were being constructed in European Turkey be the means of promoting commercial and social intercourse with India. But with regard to railways in India itself, the opening of the Suez Canal must be very beneficial, as tending to give not only a better transport of materials, but also a greater supply of intelligence and enterprise. He was glad to hear Colonel Kennedy call attention to the contrast between the United States and India in this respect; for the railway system of India was yet but in its infancy, and until it was far more complete it would be impossible for the real development of that great country to take place. With regard to the advantages which English commerce might derive from the opening of the canal, that must entirely depend upon the amount of intelligence and enterprise which was brought to bear in connection with it. And here there were material interests at stake of the very greatest importance; for instance, not only the question of cotton culture, but the very cotton trade itself. At present, England was the great cotton market, but if a great development of cotton cultivation took place, not only in India but in the East generally, the result might be that if England did not devote her energies to the subject, the cotton market might be transferred to Marseilles. On the other hand, he was not without hope that, by the promotion of the silk culture in India, and by means of the Suez Canal, they might yet restore the silk market to England, the removal of which to France had been very disadvantageous to this country, particularly in periods of scarcity, when all the best portion of the produce went to France, and only the inferior portion came to England. Sir Frederick Arrow had dwelt upon the saving of time but Mr. Navroji, speaking as a merchant, had pointed out the great importance of bringing goods speedily to market, in order to realise the highest market price, and also to save interest on capital, and in this respect certainly it would confer great benefit on the population of India. No doubt the cultivation of cotton would be stimulated to a great degree, by giving the cultivator an assurance of a better price, for when his produce could be thrown into the market in large cargoes and in a fixed period of time, the result would of course be much more certain. He regretted that he could not agree altogether with Mr. Campbell, as to the benefit which India would derive from a closer connection with the South of Europe. Commercial advantages, of course, must result from intercourse with any country, but still it was quite possible for disadvantages to be connected with it. No doubt there might be benefits arising from a connection with populations under similar conditions with regard to temperature and climate, but certainly the populations of Southern Europe were not at present in such a social condition that it was desirable that a closer connection should be formed between them and the population of India. Indeed, the construction of the Suez Canal had already been the means of throwing into the East a number of the refuse of the population, and had opened, in fact, a gateway for all the vagabondage of Southern Europe, which had already caused so much mischief in the Levant and in Egypt, to pour into India and China. So far, therefore, from regarding it as an advantage to India to be more closely connected with the people of Southern Europe, he believed the great advantage they would derive would be a closer and more intimate connection with England; because the population of India had, in the main, a healthy moral constitution, which enabled them, as had been said, to easily assimilate

the institutions of this country, to profit by them, and to apply them for their own social benefit and political advantage. He thoroughly agreed in that respect with Mr. Campbell, that India would benefit through the Suez Canal by the extension of English enterprise, and the infusion of a greater body of men from England and America, capable of promoting the true interests of India. Even at present the facilities of communication were producing this effect, that there was a much larger body of men, both in public and private life, who had a more or less intimate acquaintance with India and Indian affairs, and the more this could be extended, unquestionably the better would it be for both countries, and he believed for the world at large.

Mr. Wallace J. Harding, while he confessed to having listened with much interest both to the paper and to the discussion, and to having learned more about the Suez Canal than he knew previously, was still somewhat surprised to hear such an unqualified pæan of praise uttered with respect to an enterprise which, a few years ago, he had always heard spoken of in such very different terms. Still he had expected to hear some allusion made to the difficulties of the canal; for instance, with reference to the passage of the *Brazilian* with a large cargo of cotton through the canal, he had been informed, on very high commercial authority, that this vessel had been chartered from Bombay to Alexandria only, where the goods were to be transhipped to a larger vessel, to come on to Liverpool. Again, he was informed that the Pacha of Egypt was at this moment spending £2,000,000 on a railway which was to run parallel to the canal, and an equal sum in improving the harbour of Alexandria. At the same time it was a somewhat singular circumstance that the Peninsular and Oriental Company had so little faith in the canal that they were building larger vessels than ever, two being now in course of construction which would be too large to go through the canal. It seemed to him somewhat remarkable that, while the Viceroy of Egypt took no interest in the Suez Canal further than as a shareholder, he should be squandering the resources of the country in the way he had mentioned, the result of which would be that when ships arrived at Alexandria their cargoes could be at once transhipped by hydraulic power in a remarkably short space of time, and forwarded by rail to the other side of the Isthmus, thus rivalling in a great measure the advantages offered by the Suez Canal. And there was this difference to be noted, that, in the case of the canal, the ship itself as well as the cargo had to pay toll, and these ship-tolls were exceedingly heavy. Again, as there would be a loss of two or three days if the mails went by way of the canal, they could not be expected to take that route. He was as firm a believer in the ultimate success of the canal as anyone, and had no desire to throw cold water upon the scheme, but he thought at the same time it was only fair that these deficiencies should be noticed.

Mr. Trelawney Saunders said he had been much struck with the manner in which one of the previous speakers had expressed himself on the subject of the cultivation of cotton in India, in comparison with the same in America. In the latter case, he referred to what had been done and was doing by the private enterprise of the planters themselves; but when he came to India, he at once introduced the question of government assistance. This subject had been often considered before, and could not, indeed, be discussed too often; but if Manchester were so anxious for a supply of cotton from India, why did she not apply herself directly to its cultivation there. With regard to the main subject of discussion, he, like the previous speaker, had been much struck with the wonderful unanimity which now prevailed, and could not but contrast it with what he knew to have been the tone of feeling on the subject up to a recent period. He must confess to being a little surprised at hearing the old story repeated about the political aspect of the question having alarmed Englishmen. He had always understood that the real ground of the objections which were taken in this country to the Suez Canal was based on the evidence of Mr. Robert Stephenson, and of Captain Spratt, as hydrographical surveyor of the Mediterranean. He should have been very glad to have joined in the song of victory which had been raised that evening, but was fain to confess that he had not yet been able to shake off the impression which the evidence of those two great authorities had produced upon his mind. Nor had he yet heard anything to contravene that evidence. On the contrary, he would quote the authority of an Admiralty surveyor of the present day, Captain Nares, which seemed to him to corroborate the views antecendently entertained by Mr. Stephenson and Captain Spratt. He said:—"In approaching Port Said, allowance must be made for a bank which is forming outside the west pier end. In November, 1869, this was six fathoms at half a mile from the pier end, with the anchorage marks in one. Inside the piers, the harbour is at present constantly silting up, in consequence of a current heavily laden with sand running through numerous openings in the piers, and depositing sand in a quieter water inside." These were simply the remarks of this official surveyor in reporting to the Admiralty, which were published in the papers.

Capt. Sherard Osborn said the report went on to show how this might be prevented.

Mr. Saunders said he was going on to the explanation. The reason why the sand found its way into the harbour was, that the pier was formed of large blocks of concrete or artificial stone, which were dropped into the sea and allowed to find a place for themselves, and the consequence was, that there were considerable interstices through which the sand found its way, and to such an extent that the bank inside the harbour was 150 feet in width. This showed that the same great instrumentality was still at work, which was in operation in the time of Alexander the Great, and which had been at work ever since the Nile deposited its waters in the Mediterranean, and which had hitherto worked with such success that every harbour formed to the eastward of Alexandria had successively been silted up, including Pelusium, Damietta, and Rosetta. Great as had been the progress of modern engineering science, he did not believe it was yet capable of contending with the powers of nature on such an extensive scale. The sand had already heaped itself nearly to the extremity of the western pier, extending two miles out into the Mediterranean, and when it had done that, what would be the result? Not merely the formation of a sandbank, upon which already two British ironclads had struck—though it was said this was caused by the engineers of the canal, who had selected that as the spot upon which to deposit the sand taken out of the canal, which he could hardly imagine would be the case, but should rather attribute it to the deposit of silt from the Nile—but when that bank was formed to the extremity of the western pier, although it might go on for some distance in the same direction, it must ultimately turn round and set into the harbour, and then would the answer be given to the question whether Mr. Stephenson and Capt. Spratt were right or wrong. He had endeavoured to ascertain whether there was anything in the ordinary sources of information which would enable him to change the opinion which he had formed, but he had not discovered any. It was said that the opening of the Suez Canal would throw open the local trade between the Red Sea and the Mediterranean, but as it was evident for many reasons that this trade must be carried on in sailing vessels, there seemed to him insuperable difficulties in the way, for, in the first place, the average length of voyage up the Red Sea for a sailing vessel was 45 days, though he was aware it had been done in as little as 28 days. However, the average time was what he had stated for the up voyage, and ten days to go down, and he did not think such conditions were very favourable to the development of local

traffic. They must therefore look, not to local trade, but to the trade between India, China, and Japan with Europe, and there was no doubt that anything which would facilitate that commerce would confer a blessing on the human race. Englishmen had shown what they could do when put down amidst the deserts of Australia and the forests of the New World, and in India they were beginning to operate on a field which was not a desert. It had been well said that that great country was undergoing a process of regeneration. When the four hundred millions of China were added to the two hundred millions of India, they had half the population of the globe. Here was indeed a field for enterprise, and if the political restrictions imposed by China, and the habit they had of looking too much at home instead of abroad, were once shaken off, it would soon be taken advantage of. If they wanted to get such an amount of trade from the East, as should make the Suez Canal profitable—so long as it remained open; the enterprise of Western Europe must be devoted to the development of the products of those vast regions of Asia, of which we had far too limited a supply—tea, coffee, silk, cotton, &c. The labour of the vast population of those regions must be stimulated and directed to the production of staple articles in far greater quantity, so that the price may be reduced, and that they might be returned to them in a manufactured state. These were the points to which the enterprise of England should be directed, and if the Suez Canal aided in any degree to develop the resources of the East, it would deserve all the encomiums which had been passed upon it; but he believed that a still more rapid mode of communication was needed, and that they must look to the development of railway communication to bring the vast populations of the East into such close connection with Europe that western ideas might take root and bear such fruit as would be profitable to both sides of the globe.

Sir Frederick Arrow said the result of the discussion had clearly been to show that, from the opening of the canal, great commercial advantages might be expected, not only to this country and to India, but also to Europe at large, especially those ports which bordered on the Mediterranean. He did not come there as the special advocate of the Suez Canal further than to show the influence it was likely to have on India, the subject of the discussion, but still he might be permitted a few words in reply to some difficulties which had been suggested; and if no more urgent arguments against it could be adduced than those they had heard that evening, that of itself was enough to stamp the enterprise as a success. He was well aware that objections had been raised by Mr. Stephenson and Captain Spratt, but he had heard with some surprise the colour which had been put upon the remarks of Captain Nares. He had had the pleasure of meeting that gentleman in Egypt, and whatever might be the apparent effect of any of his remarks taken in detail, the general tenor of them, and the whole of his conversation, showed that he believed not only in the present but also in the future success of the canal. It was quite true that the western breakwater was made in a very imperfect manner, simply because money was very scarce, and the object was to get a safe passage at the earliest possible period, leaving it to a later period, when returns began to come in, to make good any defects; and, at any rate, he had seen the river and outer harbour of Port Said crowded with 200 or 300 sail of all nations, who all, as he believed, got both in and out in perfect safety, in spite of the obstacles which had been mentioned. As to the sand-bank on which Her Majesty's ship had grounded, which had been alluded to, he believed a dredger would remove it in a single week; and it was going a little too far to say that the harbour was going to silt up on account of this sand-bank on which two vessels had struck, because it was perfectly well-known that that bank was a creation of the canal itself, consisting of the sand dredged in the progress of the works, which perhaps had not been carried far enough out, and certainly ought to have been buoyed, as was the case with the same kind of banks at the mouth of the Tyne and other rivers in England, the mouths and channels of which required constant dredging. If this precaution had been taken, there would have been no danger of vessels grounding, but it was evident that it had no connection with the deposit of the Nile, for this reason, that there was a deep-water channel between the two, so that vessels could actually pass between the western breakwater and this bank. There might be, and probably would be, as Captain Spratt, for whom he had a great respect as an hydrographer, said, a good deal of deposit and silt, but he believed it would be nothing that could not be easily removed by the ordinary appliances, which in the ancient times alluded to were not known. When gentlemen asked why the Pacha was spending money on the port of Alexandria, and so on, he could only say that if any one could tell the reasons which led an Eastern potentate to spend money—especially in Egypt, where money was squandered in a most marvellous manner—he knew more than most people. The Viceroy had certainly signed a contract for the formation of a harbour at Alexandria, which, when completed, would no doubt be very useful, but the very fact of the Suez Canal itself, and the wants which it would create, and the stream of commerce which would flow towards Egypt, were so many reasons why such a harbour was necessary. Another objection had been taken in the remarks made by Mr. Navroji as to the amount of commerce that would pass through the Suez Canal, and the communication that would grow up between the coasts of the Mediterranean, the Archipelago, the Black Sea, and India. He could only say that when he was there he saw an immense variety of flags—Russian, Greek, Egyptian, Italian, French, and English, which at least showed that they took a great interest in it. Then, with regard to the Peninsular and Oriental Company, there was good reason for their not availing themselves of the canal, as by so doing they must inevitably lose perhaps 48 hours, and with them, carrying the mails under a contract of which time was the essence, speed was the primary consideration. But, however, oddly enough, the same day which brought news of the *Brazilian* passing through the canal, also brought the intelligence that the first ship of the Messagéries Impériales line, the *Hooghly*, had come by that route, bringing the India and China mails. The *Brazilian* brought 14,000 bales of cotton, or about 2,800 tons. She took nineteen days to get to Suez, and two days to lighten and get through the canal. How much of the cargo was taken out he did not know, but there was at the present moment, as Captain Osborne had said, a depth of 22 feet of water, which was quite sufficient for all present purposes, and if it wanted deepening or widening hereafter, the only requisite would be money. The rock at Serapium had now been removed, and there only remained one or two shoal places, which could easily be dredged out, and then there would be a sufficient depth for any ship to go through easily. But if it should be found that the canal became choked with traffic, what could be easier than to make another? in fact, to have a double line of rail as it were. There were the same fresh-water lakes and dry basins, by the aid of which this one had been made, and there would be all the advantage of experience, and of the present communication to bring material. He was quite of opinion that this great work was a blessing to the commerce of the world, which ought to be internationally supported, and he felt satisfied that having been once opened it would never again be closed, for it would be found a communication which the world could not do without. From an engineering point of view, he did not consider it a great work, but it required, for all that, an immense amount of genius and enterprise to carry it through, and, now that it was completed, he was quite satisfied that Englishmen, with their

usual generosity, notwithstanding the opposition which it had met with, and very properly, at the hands of Lord Palmerston, as a political enterprise, would acknowledge their error, and lend it all the support in their power.

The Chairman said he was sure the meeting would cordially unite in a hearty vote of thanks to Sir Frederick Arrow, for the able paper which he had laid before them. Many of the questions which had been raised in the course of the discussion it would be impossible to dispose of without further consideration, and, no doubt, opportunities for this would be afforded; but with regard to the canal itself, it was pretty clear what the feeling of the majority was, and even those who were most sceptical must admit that the causes which originally gave the Cape route a real advantage over every other mode of communication with the East would now give the same advantage to the Suez Canal. It was not only that the original routes by Palmyra and Berenice were closed by the efforts of governments and by the inroads of warlike and hostile nations, but when a way was found round the Cape, it was found that goods could be carried the whole way without transhipment, and this it was which outweighed almost all other considerations. In the same way, the opening of the Suez Canal would restore the same advantage, and thus the speed of the overland route would be secured without the inconvenience of transhipment and land carriage. Even Mr. Saunders must admit that when once the way was made for water it would prevail; but at the present time he did not believe that the opening of the canal would have any prejudicial effect on the overland route. Not only would it expedite commerce, but the inevitable result of all such operations was to give an increased sense of the value of time; and as they all knew that the straightest route must in the long run be the quickest, and what the steamer could do the railway would strive to emulate, the opening of the canal would set men of science thinking how they could obtain a still more direct and rapid route from the Mediterranean to the Persian Gulf; and though the immediate result might be that Aleppo and Bagdad might have to complain of a partial loss of trade, yet there would soon be efforts made to save yet another day on the journey, and what the ultimate result would be no man could tell; he believed the imagination of even the most poetical would fail to picture the reality. But, at any rate, he felt assured that in every aspect in which our connection with India was considered, whether in a commercial point of view and the great field it offered for enterprise, or whether in connection with any scheme of philanthropy, or any views of the better government of the world in general, the greater permanence of peace or the less frequency of war, in all these respects the completion of such a work as the Suez Canal must produce the most beneficial results. He trusted that what had fallen from Sir Thomas Bazley would not be forgotten, with reference to the desirableness of making this great work the common property of all nations. England had done enough in different quarters of the globe, and might well allow France the credit of the Suez Canal, and might also take the first step towards making it an international work, abjuring all selfish views, and letting it be understood that, in case of any war, it should not become the exclusive property of any one nation, but should still be open to all the world, in the same way as the Straits of Gibraltar. He thought it exceedingly probable that, by so doing, the canal would be sooner completed, and put in such a condition that the whole of the benefits arising from it would be more readily and fully appreciated. There was not time to enter into the cotton question, but he might remark that that was pre-eminently a question of cheap communication; it was no use having it cheap in one place or another, unless there were ready and economical means of transporting it from the field to the factory; and it was no use to sit down and think the work was accomplished when one obstacle was removed. One good result of the canal he hoped would be, that many more of the community would take the opportunity of visiting India, whence they would no doubt return with many a lesson of wisdom and goodness, and they would also confer an inestimable benefit on India by paying more attention to its affairs. The Indian government would be all the better for being more responsible than it was at present to the educated public opinion of England. India was now making great strides in agriculture and other branches of industry, but, although much had been done to promote progress in this direction by the Society of Arts and other associations, many of which had sprung from it, much still remained to be done. Even in England, agricultural chemistry had an immense deal to do, but in India it had not begun its work. One of the lessons which those who visited India would bring back with them would be, that the population of that country were particularly teachable, and willing to adopt anything that they saw would be advantageous to themselves, and there was therefore every encouragement to those who were disposed to introduce improved systems of agriculture amongst them.

The vote of thanks was carried unanimously.

EDUCATIONAL NOTES.

It should have been mentioned last week that the Convocation of the province of York have discussed the government Bill. The Rev. Canon Woodford proposed certain resolutions, which were supported by the Bishop of Carlisle and the Dean of Chester. Amongst these were, that the Convocation was prepared to concur in the conscience clause and the provision for school inspection, but desired to point out certain modifications and alterations which appeared likely to make the Bill more efficient. Among these were, that, considering the serious difficulties attending direct compulsion, and the probable unwillingness of school boards to enforce, it was desirable that compulsion, if introduced, should be entrusted to some official whose functions shall be extended to all public elementary shools whatever; that viewing the importance of scientific and technical instruction at the present juncture, they (the Convocation) suggested that clauses should be inserted for the promotion and encouragement of such education, especially in the manufacturing, mining, and town districts.

The Manchester Education Bill Committee have adopted a report, cordially approving the main principles of the Government Bill, and resolving to use its influence to support the second reading. The two Bills prepared by the Committee have therefore been withdrawn. At the same time, the committee expresses its opinion that the time required to bring the provisions of the Bill into operation is excessive, and that school boards ought to be called into existence at once in every district. They think it undesirable to leave the religious character of rate-provided schools to be determined by these boards, and adhere to the principle that "no religious formularies should be used nor anything in support of, or in opposition to, the peculiar tenets of any religious sect be taught in the schools, provided that this shall not be held to exclude the reading of the Bible." They hold also, that the permissive power given to school boards to make bye-laws to compel attendance is unsatisfactory, and they think the compulsory power should be positive.

A deputation laid this report before Mr. Forster, who, whilst admitting that the questions raised by these amendments were fair subjects for discussion in committee, pointed out that they were not altogether free from difficulty. It has been arranged that amendments

in accordance with the committee's report shall be moved by Sir Thomas Bazley, Mr. Jacob Bright, and Mr. Hibbert.

At an important conference of thirty members of Parliament, held on the 4th inst., under the presidency of Mr. George Dixon, it was determined, on behalf of the League, that when the Education Bill comes on, at later stages, the question of free schools shall not be pressed, but the following points shall be persisted in:—The universality of school boards, absolute compulsion of attendance, separation of hours for religious teaching from hours for secular teaching, and the unsectarian character of new schools founded and supported by rates.

A very large and influential deputation of representatives of the League had an interview with Mr. Gladstone on Wednesday last, who was accompanied by Earl de Grey and Mr. Forster. Mr. Dixon, M.P., in introducing the deputation, said it consisted of about 400 gentlemen, who represented above 70 localities. Among those present were thirty members of Parliament and twelve mayors.

Their views were principally stated by Mr. Dixon, Mr. Chamberlain, Mr. Mundella, and Sir C. W. Dilke. Among the objections urged against the government Bill, were those relating to the appointment of school boards; and it was proposed to amend the Bill by enacting that such boards should be established in all districts, and they should be elected without the delay contemplated by the Bill. The League objected to the recognition of permissive sectarianism, and to the retention of school fees, believing that the free system was a necessary corollary of compulsory education.

Mr. Gladstone, in reply, said he was pleased to find that, apart from the particular objections brought forward upon that occasion, there were matters in the government Bill which were regarded with satisfaction by them. The avowal of that satisfaction, together with the frank statement of their objections, formed a basis on which they might hope that, by united effort, and by proceeding in a spirit of firmness and conciliation, a useful and satisfactory measure would be passed. He then asked several questions as to the views of the deputation on various points, particularly as to the mode in which the League proposed to deal with the religious question, and answered some of the objections made to the Bill.

A deputation from the Union is to have an interview with the members of the government to-day (Friday.)

According to the monthly circular just issued by the Executive of the League, the number of branches formed and in operation is now 113, and others are in process of formation. The funds promised and realised amounted, on the last day of February, to upwards of £58,000, of which nearly £5,000 was subscribed during the month.

Meetings, at which the views of the League have generally prevailed, have been lately held at Falmouth, Plymouth, Northampton, Stourbridge, Newcastle-on-Tyne, Birkenhead, and other places.

The Birmingham Town Council have virtually adopted the amendments proposed by the League.

At a conference of Noncomformist ministers, held at Nottingham, strong resolutions in opposition to the Bill were passed. It was resolved that the Conscience Clause was invidious, useless, illusory, and deceptive; and further, that only such schools ought now to be created by the State as shall be strictly undenominational. Petitions have been adopted by the Nonconformists at Birmingham, and also at Gravesend, expressing very similar views. The Bill has also been severely handled at Liverpool by the United Presbyterian Presbytery at their annual meeting, and by a conference of Protestant Nonconformists. The former body resolved to petition the House to amend various clauses, which, if passed unamended, "will seriously interfere with the religous liberty of the people;" while, at the conference, it was urged that the clauses relating to religious instruction were calculated to shirk and not meet difficulties, to settle nothing and unsettle everything, and even to revive religious animosities.

At a meeting of the North Staffordshire Association of Certificated Schoolmasters, held at Newcastle-under-Lyme, resolutions in favour of direct compulsion, enforced by the central government, and also of denominational education with a conscience clause, were carried.

At the monthly council meeting of the Central Chamber of Agriculture, Colonel Tomline, M.P., in the chair, the Bill was discussed, and a general approval expressed of the measure, but it was resolved that adequate opportunities for instruction may be secured by regular attendance at school up to the age of ten years, supplemented by partial attendance after that age; and also that giving school boards power to borrow money, to be repaid out of local rates, and power to levy a rate, would be increasing an injustice already inflicted upon the owners of rateable property; and that, as the education of the people is a national object, the whole of the public contribution should come out of the general taxation, until the present system of rating has been revised. The Norfolk Chamber of Agriculture has also discussed the Bill, but give it only a qualified approval. The compulsory system was objected to, but considerable amount of feeling was displayed in favour of secular education. The Bill has been also discussed at a meeting of the Warwickshire Chamber of Agriculture, where the general feeling was in its favour, but it was urged that boys should not be compelled to attend school after ten years of age.

At a crowded meeting of working men exclusively, held in St. George's Hall, Wolverhampton, the League views were adopted, especially stating "that the ticket system, proposed by Mr. Forster's Bill, is repugnant to the feelings of the British workman, and would be invidious and mischievous in its operation."

The committee of the Surrey Congregational Union has adopted resolutions relative to the religious aspects of Mr. Forster's Bill. They express approval of the proposal to allow other than denominational schools to participate in the Parliamentary grant, and also of the intended abolition of denominational inspectorships. They condemn the permission to establish new denominational schools, and urge that no conscience clause would be of any utility in the rural districts.

A meeting of Welshmen has been held, in the "Freemasons' Tavern," to consider the Bill as it affects the principality. It was agreed to urge the modification of the conscience clause by introducing the words, "No book shall be used in the school for the purpose of religious instruction other than the Bible," and by omitting the words relating to religious formularies.

At a special meeting of the Central Executive of the Union, held at the Westminster Palace Hotel, Mr. Cowper Temple, M.P., in the chair, a report was adopted pointing out what in their opinion are the merits and defects of the government Bill. They consider that it deserves support, inasmuch as it aims at supplying elementary education without prohibiting religious instruction, without superseding parental responsibility, and without extinguishing existing schools; but that it is defective in not adopting indirect in preference to direct compulsion. They consider, however, that compulsory attendance at suitable schools may be rightly enforced on vagrant children, and on those whose parents are receiving parochial relief, or are unable to pay the school fees.

A conference of supporters of the Union has been held at Clifton, under the presidency of the Bishop of Gloucester and Bristol, and the Mayor of Bristol, the Bishop of Bath and Wells, the Rev. Dr. Barry, Earl Nelson, and others, advocated views similar to those just stated.

At a conference of clergy and laity held at Bedford, under the presidency of the Bishop of Ely, resolutions were carried expressing a general approval of the Bill, but at the same time, considering it would be impossible

to carry out satisfactorily a compulsory system, direct or indirect, through the aid of local boards, and expressing a wish that some external power should be created for the purpose.

At a meeting of the clergy of the rural deanery of St. Pancras, the Rev. A. W. Thorold in the chair, it was unanimously resolved that, while approving of the main provisions of the Bill, they think "it very desirable greatly to modify the constitution proposed by the Bill for the school boards. They are also of opinion that the question of compulsory education (in case the principle of it is carried) requires to be more fully considered with reference to the possibility of its extension to all elementary schools in the country."

The Burslem (Staffordshire) Local Board of Health has discussed the Bill, and strong objections were expressed against what was considered the cardinal feature of the measure, by which the power of appointing school boards where there were town councils was vested in those bodies, but local boards of health were not recognised, and it was decided to memorialise the Vice-President of the Council, requesting such an amendment of the Bill as should confer upon local boards of health identical powers with those intrusted to the town councils.

With reference to the education question in Scotland, at a meeting in the Council Chamber, Edinburgh, under the presidency of the Lord Provost, resolutions were passed in favour of the Bill which passed the Commons last year, and expressing a belief that Government would have no difficulty in passing a similar measure through both Houses this session. The addition of a compulsory clause was recommended.

A meeting has been held at Glasgow, under the presidency of the Lord Provost, when it was unanimously resolved to form a branch of the National Education League in Glasgow, and to petition Parliament in favour of any Education Bill for Scotland in accordance with the League programme.

Rather a brisk correspondence has taken place in the public journals between the Rev. E. A. Abbott, of the City of London School, and the executive of the League. Mr. Abbott complains that the League have deviated from its original programme, with reference to "unsectarian" schools; this is warmly repudiated by both the chairman and secretary of the League.

CORRESPONDENCE.

MR. HOPE'S PAPER ON SEWAGE.

Sir,—Not having heard the first part of Mr. Hope's paper, on Wednesday evening last, I was not aware of his remarks as to the valuation of liquid town sewage until I saw them in the *Journal*, otherwise I should certainly have replied at the time. I say replied, for it would be mere affectation to assume the remarks in question did not refer to an article, written by me, which appeared in *Nature*, on the 23rd December last. Mr. Hope takes objection to the statement made in that article as to the practical value of the ammonia in sewage being reduced by the enormous amount of water mixed with it—10,000 times the weight of the ammonia on the average. He declares that statement to be a strange paradox "in the mouth of a chemist who, in the ordinary routine of his daily business, is perpetually called upon to put a practical money value, by means of chemical analysis, upon all kinds of artificial manures."

In making this objection, I fear Mr. Hope has been carried away by his enthusiasm for sewage irrigation, and has thus been led to forget that every chemist who has dealt with the subject of liquid sewage, emphatically pronounces the influence of the very large mass of water be that of reducing the practical value of the ammonia ow the value it has in materials containing such an amount of ammonia as guano does, for instance. In this case, ammonia is worth say 8d. per pound, but a pound of ammonia in sewage is not worth 8d., because the 10,000 pounds of water mixed with it introduces some difficulty in getting the ammonia upon the land, and a still more serious difficulty in making the ammonia remain in the land. Years ago, this fact was very clearly illustrated by Mr. Way, in his evidence before a Parliamentary Committee, and it is universally recognised by everyone who has any pretension to chemical knowledge. In my own opinion, nothing can be more prejudicial to the utilisation of sewage than a disregard of this obvious fact, which will have to be faced sooner or later. Much mischief has already been done by the disappointment consequent on exaggerated anticipations as to the value of liquid town sewage, and it would seem to me nothing should be more carefully avoided, by those who desire to see the immense aggregate value of sewage turned to some account, than giving any cause for such unfounded expectations being entertained by those who have to get rid of their sewage.

But Mr. Hope has fallen into a still more serious error; for while endeavouring to extricate himself from the puzzle in which the statement as to the value of ammonia in sewage had, as he states, involved him, he has entirely misrepresented the reasons given for that statement. It is not the obligation of applying liquid sewage to crops, or even to land, at all times of the year, that reduces the practical value of the ammonia, but it is the enormous proportion of water through which the ammonia is distributed which partially extinguishes that value. Mr. Hope's long argument in reference to an excessive application of manure to land was, therefore, quite beside the question, and had no bearing on the cardinal fact that, although the intrinsic value of ammonia may be 8d. per pound in any case, just as the intrinsic value of gold is some £4 per ounce, still, the practical value of ammonia in sewage, like the practical value of the gold in Rhine sand, is less than what it would be in a more accessible condition.

Since I entertain the hope that, ere long, some portion at least of the vast amount of material which is now wasted by the discharge of sewage, though valuable as manure, may be utilised so as to increase and cheapen the production of food, I think it the more necessary to protest against the propagation of erroneous views, especially when they are urged with the talent and plausibility which Mr. Hope commands.—I am, &c.,

Benjamin H. Paul.

March 1, 1870.

OBITUARY.

The Right Hon. Henry Unwin Addington died at his residence, in Eaton-place, on Sunday last, in his 79th year. He was for some time Envoy and Minister Plenipotentiary to the Court of Spain, and was the second son of the Right Hon. John Hiley Addington, M.P., brother of the first Viscount Sidmouth, and was born March 27, 1790. He was educated at Winchester, and entered the Foreign-office in 1807. After occupying various posts, in October, 1822, he was appointed Chargé d'Affaires at Washington, and in the January of 1826, Plenipotentiary in London for negotiating with the United States. In 1828, he became Minister at Frankfort, and in the following year, Envoy at Madrid. Under the second administration of Sir Robert Peel, he became one of the Under-Secretaries of State for Foreign Affairs, and he held that office until the March of 1854, when he retired, being then made a Privy Councillor. He married, in 1836, Eleanor Anne, eldest daughter of the late Thomas G. B. Estcourt, M.P. for Oxford University, and sister of the Right Hon. T. Sotheron-Estcourt. He was elected a member of the Society of Arts in 1861.

NEW PUBLICATIONS.

Food Journal, 8vo., 6d. (J. M. Johnson and Sons, 3, Castle-street, Holborn).—A monthly review, in magazine form, of the many and various matters relating to social and sanitary economy, and a special record of food and public health. The first two numbers include articles by authors well known in connection with the food question. Mr. Phillips Bevan is the editor.

Silk Supply Journal, 6d. (J. M. Johnson and Sons, 3, Castle-street, Holborn), is the organ for all interests connected with the silk trade and silk industry generally.

Photographic Art Journal, 4to, half-a-crown (Sampson Low, and Co., Fleet-street).—The special feature of this new journal of photography consists of the illustrations, which are examples of printing in permanent pigments. The first number contains three:—"The Return of the Flock" (after Jacque), "The Nativity" (after Albert Dürer), and "A View from Nature" (taken near La Grande Chartreuse).

GENERAL NOTES.

The number of Chinese now on the Pacific coast, in statistics furnished to the California Legislature, is given at 89,500.

Alizarine.—The manufacture of substitutes for alizarine and madder red is now being carried on upon a considerable scale by Mr. W. H. Perkin, the colours so produced being obtained from a coal-tar base.

Mr. Forster's Speech on Education has been revised by him, and published separately. It will be found to correct many misapprehensions which have been uttered respecting the operation of the proposed Bill.

Exhibition 1871.—The French Commissioner to the London Exhibition of 1871 will be M. Ozeune, Councillor of State and Under-Secretary of the Ministry of Agriculture.

Bronze Coinage.—The cost of material for the bronze coinage is less than £100 a ton; the cost of the workmanship, by contract, is about £50 a ton, and the pence are issued or sold at the price of £448 a ton; showing a profit to the State of £330,000, or equal to about £10,000 annually.

The Subterranean Canal in Naples.—*Giornale di Napoli* says:—"The subterranean canal destined to carry the waters of the Lake of Agano into the sea is now completed, being 1,400 metres in length. This work, one of the most useful of those undertaken in late years by private persons, has been accomplished, in spite of enormous material difficulties, and considerable opposition."

Art Exhibition at Cardiff.—The committee have decided to hold the above in the Drill Hall, Cardiff, in the months of August and September next, and it is intended to employ any surplus which may result in founding a public institute and museum, with the necessary class-rooms for the use of the pupils in the Science and Art Department. The South Kensington Museum will contribute largely.

Agricultural Statistics.—The Board of Trade have lately issued some items of information of rather serious import as regards the meat supplies. It seems that, in 1869, we possessed 700,000 cattle, 350,000 pigs, and 1,110,000 sheep less than we had in 1868. On the other hand, there was a considerable increase both in corn and grass crops. The number of acres under corn crops in 1869, was 7,785,033, as against 7,499,218 in 1868, while the average of the green crops was increased by 174,079, a large proportion of which consisted of peas.

A New Dock, which has been constructed in the Isle of Dogs, and which belongs to the East and West India Dock Company, has a water area of 33 acres, and will admit the largest ships.

Exports of Earthenware and China.—In the month of February, 10,803 crates of earthenware and china were exported from Liverpool, compared with 9,631 in February, 1869—increase, 1,172; and 4,969 casks, compared with 4,790—increase, 179. The total number of packages was 15,772, against 14,421, in February last year—increase, 1,351. The United States took two-thirds of the total quantity.

The Pennsylvania Oil Trade.—The statistics of the American Pennsylvania crude oil industry for the past year are now published. The total production of the year was the enormous amount of 4,215,142 barrels, being a daily average of 11,548 barrels. The production of 1868 was 3,715,741 barrels, the increase during 1869 over the previous year thus being 499,401 barrels, the increase per day being about 1,460 barrels.

French Iron Trade.—The parliamentary commission appointed to inquire into the facts connected with existing treaties have addressed circulars to the chambers of commerce and consultation chambers of arts and manufactures all over the empire, asking for lists of the industries of each locality, with memoranda of the importance of each, and for any economical and statistical information that will throw any light upon the subject.

The Utilization of Sewage.—The number of towns giving their support to the proposed investigation of the treatment and utilization of sewage by the British Association Committee is rapidly increasing, and already numbers upwards of seventy-five, Manchester heading the list with a contribution of one hundred pounds—Halifax, Plymouth, Bath, Cardiff, Exeter, Greenock, Ipswich, and Hanley, also contributing liberally; Oxford and Cambridge, with some twenty other towns, contribute smaller sums.

The Suez Canal.—The *Food Journal* says:—"The opening of the Suez Canal is likely to affect English exports and imports prejudicially in some quarters, if it has not already begun to do so. A large trade has long been transacted in Mincing-lane in high-priced teas, which, being too costly for the English market, are sent to Russia from this country. Now, however, the teas will go direct, *vià* the Suez Canal, to Galatz and the Black Sea, and thus a considerable amount of trade will be diverted from us.

Signs of the Weather.—Mr. Robert Scott, at the Royal Institution, in his last lecture on "Meteorology," said that when the clouds lie low on the hills, it is a sign of rain, for the air near the ground must be then largely saturated with moisture. Very bright, clear weather, making very distant hills plainly visible, is also a sign of rain, for when the air is dry it contains more dust and haze. As the vapour condenses, it first attaches itself to to the fine particles of dust, and by rendering them heavier causes them to sink to the ground. A fine star-light night in otherwise rainy weather is a sign that it will probably begin to rain again next morning.

Tramways.—In consequence of the whole question relating to tramways being about to be referred to a select committee of the House of Commons, all the tramway bills now before Parliament will be postponed till next session. The select committee about to be appointed will not proceed to take evidence, it is understood, till after Easter. In all, says *Engineering*, there are twenty-seven tramway companies asking for powers over 515 miles of road, with a capital of four millions. For London alone there are seven companies seeking powers over 125 miles, in some of the most important streets; while others have in contemplation systems of tramways for Manchester, Liverpool, Birmingham, Leeds, Glasgow, Portsmouth, and Plymouth.

Emigrants from England.—The following is the number of emigrants who left Liverpool during February:—United States, 25 ships, with 4,612 passengers, of whom 2,598 were English, 222 Scotch, 790 Irish, and 640 foreigners. There were three vessels to Victoria, with 72; seven to South America, with 66; two for Africa, with 21; and one for the East Indies, with 15. The total emigration for the month was 4,856, being 271 more than the previous month, but 88 less than in the corresponding month of last year.

The French Telegraph System.—*La Liberté* publishes some statistics to prove the beneficial results that have followed a reduction in the tariff for telegraphic messages. On the 1st November, 1869, the charge for an ordinary message between any two telegraph offices in France was reduced to 1fr. In December, 1868, under the old and higher scale, the number of messages sent was 330,541. In December, 1869, with the reduced tariff, the number was 495,135, or an increase of 49 per cent. The receipts in December, 1868, were 808,079fr., and in December, 1869, 825,582 fr., or an increase of 2 per cent.

Customs Revenue.—The gross amount produced by the customs duties of the United Kingdom, in the year 1869, was £22,224,203, being £469,304 less than in the preceding year; the loss by the repeal of the duty on imported corn was in itself more than equal to that amount. The customs duties on tobacco produced £6,641,985; on sugar, £5,746,192; on spirits, £4,218,656; on tea, £2,797,260; on wine, £1,512,291; on corn (up to the repeal of this duty on June 1st), £339,347; on currants, raisins, and figs, £435,228; on coffee, £363,874; on chicory, £99,367; on cocoa, £27,350. Tea and tobacco show an increase, spirits a decrease, and wine a decrease of as much as £469,000.

The Air of Monaco.—From a series of observations made at Monaco, on the shores of the Mediterranean, Dr. D'Hercourt concludes that there is always on the sea shore an atmosphere impregnated with saline particles; this layer of air has, at the above-named place, some 500 metres horizontal, and some 60 metres vertical extent. This impregnation of salt is due to what the author terms pulverisation" of the sea water by the breaking up of the surf, and is not directly influenced by either barometric pressure, hygrometric state of the atmosphere, or its temperature. This hydro-mineral dust *(poussière)*, as it is called by the author, is, unless there happen to exist near the coast physical obstacles, in the shape of high mountains carried far away inland, and is not to be confounded with what is of more coarse nature, and termed "spray," which is only quite local, and produced when a gale of wind blows. The author states that, even on calm days in winter, the atmosphere near Monaco is at least up to a height of 70 metres, and some few miles inland impregnated with this hydro-mineral dust. There is no tide (rise or fall of water) perceptible in the sea alluded to.

Exportation of Steam-Engines.—The value of the steam-engines exported from the United Kingdom in the ten months ending October 31st, last year, was computed at £1,429,499, as compared with £1,470,171 in the corresponding period of 1868, and £1,717,270 in the corresponding period of 1867. The value of the steam-engines exported to Russia was largely increased last year, having risen to £294,284, as compared with £149,618 in the corresponding period of 1868, and £65,189 in the corresponding period of 1867. While the demand for English steam-engines (in which expression, we presume, we may include "locomotives") largely increased last year in Russia, it has declined in India, in consequence of the slackening which has taken place in the work of Indian railway construction. Thus, in the ten months ending October 31st, we only sent to India steam-engines to the value of £241,496 as compared with £472,601 in the corresponding period of 1868, and £811,961 in the corresponding period of 1867. There was rather an improved demand last year for English steam-engines in Egypt and Australia, but a falling off occurred as regards France, Spain, and Brazil.

American Railways.—It appears that the addition to the railway system of the United States during the past year was 6,588 miles, a total nearly twice as large as in any previous year. The first railway in America was commenced with three miles at Quincy, Massachusetts, in 1827, and the total length is now 48,860 miles, while there are 27,507 miles projected and in progress. The State with the greatest mileage is Illinois, which figures for 7,186 miles, and is followed by Pennsylvania with 6,878, Indiana with 5,331, New York with 4,735, and Ohio with 4,613. California has already 2,307 miles, and is far above some of the older States, such as Louisiana and Mississippi. The State with the least mileage is, of course, the small one of Rhode Island, which figures only for 121 miles. This account of length of roads does not include the second tracks with which most of the leading lines are supplied, nor the sidings and turn-outs. These may be estimated at 25 per cent. of the length of road, and are being added to yearly. Adding these supplementary tracks to the tabulated mileage, the total length of equivalent single track in use is about 60,000 miles, and adding to this the equivalent for the city passenger tracks, to nearly 65,000 miles. As regards works in hand, it is stated that the new year opened with nearly 300 railroads in process of construction between Maine and California. These, it is estimated, when finished, will represent an aggregate of about 15,000 miles, and great efforts will be made to complete them all within the twelvemonth. Assuming the cost of building and equipment at 40,000 dollars per mile, the expenditure will be six hundred millions of dollars for the year 1870.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. Benjamin Paul, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light."
Social Science Assoc., 8. Mr. Joshua Williams, Q.C., "On the Real Estates Intestacy Bill." The Hon. Baron Pigott in the chair.
R. United Service Inst., 8½. Col. H. H. Maxwell, R.A., "On the Field Gun for India."
R. Geographical, 8½. 1. Capt. R. V. Hamilton, "On Morell's Voyage towards the South Pole, and on Steam Navigation in the Antarctic Seas." 2. Mr. J. W. Tayler, "On the Formation of Fiords in Greenland."
British Architects, 8.
Medical, 8. Annual Meeting.
London Inst., 4.

Tues ...Royal Inst., 3. Dr. Rolleston, "Nervous System."
Social Science Assoc., 8. Dr. W. B. Hodgson, "On Competition." (At the House of the Society of Arts, by permission.)
R. National Lifeboat Inst., 2. Annual General Meeting. (At the London Tavern.)
Civil Engineers, 8. 1. Discussion upon Mr. Fox's paper "On the San Paulo Railway;" and (time permitting) 2. Mr. Robert Briggs, "On the Conditions and the Limits which govern the proportions of Rotary Fans."
Statistical, 8. Rev. Dr. Buchanan, "On the Financial System of the Free Church of Scotland, and its Results."
Pathological, 8.
Anthropological, 8.

Wed ...Society of Arts, 8. Mr. W. Pitman, "On Surface Decoration."
Meteorological, 7.

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Sir Henry Barkly, "On the Flora and Fauna of Isle Ronde, near Mauritius." 2. Dr. Dickie, "On *Algæ* found in the N. Atlantic Ocean."
Zoological, 4.
Chemical, 8. 1. Mr. W. H. Perkin, F.R.S., "On Artificial Alizarine." 2. Dr. Divers, "On the Combination of Carbonic Anhydride with Ammonia and Water."
Royal Inst., 3. Prof. Odling, "Chemistry of Vegetable Products."
Numismatic, 7.
Royal Society Club, 6.

Fri ......Philological, 8½.
Royal Inst., 8. Mr. J. F. Bateman, "On the Subway to France."

Sat ......Royal Inst., 8. Mr. Lockyer, F.R.S., "The Sun."

Journal of the Society of Arts.

FRIDAY, MARCH 18, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at eight o'clock:—

March 23.—Adjourned discussion on Mr. W. Bridges Adams's paper "On Tramways for Streets." On this evening Chas. Hutton Gregory, Esq., will preside.

March 30.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

CONFERENCE.

The Council have decided to call a morning conference at an early date* to discuss the question of the "Relations of the State to Science, and the Necessity for Official Inquiry into the subject by Royal Commission." Col. Strange, F.R.S., will open the discussion by reading a paper on the subject. Members and their friends are invited to attend.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session, by Dr. Benjamin Paul, F.C.S., was continued on Monday last, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," The remaining lectures will be delivered on Monday evenings, the 21st, and 28th of March, at 8 o'clock.

Syllabus.

1. Nature of combustion; effects; different modes of combustion; conditions under which it takes place; evolution of heat and light attending combustion; quantitative relation of the phenomena of combustion; measurement of quantities of heat; temperature; quantity and intensity of heat.

2. Use of fuel for domestic purposes; as a source of motive power; for industrial operations not requiring intense heat, distillation, evaporation, &c., and for producing cold; varieties of fuel.

3. Use of fuel for producing very high temperatures in metallurgy, and in the working of metals, glass-making, and other industrial arts; waste gases of smelting furnaces; means of arresting combustion; extinction of fires.

4. Use of combustible materials for producing light; varieties of illuminating materials, coal-gas, petroleum, and paraffin oil; measurement of light; photometry.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

An abstract of the lectures will appear in the *Journal.*

* Notice of the day and hour, when fixed, will appear in the *Times* and other newspapers.

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum on Wednesday morning, the 27th of April. Cards will be issued shortly.

DRILL REVIEW.

The Council have the pleasure of announcing that the review of schools drill will take place in June, as stated in the *Journal*, p. 343, in the presence of his Serene Highness Prince Teck and her Royal Highness the Princess Mary of Teck.

ART-WORKMANSHIP EXHIBITION.

This Exhibition closes to-morrow, the 19th instant, preparatory to the articles being sent to the South Kensington Museum.

METROPOLITAN PUBLIC WORKS AND BUILDINGS COMMITTEE.

The Council have appointed a committee to confer with the Chief Commissioner of Public Works, the Lord Mayor of London, and the Chairman of the Metropolitan Board of Works, with the view of establishing such harmonious action between the several authorities they represent, as may prevent the creation of public or quasi-public buildings which shall disfigure the metropolis; and that the members of the Thames Embankment Committee of last year, viz.:—Lord Henry G. Lennox, M.P., Chairman of the Council; Lord de L'Isle and Dudley, Vice-Pres. of the Society; Right Hon. W. Cowper-Temple, M.P.; Lord Elcho, M.P.; Baron Meyer de Rothschild; the Hon. Auberon Herbert, M.P.; A. B. Beresford Hope, M.P.; William Boxall, R.A.; Sir William Bodkin, Assistant-Judge, Vice-Pres. of the Society; Hyde Clarke, Member of the Council; A. Baillie Cochrane; Henry Cole, C.B., Vice-Pres. of the Society; Lieut.-Col. E. F. Ducane; Sir C. W. Dilke, Bart., M.P.; Sir W. R. Drake, F.S.A.,; Lieut.-Col. Ewart, R.E.; Edwin W. Field; Alderman Sir T. Gabriel; W. H. Gregory, M.P.; C. F. Hayward; John Locke, M.P.; Right Hon. Lord John Manners, M.P.; J. E. Millais, R.A.; S. Redgrave, Vice-Pres. and Vice-Chairman of the Council; Lieut.-Col. Scott, R.E.; G. E. Street, A.R.A.; Seymour Teulon, Vice-Pres. and Vice-Chairman of the Council; Sir Charles Trevelyan, K.C.B.; Richard Westmacott, R.A.; Marquis of Westminster (Chairman of the Committee); Rev. Henry White; Sir Joseph Whitworth, Bart., Vice-Pres. of the Society; Watkyn Williams, M.P., together with Viscount Sandon, M.P., J. A. Hardcastle, M.P., and C. Buxton, M.P., be requested to serve upon it, with power to add to their number

NOTICE TO LOCAL BOARDS.

Secretaries of Local Boards are requested to notice that candidates desirous of being examined in Musical Composition, holding the Tonic Sol-fa Association Certificate of "Honorable Mention" in Musical Composition, and the Member's Certificate of "General Musical Culture," need *not* undergo the Preliminary Examination.

LIBRARY.

The following works have been presented to the Library, and the thanks of the Society have been communicated to the donors:—

Transactions of the Social Science Association at Bristol, 1869.

Life Assurance; a Lecture, by G. W. Jones.

Indian Railways, by General Sir A. Cotton, K.C.S.I.

Means of Screw Ship Steerage, &c., by Rear-Admiral E. A. Inglefield, C.B., F.R.S.

Extracts from the Information received by His Majesty's Commissioners as to the Administration and Operation of the Poor Laws, 1837.

Memorandum on the Merchant Shipping Code, 1870, by T. H. Farrer.

Chemin de Fer de l'Etat. Tarifs pour le Transport de Voyages and Compte Rendu des Operations, 1868, Postes-Telegraphes.

Annales de l'Association Internationale pour le Progrès des Sciences Sociales. 7 vols.

Year Book of Canada, 1870.

First Book of the Middle-class Examiner, containing 100 Examination Papers, by W. McLeod, F.R.G.S.

Description of the Roman Tesselated Pavement found in Bucklersbury, by John Edward Price, 1870. Presented by the Library Committee of the Corporation of London.

The following work has been bought and added to the Library:—

Paris, ses Organes, ses Fonctions, et la Vie, dans la seconde moitié de xix^me. Siècle, par Maxime du Camp.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

FIFTEENTH ORDINARY MEETING.

Wednesday, March 16th, 1870; Professor T. Hayter Lewis, F.S.A., in the chair.

The following candidates were proposed for election as members of the Society:—

Bishop, Alfred, 17, Speck's-fields, Mile-end New-town, E.
Cotton, F. L., 29, Gracechurch-street, E.C.
Dalziel, W., Creek-bridge Copper Works, Creek-road, Deptford, S.E.
Davenport, E. G., 18, Gloucester-crescent, N.W.
Davey, Arthur Stevens, 59, Queensborough-terrace, Kensington-gardens, W.
Harris, E. Henry, 14, Devonshire-square, E.
Lamport, Chas., Clarendon-house, Upper Norwood, S.E.
Medd, Henry, 7, Alfred-place, Bedford-square, W.C.
Mitchell, Joseph, 66, Wimpole-street, W.
Phillips, Stephen S., 10, Baker-street, Portman-sq., W.
Smith, William Bickford, J.P., Camborne, Cornwall.
Vavasour, William, Hazlewood Castle, Tadcaster, York.

The following candidates were balloted for, and duly elected members of the Society:—

Allan, George, C.E., 18, Leadenhall-street, E.C.
Clark, Frederick A., Hammersmith-mall, W.
Cubitt, James, 26, Finsbury-place, E.C.
Dickinson, Sebastian Stewart, M.P., 12, Suffolk-street, Pall-mall, S.W., and Brown's-hill, Stroud, Dorset.
Frielinghaus, Charles, 2, Lawrence-lane, Cheapside, E.C.
Gream, G. T., M.D., 2, Upper Brook-street, W.
Holm, John, F.R.C.S. Edin., Lifford-lodge, Barnsbury-park, N.W.
Morgan, Robert, C.E., 8, Richmond-ter., Whitehall, S.W.
Tasker, Wm. Henry, 4, Telford-st., Bradford, Yorkshire.

The Paper read was—

ON SURFACE DECORATION.

By William Pitman, Esq.

By the kind permission of the Council of this Society, I intend this evening to read a paper which I hope will interest you, upon a subject which has engaged my attention many years, and which is really an inexhaustible subject, namely, "Surface Decoration."

So much attention has been paid, and so much skill has been employed in producing copies of nearly every kind of work; so many prizes have been awarded in this room and elsewhere in abundance, that I think it well occasionally to look around and see what success has attended so much labour, and what advance towards perfection has been attained. It is not an easy task to confine oneself to one subject, but I propose to describe a few modes of treatment, which to me seem correct for decorating ceilings, walls, windows, and floors, to which I beg your indulgent attention.

In the first place, I remark, in all cases we should not only allow, but invoke, the aid of Nature to assist us, carefully studying her varied beauty of form, her richest luxuriance of colour. We cannot exhaust her treasures by the most diligent research or careful study, and the more we examine her beauties the more we shall be lost in amazement, but we shall find that nothing natural, either in form or colour, can ever be positively ugly or incorrect. There are many objects we individually like and dislike, but it is quite possible that as the colours we think most beautiful are unseen by one who is colour blind (and there are many such), so natural forms we dislike exceedingly may be highly appreciated by others, who see great beauty in them; some of you, I have no doubt, take as much care of your specimens of ferns as others of the choicest roses.

Ceilings.

The decoration of ceilings appears in the present day to receive but little attention; they are too often apparently forgotten. The floor is covered with the softest carpet, glowing with colour; the walls hung with richness and ornamented with pictures and mirrors; the windows festooned with brocade, and the ceiling but too often looks like a white sheet, covering up the whole, to keep the dust from the furniture. Formerly, ceilings received a great amount of consideration, some beautiful examples of which still remain. Many of the Italian palaces contain ceilings which were painted by the first masters of the day; noble productions, bold, effective drawing, and with glowing richest colouring, worthy of being visited and admired now, after more than two or three centuries have passed. The ceiling of the Chapel Royal, St. James', was a proud effort of Holbein's skill, which he painted in 1540, and which was admirably restored by Sir Robert Smirke about 30 years since. In Paris we find many grand ceilings, especially in the church of the patron, Saint Genevieve, which was begun by Monsiour Gros, by order of the Emperor Napoleon, in 1813. It was afterwards finished, with

certain alterations, to suit the Bourbon dynasty. I shall not easily forget the effect it had upon me; the clever arrangement, the excellent colouring, the magnificent scale of the work, the surface covering a space of 3,256 square feet, combined with the vast area of the building, create an impression not easily effaced. The artist had £4,000 for his work, and was created a peer of France by Charles X., to show his appreciation of the merits of this great artist. Here in London, upon the dome of our metropolitan cathedral of Saint Paul's, for the admiration of our foreign visitors, we have a make-believe arcade, with sham architectural features, mouldings, cornices, pilasters, balusters, niches and figures, painted in sham-shadow colours. Is it possible that our artists can ever hope to be created peers of the realm if they only receive such commissions as these?

Many beautiful old ceilings are coved and formed in panels, generally a large centre, perhaps a circle, or an oval, surrounded by smaller compartments, enriched mouldings framing the whole work; the surface of the panels filled in with scroll work of different designs, either modelled separately or worked in fine plaster on the ceiling itself (a method I should very much like to see carried out again), forming its own light and shade, and, when enriched with colour and gold, cannot be surpassed. The beauty of the arrangement and colouring, by Mr. Owen Jones, of the stalactite roof in the Alhambra-court, at Sydenham, was very great, and I extremely regret its loss, through its unfortunate destruction by fire, a year or two since.

One of the best stucco ceilings I recollect, is the ceiling of the staircase leading to the picture-gallery at Wentworth-castle, Yorkshire; a good plain example is the ceiling of the great hall of St. Bartholomew's Hospital, in Smithfield; and one of the best painted ceilings is the beautifully designed and painted nave of Ely Cathedral, by the late Mr. Le Strange and Mr. Gambier Parry.

The thanks of every lover of colour are due to Mr. Sidney Smirke and Mr. Willement for designing, and the Benchers of the Temple for their liberality, in allowing the design to be carried out so successfully upon the ceiling of the Temple Church. It was the wonder of my early days, and is still a treasured delight. I have ever considered it a great step in advance, and after all that has been done in this great city, until the recent decoration of the staircase of the Foreign-office and St. Stephen's Crypt, at Westminster, I cannot refer you to anything better.

Flat ceilings should always be a shade of silver grey or blue, more or less warm or intense in colour as the size of the room or use of the building should suggest, which may be ornamented with shades of the same colour, or white, or red, or gold. Look at nature. Mr. Crace has told us, in this room, "she never errs." Her harmony is always beautiful, "ever perfect." The canopy of nature, the sky, is always of that tint, sometimes very pale, sometimes intensely blue, sometimes ornamented with soft tinted clouds, appearing like floating silver, sometimes sprinkled with myriads of stars, and sometimes literally blazing with glowing tints of vermillion and gold. Mr. Colling tells us that ceilings should appear "light and elegant, anything that is agreeable, so long as it is kept light, rather than the ordinary and vulgar whitewash." He says:—"Our whitewashed ceilings are a remnant of barbarism, handed down to us from our Puritan Fathers, the same who were so fond of beautifying our churches with their indefatigable whitewash brush." Blue is always best used as a ground colour. It seldom looks well in lines or small objects. We are so accustomed to see it in such quantity in nature in the sky above us that it seems scarcely to be sufficiently represented to look proper when in small objects. How very rarely do we see a perfectly blue flower. Red, on the contrary, should never be the predominant colour. It should be used sparingly upon surface, or diapered with dark colour or gold. It may be most successfully used in lines and back grounds of enrichments, and is always a pleasing addition.

Great effect is produced and good taste displayed by enrichment with contrasting colours and gold, but treating the whole as a flat surface, never, under any consideration, painting ornament in shadow colour to appear as relief. Simple lines and stencilled ornaments are sufficient modes of decorating any flat ceiling, and by properly modulating rich colours, the whole work may be decorated satisfactorily, and exhibit good taste, too. At Addington, the seat of Mr. Hubbard, the ceilings have been decorated, under the direction of Mr. Owen Jones, in this manner with great success.

Walls.

I will now direct your attention to wall decoration. As the surface in most apartments is considerable, and meets the eye on every side, I think it worthy more consideration than it seems to receive; and that its adornment is seldom cared for as much as it should be. We will suppose a case. You have built or purchased your house; then you think of its decoration. You perhaps go to your decorator without your architect, or perhaps without even seeking his advice upon the matter. You see an immense variety of decoration, hangings, and paper patterns—every colour, every style—in such mingled variety and mixing of form, that you get tired, and say, perhaps, "I will have this or that," the consequence being, too often, your choice is unsuitable. Probably you choose a brown and gold paper for the dining-room, where everything should be rich and exhilarating; grey or white and gold, with some exquisitely-drawn device, for the drawing-room; perhaps a green chintz for a bedroom with north aspect, a pink diaper for one facing south; and, to crown all, a most bilious-looking marbled paper for the whole of the surface of the entrance-hall and staircase, from top to bottom of the house *ad nauseam*, and there the matter ends. But, now, is it not too often unsatisfactory? The dining-room walls look as if covered with brown paper, similar to what you lay under the carpets, with a stray leaf or two of gold here and there, which appears to have blown in at the window, and adhered by accident upon the wall. The drawing-room walls look cold—no colour, no effect in them; and the elegant object which looked so well in the hand, is quite lost upon the surface of the wall. Perhaps you have it covered with another. If you do not, you are sure to say, "Well, I will certainly choose a different kind of pattern next time." The bedrooms, too, are unsatisfactory; and the staircase a monstrous sham. You get an effect, more or less, of marble for £20 or £40 upon a surface which would cost forty times that amount, if only cased with marble half-an-inch thick; besides which, marble is unsuitable to our cold climate. And who would choose a yellow marbled paper for a good house, when you may see it in every brick house built in the outskirts of this city which is let for £40 per annum.

Many of the old patterns which were prepared for staircase walls, a few years since, were in imitation of Gothic traceried windows, with a perspective aisle leading, perhaps, to a cowshed, or opening to a beautiful river view, with a man or two in a boat fishing, and sometimes swans swimming proudly along; sometimes representations of blocks of granite with chamfered edges, and real sparkling glass introduced for effect. In bad taste, as they certainly were, I equally deplore the lack of taste exhibited almost always in choosing yellow marbled paper now.

The walls of the staircase, if divided into panels and decorated with different colour marbles and inlay patterns of geometrical arrangement, may look well; but certainly not in such quantities of one colour as is generally seen. Staircase walls, if painted a light grey, either in encaustic or distemper, and ornamented with some simple stencilled device in marone, would look well, and be quite

a foil to the richer decorations of the rooms. Where paper is used, any simple pattern, not too often repeated, printed in chocolate or self-colour, dark, on any light ground, would, in my opinion, be much better than any imitation of marble could possibly be, and, if desired, could be as easily prepared and varnished as marbled paper.

Let us now consider a few of the modes in which walls were formerly decorated, and perhaps ideas may be suggested which may be of advantage to us now.

In the history of the ancient palace of Westminster, by Smith, we are told that in the thirteenth century, in the reign of the patron of art, Henry III., "it was decorated in high perfection; in one chamber all the warlike histories of the whole Bible are painted with inexpressible skill, and explained by a regular and complete series of texts, written in French over each battle, to the no small admiration of the beholder, and the increase of royal magnificence."

About 1312, Langton, Bishop of Lichfield, commanded the coronation, marriage, wars, and funeral of his patron, King Edward I., to be painted in the great hall of his episcopal palace, which he newly built. Fanciful devices, many a holy text and saintly legend, with various sentences, emblems, and mottoes, which gave opportunity to the artist to display his skill and exercise his wit, we see in the remains of this kind of decoration, wherever it is found, and in later times the arms of the sovereign, and the armorial bearings of the family, and other loyal emblems were often grouped with good taste, producing a rich effect.

Tapestry, the most comfortable kind of wall decoration, was introduced into England, as furniture hangings, by Eleanor of Castile. Previously, needlework tapestry had only been used for vestments, and for the decoration of the sanctuary, no doubt a continuance of the vail in the Holy of Holies in the Hebrew Temple, or for special decoration on festive occasions. It was woven at Arras, in the fourteenth century, and, from its superior comfort, soon became a formidable rival to wall decoration by the pencil. Miss Strickland tells us of Eleanor—"The coldness of our climate must have made it (tapestry) indispensable to the fair daughter of the South, chilled with the damp stone walls of English halls and chambers."

In 1586, the unfortunately-beautiful Mary Queen of Scots describes her miserable residence (*vide* "Raumer's Contribution"). She says:—"The walls surrounding the house are so high, neither the sun nor fresh air could penetrate it. The damp, however, is so great that every article is covered with mouldiness in tho space of four days. I have for my own accommodation only wretched little rooms, and so cold, that were it not for the protection of the curtains and tapestries which I have had put up, I could not endure it by day, and still less by night."

Tapestry hangings did not remain on the walls as modern hangings do now; they were carried from place to place as they might be required, by the groom of the chambers attending a royal progress, and often, by their want of judgment in arrangement, causing many ridiculous blunders to arise.

I have no doubt that in consequence of the comfort and easy manner of decorating walls with tapestry hangings, the artists of the day gave more particular attention to the decoration of ceilings, as many magnificent ceilings are still to be seen, but accompanied by bare walls.

Excuse me if, in passing, I remark that, at the present time, in some of the cottages in France, the paper-hangings are cut into requisite lengths, and fastened to the wall with tin-tacks, not pasted on, so that should the owner remove elsewhere, they can be taken down and removed with the other furniture.

I often wonder that curtains are not now more often used upon walls, as they produce such a rich effect, and can be so easily taken down and cleaned. I have seen them used a few times with the most satisfactory results; pictures can be hung against curtains with the greatest ease, and they form a capital background.

The nearest approach to the old style of tapestry in the present day is occasionally seen in rooms where wall-panels are formed in wood skeleton-framing, and covered with rich silk, either divided by another colour silk, framed with gilding, or with arabesque painted pilasters, at suitable distances, according to the size or use of the room.

A beautiful piece of mediæval embroidery, representing scenes in the life of St. Martin, belonging to the Worshipful Company of Vintners, and kept usually at their hall in Thames-street, is an excellent example of that class of read-work, and in good condition.

Leather has ever been a favourite material for decoration, and especially appropriate for hanging in palaces and large mansions. It affords infinite scope for representing foliage, scroll ornament, flowers, and heraldic devices, of elegant design and good workmanship; capable of receiving sufficient relief in any style to be easily followed by a good colourist and gilder. Spain, Italy, and Flanders, centuries ago, manufactured gorgeous leather tapestries. Later, Germany, France, and especially England, held the first place in its production. The durability of the material, the distinctness of the embossed pattern, the brilliant colouring, the brightness of the gold and silver, capable of receiving the highest burnishing, has made it a favourite in all ages, for we see it from Egypt in the British Museum two or three thousand years old. It was in the Hall of the Lions in the gorgeous Alhambra; and nearer home many chambers are decorated with excellent effect in all the original brightness and beauty. I saw a staircase at Oxburgh-hall, the seat of Sir Henry Bedingfield, a few years since, in which all the panelling was filled in with old leather, the flowers and ornaments of which had been entirely repainted and gilded; the wood mouldings were painted black and marone and gold, and the whole effect very rich. I do not like it for frieze or moulding ornamentation in imitations of relief. I am heartily glad that the fashion of covering brackets, legs of tables, picture-frames, &c., with leather flowers and leaves has exploded, together with potechomaine and other foolish, useless occupations, which were nothing more nor less than an absolute waste of time. Leather is the only material except china which I like to see ornamented with representations of natural flowers in proper colours. It seems appropriate for rich surface decoration, and especially for Elizabethan or Rennaissance panelling.

Surface decoration by painting in fresco appears to have been coeval with architecture itself, and is a splendid mode of decorating large edifices. All data concur in proving that some of the Egyptian frescoes must have been painted two thousand years before the Christian era, yet they retain the brightness and freshness of tone they received from the painter's hand.

We are informed by Pliny and other writers that the greatest painters in Greece were engaged in painting in fresco upon the walls of their public edifices. In the Royal Museum in Paris is preserved one of these pictures painted upon a gold ground, representing Apollo and Marsyas.

The Roman people, cultivating nothing so much as the art of war, looked but indifferently upon tho arts, considering them as mere decorative occupations, and when Roman conquerors dragged the captive Greeks at their chariot wheels to serve them in ornamenting Italian cities, they were looked down upon by their military masters, and regarded merely in the light of mechanics, the result being a decay of the good taste and simplicity which the Greek painter had perhaps perfected; and gaudy colouring, mosiacs and gilding in profusion displaced intellectual beauty, grace, truth of nature, and experience. In the time of Augustus Cæsar the love of variety and the desire for extraordinary things led many of tho wealthy to prefer the glowing fanciful richness of Indian manufactures to the simply

elegant subjects of the Greek artists; and the vulgar love of display gave occasion to Apelles to observe to one of his pupils, who had painted "Helen" bedecked with jewellery, "O, young man," said he, "not being capable of making the lady handsome, you have made her rich."

It appears by research that in the dry climate of the land of Egypt, the liquid employed in fresco painting was a finely-prepared size, formed of eggs carefully beaten together and blended with vinegar, forming a substance, when properly made, which appears to have been impervious to atmospheric changes, and only yielding to actual violence.

In Italy and elsewhere lathed ceilings are admirable for the preservation of frescoes; good brickwork seems the best foundation for wall surface, but rubble walls have proved to be the very worst, they are so liable to be bulged and uneven. The frescoes which have been painted upon plastered surface, where the proportion of lime has been about one-third and river sand two-thirds, last better than any other. But whatever the construction of the ceiling or wall may be, the immediate surface for painting the picture must be plaster or stucco, and the greatest care must be taken in preparing it.

In Florence the artists are of opinion that the lime used for the paintings should, after the most careful mixing, be kept in a moist state twelvemonths, that it may not burn the colour or the brushes.

The yellow colours used are ochre, Naples yellow, terra di sienna. Reds: burnt ochre, burnt sienna, and all the oxides of iron, from orange to violet. Blue, the only brilliant colour in fresco: ultramarine and cobalt. Brown: umbers and burnt terra verte. Purple: burnt vitriol. Green: chrome green, Verona green, and terra verte. Black: charcoal black and lamp black. These colours have been well tested, and for the most part admit of being mixed in any reasonable way.

The best frescoes in London are certainly the beautifully-painted, richly-coloured figures, by the late William Dyce, at All Saints' Church, Margaret-street; and I regret they are so far from the eye that they are not easily seen. Mr. Armitage deserves great praise for the excellent drawing of the figures in one of the side chapels in St. John's Church, Islington; and the soft, delicately-tinted colouring being near the eye, is a great success.

Although there has been so much fault found, and so much said about the fading of the fresco in the Great Hall of Lincoln's-inn, if it was carefully dusted and cleaned with bread, and afterwards washed over two or three times with new milk, it would look as fresh and well as ever, unless there should be found a mouldy efflorescence, owing to the presence of saltpetre in the walls, which is little to be feared, as it is a great height from the ground. Carlo Maratti once cleaned the frescoes of the Vatican with the light wine of the country, and restored them very well.

Smoke has been described as a cause of ruin to frescoes, but its effects have been and can be removed. Damp is by far their greatest enemy; it sometimes ascends through the wall from the soil, or descends from dilapidated or ill-constructed roofs. Of course, the greatest care is requisite to be taken of them. As Mr. Wilson informs us, "Many fine works, even by Raffaelle, in the Vatican and in some of the churches and cloisters have been irretrievably injured by the populace in wanton mischief." In the Church of St. Maurizio, Milan, some of Luini's finest frescoes would be in excellent condition had it not been for such wantonness, for the barbarous hand of man has scraped off the blue colour for the value of the ultramarine, and the gold also with which parts were heightened.

In very early times we have abundant evidence of the extensive employment of encaustic painting. Pliny says of it, "We employ wax as a vehicle of painting, not only from the beauty it gives to the pictures painted with it, but also because it is a preservative of the walls which it adorns." Plutarch highly praises it. He says, "Even time cannot efface it."

Many who thoroughly inquired into these matters are of opinion that the greater part of the mural paintings discovered in the catacombs, Pompeii, Herculaneum, &c., have been encaustics, although there are counter opinions, concluding them to be in distemper). Many authors mention this process of art, and although it does not appear that it has been practised here until very recently, it seems more fitting to our climate than any other kind of painting. I hope to see some magnificent pictures painted in encaustic, even in our neglected St. Paul's Cathedral. The method is very simple. Pure wax, broken or cut into small pieces, and put into a glass vessel filled about half full, upon which must be poured spirits of turpentine and oil of lavender, with a little gum mastic. When all is thoroughly dissolved, a clear liquid is formed, which should be carefully drawn off into a large-mouthed stoppered glass bottle, lest evaporation should arise and render the liquid too thick for use. Vitruvius advises the addition of a little pale linseed oil. This preparation should be kept in a warm place, and is quite ready for saturating the wall, or of mixing the colour for painting. The artist must next provide a portable grate for heating the surface of the wall to about 100 degrees, then applying the liquid preparation of wax to the surface of the wall, with large brushes, until the absorbing power ceases, shifting his heating apparatus to the next portion, and so on. A good white ground work is then to be painted in rather full body, mixed with the same preparation of wax, and when this grounding is sufficiently firm the picture may be painted. It is especially worthy of notice that all the colours used in oil painting may be employed in encaustic. When the whole work is completed it should be coated with varnish, composed of wax mastic and liquid bitumen. When sufficiently dried, the surface is heated again, and the whole sudorizes together, the varnish coating the picture itself, the ground on which it is painted, and the first preparation on the wall, which forms on cooling a combined body of these substances. This work is luminous, but not glossy, finely transparent, although so solidly painted, and is a brilliant and almost imperishable work of art, which seems especially adapted for historical paintings and surface decoration, on either a large or small scale, as it does not confine the artist in the same manner as fresco, but allows him opportunity of retouching and shadowing freely, after the work has been left partly finished, without showing any disadvantage, it seems fitting for any work requiring the freest use of the pencil.

Damp or fire is the only enemy to encaustic; negligence, of course, will sometimes cause the destruction of the finest work of any kind. The paintings on the vaulted ceilings in the library of Sienna were ruined by some working men who mixed mortar above them.

Mosaic painting, as it was called in the reign of Constantine, when Byzantine decoration was at its height, must have been very gorgeous; being often upon gold ground work, and the ornamentation being composed of small cubes, it sparkled with great brilliancy. There were two descriptions, namely, "opus tessalatum" and "opus sectile." In the first, coloured glass was chiefly used; in the second, marble only, which was cut into the form required by the pattern. Its greatest merit is its durability, and from the nature of the work could better be executed by a skilful experienced hand in following set lines and given ornament, rather than designing original composition. It has been cleverly revived not long since, and no doubt will be more extensively used. I cannot say that I am particularly charmed with it, perhaps because I have seen but little; but mosaic must ever be in comparison to encaustic painting as the best executed scagliola is to real marble; it may be the exact colour, the exact imitation of vein and carefully polished surface; the real marble shades and glistens as the rays

of light fall upon or through it, and the least stroke of the pencil in painting shows the play of the hand or the instant idea of the painter; but as the scagliola lacks the life of the marble, so the mosaic, from the fact of its mechanical construction, possesses but little intellectual charm and lacks the instant finish and effect produced by encaustic painting.

Paperhangings are the most prominent wall decoration in our day, and, since so much has been said about them, and the question of style has been so often discussed, I will only refer slightly to them. It was the fashion, before manufacturers were relieved from the duty upon paper, to paste sheets of paper together (after the excise duty had been stamped on each sheet) into lengths of 12 yards; afterwards it was ground-coloured, and then printed upon with blocks. The piece upon the wall, grey, with a white trellis and green sprig, is a specimen of the method of making up the pieces of paper and also of the style of pattern then considered in good taste; it is about 45 years old.

Stencilling, a method of decoration either in oil, colour, or distemper, was then also much in fashion. It was one of the most cleanly methods of decoration, especially for bedrooms, I ever saw. The walls were coloured the preferred ground, and then the patterns, which were cut out with a penknife in painted vellum or oiled drawing-paper, were rubbed over with brushes of flattened surface, dipped into the desired tints of colour, and when dry looked exceedingly well if carefully executed. The old patterns marked are a few which were made for showing, for selection and choice of pattern and colour, more than thirty years ago. I have carefully kept them *in memoriam*. At this time good patterns, in the hands of a judicious, careful man, may be used for some of the best kind of flat decoration, although paper is so general. Walls always look well in tints of green, olive, and grey; and drab or fawn colours, if diapered with green, red, marone, and gold, have generally a good effect.

Impressed gold papers, printed with finely-engraved brass dies, have been lately introduced, and for workmanship cannot be surpassed. The patterns shown are good examples; the great reason being, apart from their richness, there is no attempt at shadow, which should always be avoided. The ground colours are laid in a careful and superior manner, and soft good effect is obtained. The specimens of flock paper are the reverse of the impressed gold, for as in one case the gold leaf is pressed by a warm cylinder into the ground colour of the paper, so the relief effect accompanied by real shadow is produced by printing the block in flocking size and flocking the same, repeating each process several times until the desired relief is formed. The pattern is then in relief in white flock upon a sized white paper ground, as you see in the lower part of one of the painted specimens. It is very easily applied to the wall, and especially suitable for panel decoration; it may be finished after being sized with ordinary glue size, and one coat of paint to prevent absorption in any tint of distemper colour, or finished in paint, and relieved with colour and gold according to taste, finished as the style of the room or staircase may require. The newest French paperhanging patterns are raised in relief, and some have edging of gold as embroidery, producing the exact effect of appliqué work. Several good examples are before you, also embossed thick paper in imitation of old leather, and which produces similar effect.

The late Mr. Pugin, Owen Jones, and others have raised paperhangings to a pre-eminence in England. Any person with good taste may easily select patterns appropriate to every kind of room. I think our manufacturers are not behind any country in this particular. We must now educate the working men, get them to study nature; and those who set the working patterns should remember the lines in Thompson's "Spring":—

> ——"Who can paint like nature?
> Can imagination boast,
> Amid his gay creation forms like these?
> And can he mix them with that matchless skill,
> And lay them on so delicately fine,
> And lose them in each other, as appears
> In every bud that blows?"

Look at the beautiful colouring of nature, so bright, so bold, so sensitively soft, so freely distributed, yet charmingly adjusted, the groundwork always judicious in tint, it heightens the lustre of all above it. Look at the beautiful tints upon the rocks. Every shade of gray and golden green, red, and purple, and black; beautiful heather, and shining golden gorse; blue and gray marl; a mingling of such gorgeous colour that cannot be surpassed.

Mr. Crace arranged his idea of harmonious colouring for a certain occasion, in the following manner (and he will, I am sure, pardon me for mentioning it here, for they should be printed up in every workshop, as references):—

1. Black and warm brown.
2. Violet and pale green.
3. Violet and light rose-colour.
4. Deep blue and golden brown.
5. Chocolate and bright brown.
6. Deep red and gray.
7. Marone and warm green.
8. Deep blue and pink.
9. Chocolate and pea green.
10. Marone and deep blue.
11. Claret and buff.
12. Black and warm green.

Our rooms should always be bright and cheerful; they should never be painted or papered dark or dull. The climate is mild but changeable, and so much of the year dull and cold, that we should always remember it when choosing our colour for their decoration.

Windows.

Windows are the subject of our next division. As it is of the greatest importance in most houses they should be easily opened, they should be lightly ornamented with drapery; instead of covering up half the window, as it often does, it should be so arranged that the air and ventilation should not be interfered with.

A window glazed with ground glass is almost always unsatisfactory. The vitrified surface being removed, the smoke and dust discolours it, and makes it difficult to be kept clean. White enamelled glass, having a semi-opaque figure upon a transparent ground, is more satisfactory. If the windows of a dining-room were filled with clear light pink glass, the effect of the room would always be pleasant and comfortable. The greatest care should be taken to avoid introducing dark colours, unless in the top or bottom division of the window, where heraldic devices and armorial bearings will look well, and greatly enrich the appearance of the room.

The art of painting glass is one of the most simple; it only requires a good draughtsman, and a good taste for arrangement of colour, for the best windows are those where glass is used which has been coloured in the manufacture. The glass requires to be carefully outlined and shaded by one process or another, according to the method of the painter, which, when leaded and finished, cannot be surpassed for effect. There is as much difference between real coloured glass windows and enamel painted windows as there is between real gems and paste stones.

The Munich painted glass at Peterhouse, Cambridge, which cost £5 per foot, looks very beautiful. I remember the pleasing effect of the window representing "Peter and John at the Beautiful Gate." The door is represented partly open, showing the lamps, which are lighted; and as the sun was shining through the glass, it had the exact effect of the flicker of the flame.

When glass is stained by enamel colour, it must in time wear off the vitrified surface. One of the beautiful windows at Mr. Beresford Hope's church, at Killdown,

in Kent, is spoiled in consequence of some of the colour peeling off; and the whole of the windows I have seen painted in enamel, although soft and beautiful, appear like the best kind of transparent pictures painted upon silk.

I have two or three pieces of old glass, which were originally in a chapel at Islington, which was stained on the surface, and much of it is obliterated. In the staircase at Apothecaries' - hall, Blackfriars, there are two or three parts of windows where the colours are entirely lost, in several places the yellow stain and the brown shadows alone remaining.

Flemish windows, although coarse in comparison, present the effect of the brightest, richest, sparkling gems. In the window of the chapel at Hatfield-house the colours are as bright as emeralds, sapphires, and rubies.

I fear to exhaust your patience if more is said at presant about stained glass, as it is so intimately connected with church decoration, which is well worth an evening's consideration alone.

The window cornices and curtains should always be light and elegant, the material being of the least consequence, sometimes velvet and lace, sometimes brocade or damask, and sometimes chintz. Fringes and tassels cannot be too light and fanciful, and seldom too often repeated. The old netted tassels, made of an infinite number of tufts and knots, look much better than a large wood top, covered with silk threads and bullion fringe ends, of the present fashion. A careful, clever upholsterer, with good taste, having a fringed vallance, a few yards of cord, and a dozen tassels, can make almost any window look elegant.

Where there are two or more windows in the side of a room, by all means put silvered plate-glass just above the floor to the level of the lath of the window cornice. It is the most effective ornamentation. In small square rooms narrow glasses set across the angles of the room increase the effect of the windows greatly.

Floors.

Time would fail me to tell you of the various ways in which floors are decorated. Since the days of Queen Elizabeth we have certainly advanced, for her floor was covered with rushes, rather an inconvenient mode of decoration we should think now. The incised marble of the 14th century, in which the pattern is drilled and cut out with a chisel, and then filled in with lead, we may see restored, in some degree, in the new floor of the Guildhall. The beautiful inlaid marble and mosaic round the shrine of St. Thomas à Becket is still partly to be seen at Canterbury Cathedral. The cold, comfortless effect of the combination of white and black squares, or lozenges of marble, is still in many an entrance hall, and in churches and public buildings. The revived manufacture of encaustic tiles has given an appearance of warmth and finished effect to hundreds of chancels in new and old churches, and when the patterns are well chosen, and not too often repeated, they have very good effect. A few good patterns are preserved at Tintern Abbey, many at Malvern, a few at St. Alban's and elsewhere, but the new ones are perfectly correct, and, as far as the manufacture of them is concerned, they appear better than the originals.

Wood floors, laid in geometrical patterns and polished with wax, look very well, but I think nothing looks better or feels more comfortable than an Eastern-pattern carpet, laid in the middle of the floor, with a parquet bordering round the rest part of the room. Carpet should never be cut into all sorts of shapes, or the edges to fit close to the skirting; it wastes material, and is a great cause of the accumulation of dirt and dust. When parquet is not used, the floor can be stained and waxed-polished, and the effect is very good. Care should be taken in choosing the carpet to have suitable colours, and a proper flat horizontal pattern. It is rather astonishing to see such absurd carpet patterns continually, when so much has been said about them. Some manufacturers give us for a hearthrug a border of natural flowers, with a lion in the centre. Who would put their baby on it I should like to know. Another will give us a brace of pointers; another, a design of water lilies, and imitation of real water. Think of sitting near the dining-room fire with your feet in cold water. The carpets are sometimes a floral ground with sprigs of roses, shaded like life with stems and leaves, thorns and all. I have not yet seen thistles and nettles designed for carpets, but I do not despair. We often see imitation ribbon tied in true-lovers' knots, and bows, and ends, which are suggestive of catching one's toes and tripping up. Sometimes imitation mouldings in high relief, formed in lozenges, squares, and panelling, like an inverted oak ceiling, really painful and apparently hazardous to walk on. The patterns of most of the Turkey carpets, the Scinde rugs, and Persian carpets, are the very best, because suitable for their position. They would only look like carpeting, place them where you may. Our carpets may be strained over a ceiling for panelling, and many patterns, being vertical, would suit a wall. But it is not so with an Eastern carpet; it is a carpet, and you could not use it for anything else. The small squares of the most beautiful colours will not suffer in imagination by being stepped on; they seem solid, and designed for the purpose; but who would willingly step on natural roses or bunches of ribbon? The carpet before you is a good specimen of a Persian pattern, woven as an English Axminster in one piece, bordered to suit the room. Carpets should always be rich in colour, bright in effect, and gem-like in pattern. Where these things are remembered, and the articles manufactured are exhibited in good windows, buyers will purchase them, if their taste is directed a little by the seller.

We must educate the working classes, that they may be not only working men, as too many of them are, but workmen. Get them to study nature, observe her beauty, think, take interest in the cost of producing their work as well as in its finish. I think it is better for a government to assist in providing scientific education of every kind, that men may be skilful in their work, that orders may not be sent to foreign markets for manufacture, than for them to allow the working classes to be listless and indifferent to the ruin of commerce, reducing the quantity of labour, which causes poverty and distress, and ultimately to provide funds for their emigration. It is making matters worse by allowing the sinews and strength of the country to pass away. Professor Ruskin tells us ("Taste," page 174) "It is nothing to give food and medicine to the workman who has broken his arm, or to the decrepid woman wasting in sickness," it is an every day duty. "But it is something to use your time and strength to war with the waywardness and thoughtlessness of mankind, to keep the erring workman in your employ until you have made him an unerring one." I think these words, which are full of truth, will equally apply to a government as to individuals, and if you are more actively assisting and increasing the number of those who take great interest in technical education, which will, I believe, cause workmen, employers, and patrons to be a mutual assistance and comfort to each other, I shall be quite pleased at the reception of my paper upon surface decoration.

DISCUSSION.

Mr. Hyde Clarke said he had long since been engaged in these matters, and had had the opportunity of studying on the spot some of those influences which affected Eastern art and Eastern manufactures. With regard to the paper which had been read, he could not but regard it as a sign of progress, coming as it did from a practical decorator, well able to deal with the subject, and following the utterances of such men as he had heard years

ago upon this subject, when public attention was less given to it, and when it was more necessary to raise the voice of warning and to give counsel than now. In those days it was very difficult to obtain an enthusiastic and appreciative audience such as Mr. Pitman had that evening. To those gentlemen who had taken part in the subject before, it must be a matter of great congratulation to see the progress which had been made in the last thirty years, and especially so because it was a progress from below rather than from above. When the subject was first taken up it was very difficult to obtain English workmen to carry out the plans, and great service had been rendered by artistic decorators and art manufacturers in having endowed the country with skilled workmen, thus making England independent of the Continent. At the period when this agitation began it was well known that artists were not deficient in genius or ability, for, considering the power which English artists possessed of dealing with nature and colour, and their proficiency in landscapes and in the figure, it was evident that they had amongst them the elements of the highest excellence. He need only refer to two men, very dissimilar in their mode of treatment, Flaxman and Etty—men who stood almost alone. But it must not be forgotten how much they had still to do. By the destruction of the old School of Art in the period of the Reformation they lost their traditions and their schools of art. They were now attempting to recover them; and they must not only give lessons such as they had heard in that room over and over again, but they must educate the public until they had an audience capable of appreciating and understanding those lessons. They wanted not only the workmen to be trained, but also the public to appreciate and encourage the workmen. Mr. Pitman held out to them a very great and important principle—to look to nature as the great example for art—but they should not look exclusively to nature. Mr. Pitman had said they ought never to have carpets in which they trod roses under foot. He could not but remember that in the East at this season of the year it was scarcely possible to move one's foot without flower after flower being crushed. It seemed to him by no means unnatural to tread upon flowers and herbage; indeed, more natural by far than treading upon artificial tesselated pavements. This remark applied with referrence to carrying the principle of adherence to nature too far, for, in fact, on looking round the room at the various specimens brought forward as the original productions of decorative art, there was very little adherence to nature in any of them. As to the carpets and mural decorations of the East, he had before observed in that room that the school of art in eastern countries was kept up by the Dervishes, or monastic orders, in the same way that similar arts were fostered by the monastic orders of Europe in the middle ages. With regard to panelling, he should like to make one observation, because decorators did not always in this respect emulate their predecessors, for it was but too common, on going into a drawing-room of the present day decorated in panels, to find that they were so arranged as to make it appear that the doors and windows of the room had been put in afterwards. On looking at the older examples of this kind of work, it was very rarely that anything of this kind was found. This was a matter not depending on the study of nature, but on the cultivation of taste, and he hoped, as more progress was made in the study of nature, so also they should not forget to develop good taste. He thought the lecturer had dealt a little unfairly with the ladies as to curtains and hangings, because it must be remembered that social requirements, and the conveniences and comforts of life, must be regarded as well as artistic taste. In this country, having a climate unsuitable to marble, they must make up for the deficiency of the climate by a warm fire, which naturally produced smoke and dust, and a good housewife must naturally desire to have such furniture and belongings as would be least likely to be injured by these agencies. He begged leave to move a hearty vote of thanks to the lecturer.

Mr. Crace said there was one topic, that of encaustic painting, upon which he should like to say a word. In his opinion it had entirely failed in this country, and the reason of it, he believed, was not difficult to ascertain. It had not only failed in this country, but the man who had most zealously brought it forward in another country, Kaulbach, had found it was not a safe medium for painting. Encaustic required the use of wax as one of the chief ingredients; and when it became dirty, as it very soon did, and required cleaning, that operation was like cleaning a wax candle, the more you cleaned it the dirtier it became. It was also apt to peel and crack, and, on the whole, he saw no advantage in its use. A mixture of turpentine and varnish would produce quite as good an effect as any encaustic painting without any of its disadvantages. With regard to what had been said by Mr. Hyde Clarke about carpets, he was rather inclined to agree with the lecturer. On one occasion, some time ago, he recollected that the cause of flowers on carpets was very warmly advocated by Mr. Ruskin, but on that occasion, he believed, it was proved that flowers in relief upon the ground were exceedingly confusing, and that it was much more pleasant and agreeable, as well as in better taste, to have a perfectly flat surface under the feet. As to the remarks which had been made about paneling, it had been said before that you should not criticise what was done by incompetent workmen, but rather go to the work of those who understood their subjects, and sought to carry out the true principles of their art.

Mr. Peter Graham said that the subject of surface decoration was inexhaustible, particularly when it was considered what great varieties of buildings there were to which it might be applied, and also bearing in mind the great varieties of style both of architecture and of decoration. It was impossible in one evening to fully enter upon any one of these subjects, but he fully concurred in the opinion expressed with regard to the great improvement of taste which had been shown in this country within the last twenty years. In point of fact, the most influential teachers and those who had most conduced to that end were those who formed the establishment at Marlborough-house which was called the "chamber of horrors," where they found at once what should be avoided and what should be followed. About the same time Mr. Owen Jones read a very able paper in that room on "The Principle of Colouring, and on Form in Decoration." It was a most valuable paper, and, as he could testify, had had, with the "Grammer of Ornament," great influence. He (Mr. Graham) was not one of those who thought that there was any superiority of natural taste in the French, but he must admit that they had a much larger number of workmen capable of executing with facility artistic works. In this respect the English were far behind them, although they were steadily, and he hoped rapidly, improving, in proof of which he might mention the various Exhibitions which had taken place since 1851, the productions in which had surprised our French neighbours. He especially mentioned South Kensington, for he believed the French set even a higher value upon that establishment than they did. With regard to style, he was of opinion that they might be very catholic in admitting varieties of style, and, although in the case of carpets, floral decorations should be treated as flatly as possible, still a very beautiful effect might be produced with them if they were kept in harmony with the decorations of the room and the furniture by which they were surrounded. Of course he condemned large floral devices, but where the carpet was made in imitation of what might be seen in nature, small flowers on a neutral ground, the effect produced would be exceedingly beautiful and pleasing. He admitted the great beauty of the Eastern productions of this class, of which a very fine

specimen was before them, and in harmony of colouring the English had not attained anything like sound excellence, for, at present, they could do no better than imitate their Eastern rivals as closely as possible. Mr. Pitman had referred to a paper-hanging forty-five years old, which was a very good design for the present day; in fact, a good design never went out of date. In order that the interior of houses should be as perfect as possible, he thought architects should study more than they did the principles of decoration, for, although some men did so, he feared they were but a minority of the profession.

Mr. J. M. Blashfield, after referring to the early efforts of Owen Jones, Minton, Pugin, and others, said with reference to the decoration of walls, he might mention, in reference to what had been said by Mr. Pitman on the subject of ground-work for fresco painting, that he had the honour of making several experiments for Sir Charles Barry, with reference to the best mixture of lime for fresco painting in the Houses of Parliament. He found the difficulty chiefly arose from the bricks. London stock bricks were generally made partly of ashes, decayed vegetable matter, common mould, and an indifferent quality of clay, containing sometimes a quantity of chalk, and these bricks were very seldom sufficiently vitrified—only just enough to form imperfect silicates and salts of an absorbent character. These salts by degrees worked their way up to the surface, and would sometimes affect even the strongest mortar—as strong as Roman cement—and these decrescent salts would impair the lime, however well prepared, and destroy the colour put upon the surface. On the other hand, a better description of bricks with the same description of lime did not produce the same result, and it had be found by some experiments recently referred to at a meeting of the Society of British Architects, that abroad, tiles were now being made free from the impurities which had been referred to, and perfectly burnt, which, when covered with lime, were perfectly successful. If they were sufficiently vitrified, and striated upon the surface, so as to hold the plaster, there would be no difficulty, even in this climate, he believed. With regard to ceiling decoration, he might remark that there were some remarkably fine examples amongst our English mansions. For instance, Burleigh-house hardly contained an apartment on the principal floor the ceiling of which did not afford an example of modelling which anyone would be proud to study and imitate. The ceilings were mostly divided into panels by their mouldings, and were painted by Laguerre and others very beautifully, and the walls were sometimes panelled, but mostly covered with tapestry or silk. The plastering work was admirably done, very different to the mode now in use, for, instead of being done by mouldings, the design was chiefly modelled out by the spatula, leather being sometimes introduced where there were large bunches of flowers. The principal part of the work seemed, however, to be done in lime, finely-chopped hair, plaster, and pounded gypsum. There were several fine specimens of this kind of work in the neighbourhood of the room where they were then assembled. Some of it had been embellished by Angelica Kaufmann, and some of the rooms in Somerset-house, formerly occupied by the Royal Academy, contained ceilings decorated in the same way.

Mr. Laing said he believed the chief cause of the failure of encaustic painting in England, which was indisputable, was the moisture of the climate. The makers of French paper hangings said that their ordinary gold papers would retain their brilliancy anywhere except in Holland and England, where it was found nesessary to have some protection from the atmosphere. Mr. Pitman had not referred specially to any of the examples round the walls as specimens of style which ought to be followed, as he thought he would have done, some of them particularly open to criticism, quite as much as the flowery carpets which had been referred to, and, indeed, he had noticed before now that a design produced by a first-rate artist, which looked very well in a small square, did not work out well on a large scale in practice.

Mr. J. D. Crace said, with regard to fresco painting, there was a good deal of misapprehension on the subject, and much which was called fresco painting was really nothing of the sort. For instance, a good deal of the Egyptian work which was often so described was, in fact, painting in distemper, and the process, from the climate of the country, would not be at all applicable to England. A lengthy discussion on the merits of fresco painting took place in that room not long ago, when the adherents of this class of art appeared in considerable numbers, but one of the most zealous brought down as an example a fine work of art under a glass case, thus proving incontestably that frescoes were not suited to a London atmosphere, or the artist would not have needed to protect his work in such a way. While on the subject of mural decoration, he might say that there was one thing which every decorator who took an interest in his art must much regret, and that was, that hardly any artists of high standing could be found to make a decorative use of their genius, and if by chance they were entrapped into painting what was called a fresco, they were as much afraid of the surface around it being decorated as if it would infallibly destroy the picture, forgetting apparently that almost every fresco of any importance in Italy was surrounded by decoration in the richest lines, though admirably adjusted to each other. The artist should not be alarmed at the proximity of colour to his work, but should rather strive to so arrange the surrounding decoration that all should form a harmonious whole. Perhaps the most striking instance of this was the chamber at Rome, in which was the famous Raffaelle fresco, "The School of Athens." The chamber was not only decorated in the richest colouring, but it had been done by another hand for itself. Raffaelle had too much good seuse, as well as generosity, to destroy the magnificent ceiling of his predecessor, Sodoma, for fear it should injure the effect of his fresco. And Giotto's paintings—for they were not frescoes, though so called—in both the upper and lower churches at Assisi, were surrounded with the richest decoration, while the windows were filled with beautiful coloured glass of the same date. He could not agree with Mr. Pitman as to the superiority of Munich glass, for though many preferred it to English, he felt bound to come to the conclusion that Glasgow cathedral had been spoiled by Munich glass, and that English glass painters having brought to their work that earnest study and attention which would always be successful, were in many respects infinitely superior to those of Munich.

Mr. Botly, after paying a tribute to the merits of the paper, desired to testify from his own experience to the danger of papering walls not thoroughly seasoned. The damp would not only destroy the paper, but also in many cases would injure looking glasses. It was, therefore, of great importance, for all decorative purposes, to see that the walls were thorougly dry.

The Chairman said all seemed to agree in the main principles enunciated by Mr. Pitman, as, for instance, that a ceiling should not be a plain white surface, that very bright carpets, chosen because they were pretty in themselves, without any reference to their surroundings, were to be avoided, and in nine cases out of ten it would happen that such a carpet would kill anything else in the room. He could also agree in the denunciation of the marble shams which were too common in halls and staircases, but on some points he must differ from Mr. Pitman. For instance, as to mosaics, he believed that in a climate like that of England mosaics with gold backgrounds, especially where large surfaces were to be covered, were by far the most valuable kind of decoration possible. He had seen much of this kind of work on the

Continent, and could not but contrast the grand old specimens in which the gold groundwork was in the glass itself, with the modern imitations, such as that in St. Boniface at Munich, where the background was made simply of gold leaf put on in the ordinary way. There could be no question that the older mosaic work, done, if not in the time of Constantine, very shortly afterwards, was infinitely superior to any other kind of decoration whatever for large surfaces which required to be seen from a distance. There was one thing which could not be too strongly enforced, that what was wanted was not so much artistic decorators, as an education of the public to appreciate what was set before them; and it must be remembered and insisted on that artistic taste was a thing that required cultivation. There was a grammar of art as well as of everything else, and without a knowledge of its principles there was a constant liability to go astray. A good deal had been said as to the imitation of nature, with which he had no desire to quarrel, but on looking around the room he saw no single specimen which could in any way be said to be a copy of nature, and in fact the minute copy of details was hardly to be desired, but rather an imitation of the several principles. He had paid much attention to this subject, and had found that in nature there was hardly such a thing to be found as a pure tint; occasionally a bright spot would be found in flowers, particularly in the tropics, but it was always in the flower itself, never in the foliage, which formed by far the larger portion of the vegetable world; all this was a strong neutral tint. It must also be remembered, in decorating rooms, that the space at command was limited, that the carpets and wall decorations had to be contrasted with tables, chairs, and other things, which did not occur in nature. The rule, therefore, seemed to be, to follow the general principle of nature in having a predominant neutral tint, relieved by bright spots or places; and in order to do this effectually and well, nature must be studied a great deal more closely than he feared people were in the habit of doing. He believed the plan which had been followed by the best decorators in past times had been this—to make the flooring of comparatively neutral tint as a groundwork, then to put in the walls of a deeper tone, and to lavish the grandest efforts on or near the ceiling. For instance, in the best mediæval works in Italy the pavements were put in in mosaic of marble of a neutral tint, then the walls were formed of polished marble, and then above came the glorious gold mosaics, of which he had already spoken, in coloured glass, this sometimes being carried up into the ceiling. Observations had been made as to the preparations of lime for the painting of frescoes, but there was this remark to be made with regard to the work of the thirteenth or fourteenth centuries, that the lime was put on in so thin a coat as to allow the grain of the stone to be seen through—it was, in fact, little thicker than a coating of whitewash. Then, again, as to the plastering of the eighteenth century, he had some short time ago to restore or rather enlarge one of Queen Anne's churches, and on examination he found that no plastering of the present day would bear comparison with the original, which was wholly the artistic work of the decorator. In the present day plaster ornaments were made in a mould, fastened up, and there was an end of it, so that it was a mere mechanical operation, whereas in the church he had referred to every ornament was fashioned separately by the workman, each particular being moulded by his own hand. On inquiry, he found it impossible to get new work done in the same manner, and therefore he was obliged to get the best imitation he could by having a mould made and the ornaments cast, but, of course, the effect was not equal to the original artistic work. With regard to the decorations of walls, he should be inclined to recommend that instead of covering the whole surface with an expensive paper, a neat ground colour should be put on, either in paper or otherwise, and that the money saved that way should be laid out in real artistic decoration of a small part here and there, either in the shape of a beautiful little picture, or otherwise. He could not have a better illustration than the room in which they were asssembled, the lower part of the walls being covered with a plain simple paper, while the upper part was occupied by the magnificent painting of James Barry. Of course this could not be exactly imitated in ordinary dwelling-houses, but the principle was the same, and it was that which was very much adopted in the buildings at Pompeii. In this way an effect would be produced which would always be pleasing, and would tend to the progress of art generally in this country.

The motion for the vote of thanks having been put and carried unanimously,

Mr. Pitman briefly acknowledged the compliment.

FOOD COMMITTEE.

The Committee met on Wednesday, the 9th inst.—Present, Benjamin Shaw, Esq., in the chair; Messrs. Antonio Brady, J. T. Ware, Hyde Clarke, G. W. Hollond, and J. Yool.

The Committee had before them specimens of American salted beef, as purchased for Her Majesty's Navy, and also specimens of English meat salted for the Navy in Deptford Victualling Yard, both specimens being furnished by Mr. Brady.

They had also before them soup made from the desiccated Queensland beef, referred to at the former meeting of the Committee.

Also a tin of preserved mutton from Australia, sent by Messrs. Kalterman and Schmitz, from the Ballarat Meat Preserving Company.

The navy beef was pronounced excellent, there being hardly any perceptible difference in the qualities of the two specimens, though the majority of the committee was of opinion that the American meat was superior to the English.

The soup prepared from the desiccated meat, with the addition of a small quantity of vegetables, was considered very successful, and the committee are of opinion that meat so preserved is likely to prove a valuable and cheap addition to the food resources of the people. The specimen from which the soup was made had been in the Society's possession, and formed part of the contents of a tin opened upwards of two years ago. The preservation was perfect.*

POSTAL COMMITTEE.

A deputation from this committee waited upon the Marquis of Hartington, the Postmaster-General, on Saturday last, at the Post-office, for the purpose of urging upon his lordship the importance to all classes of reducing the present rates of postage for the transmission of printed matter to one halfpenny for four ounces weight. A deputation from Liberal members of Parliament and others, on the same subject, was received at the same time. The deputation was introduced by

Mr. Mundella, M.P., who reminded the Postmaster-General that an understanding was come to in the last session of Parliament, on Mr. Graves's motion being brought forward, to defer voting on the question, in order to give the government time to make inquiries. There were indications that these inquiries had been instituted, and he acknowledged that improvements had been made in the Post-office service, such as the changes in the American rates, the increased weight allowed to letters in France,

* In reply to various inquiries, the Secretary states that this desiccated meat is imported by Messrs. Orr and Honeyman, Princes'-street, Glasgow, and may be purchased in London of their agent, Mr. J. Abercromby, 46, Queen-street, Cheapside.

and like changes, and he thanked the Postmaster-General for what had been done, but it was greatly disappointing to find that no reduction of the price for the transmission of printed matter had yet been adopted or proposed by the government. The adherence to the penny stamp as the minimum for printed matter was altogether a mistake, looking at what was passing around in Europe, for, as matters were at at present, circulars could actually be posted abroad in Belgium, and delivered here at one-half the charge made for sending similar packets of printed matter from one part of London to another. A reduction in the cost of sending printed matter would benefit trade, and would be no small help to the educational interest, by disseminating newspapers and books. He then drew attention to the French and Belgian system, and read a letter from Mr. Bowley, the manager of the Crystal Palace, to Mr. Thomas Hughes, M.P., the chairman of that company, which indicated that, without a corresponding change in the English rates, the industry of this country would suffer, and the revenue be charged with a very considerable amount. Mr. Bowley said:—"I can now send my circulars from Belgium to be delivered in London for five centimes (halfpenny). I send one from Paris for eight centimes (four-fifths of a penny), and if the postage (of France) is to be reduced, as it is stated, to six centimes, it will then be very near the Belgian postage. The postmaster will, therefore, certainly have my hundreds of thousands, and probably millions of packets through a Continental post, and, as I suppose the foreign post-offices get a share of the postage rate, it will be well for the department to consider whether the printing, addressing, folding, &c., of the large issue of printed advertisements used by advertisers, which can be done much cheaper abroad, shall go abroad or not." Mr. Bowley added, that if he could have his work done abroad, posted there, and delivered here at half the cost, of course he should adopt that plan. Mr. Mundella pointed out the vast increase of printed matter that had already accrued from the abolition of the paper duty, the result of cheapness, and he thought it an important consideration for the Post-office, that unless they lowered their rates, not only would the printing go to Belgium, but they would have to share a five-centime rate with the Belgian post-office. He also said that, though Mr. Graves' motion was for the carriage and delivery of two ounces of printed matter for one halfpenny, for his own part he desired to see a larger extension of weight, viz., four ounces, for the same cost.

Mr. M'Laren, M.P., said he had a special reason for attending, inasmuch as, in his constituency, a private enterprise had sufficient faith in a cheap delivery of circulars to organise a means of carrying out the plan; but the Post-office authorities, in a "dog-in-the-manger" spirit, interfered, and would neither permit the plan to be carried out themselves, nor that which the public interest demanded. He was quite convinced that if the cheap rate were adopted of carrying the ordinary weight of a newspaper for a halfpenny, there would be no loss to the Post-office, inasmuch as the present numbers of newspapers and printed packages would be increased at least threefold.

Mr. Arthur Arnold, pointed out that when Mr. Rowland Hill (afterwards Sir Rowland) proposed, in 1838, his scheme of a postal reform, he estimated a fivefold increase of letters, while actual experience gave a ninefold increase. Companies had offered to deliver circulars at greatly reduced rates, but had been prevented by the Post-office; and he urged that the concession of a half-penny rate, which the late Postmaster-General had recommended, would be honourable to the government, and beneficial to the community.

Mr. E. Chadwick, C.B., member of the Council of the Society of Arts, pointed out the importance of this concession being made in reference not only to commerce, but as a great auxiliary to the diffusion of science and spread of education; and he felt assured, looking at the results as a fiscal measure, that the experience of continental nations fully justified the reduction sought for. The Society of Arts had advocated the reduction of the rates of conveyance on all matter, printed or otherwise, such as now conveyed by sample post, to a rate of two-pence per pound, and one halfpenny for each quarter of a pound or under. They were of opinion that such a reduction would yield a profit, and lead to the augmentation of the salaries of the inferior as well as other officers of the establishment.

Mr. Le Neve Foster (Secretary of the Society of Arts) stated the importance of such a reduction to Societies like that which he represented, where a journal of their transactions, containing information in relation to science and art, was every week gratuitously distributed among the members. The saving annually to that Society, supported entirely by the voluntary subscriptions of its members, would amount to no less than £250 a year, which would thus be released for promoting the general public objects of the Society. This argument, coming from a Society which had no other than public interest to serve, could not be called selfish, as might be suggested if it came from a private firm.

The subject was further elucidated by Mr. Naylor, and Mr. Latimer (on the part of the provincial press), Mr. Macfie, M.P., Mr. E. Baines, M.P., and others.

Lord Hartington said he had been greatly interested in listening to the statements made by gentlemen so well qualified to speak upon this subject. He had taken the best measures in his power to fulfil the promise he made last session in the House of Commons, and had caused careful inquiry to be made, both as regarded the possibility of the Post-office being able to cope with the additional labour to be expected from a reduction of the rate, and also the financial effects of such a reduction. He had come to the conclusion—and he need make no mystery of the matter—that it would be quite possible for the department to undertake the increased work which might be thrown upon it; but with respect to the financial results he had not been able to form so positive an opinion, and therefore he had listened with interest to the points which had been urged on this part of the subject. The statement made by Mr. M'Laren was entitled to great weight, and all the information obtained on the subject would be of interest to the government, especially to the Chancellor of the Exchequer. It would be necessary to calculate upon some loss the first year, and it would be for the government, and not for him, to say whether it was for the general public advantage to submit for a time to such loss. He hoped to be in a position to state, on Tuesday next, what the intentions of the government were on this subject, and though he should reserve his views on the general question, he might say that he thought, if any reduction were made at all, it should not be confined to carrying the two ounces for the reduced rate, but should be extended to carrying the ordinary newspaper. He expressed a desire to learn the views of members as to the necessity of placing a limit upon the size of book-parcels now carried by the Post-office, and he allowed that the difficulties in the way of reduction of rate now sought would be decreased if such a limit were authorised, for at present, by the size being practically unlimited, the service was encumbered. The Post-office was intended and fitted, not for the carriage of large parcels, but for the rapid transmission of small ones. He desired to direct their attention to this subject, and he should like to hear their views upon it in the House of Commons; for himself, he believed the public would gain by a limitation of weight. Of course, the great question in the case of the reduction was as to its paying, for if the reduction did not pay, the senders of letters would have cause to complain that they charged double price for their letters

to what was charged for a larger bulk, but there would be nothing in this argument if the printed packet-carrying paid.

The following formed the Society's Deputation:—Edwin Chadwick, C.B.; Hyde Clarke; Admiral Sir J. C. D. Hay, Bart., M.P.; Joseph Dodds, M.P.; W. H. Smith, M.P.; Henry Jefferey; Peter Rylands, M.P.; Richard Shaw, M.P.; Sir Chas. Dilke, Bart., M.P.: John Francis; R. A. Macfie, M.P.; T. O. Wethered, M.P.; Edmund Johnson; John Symonds; David Chadwick, M.P.; E. T. Gourley, M.P.; R. Ward, Jackson, M.P.; F. Algar; James Hole; T. Hughes, M.P.; E. Baines, M.P.; P. Le Neve Foster.

The following gentlemen have authorised their names to be added to the list of this Committee:—

Annesley, Lt.-Col. Hon. Hugh, M.P.
Armitstead, George, M.P.
Baines, Edward, M.P.
Beresford, Lt.-Col. T. Marcus, M.P.
Bright, Jacob, M.P.
Brogden, Alexander, M.P.
Callan, Philip, M.P.
Cameron, Donald, M.P.
Cecil, Lord Eustace, M.P.
Clive, Lt.-Col. Edward H., M.P.
Corrance, F. Snowden, M.P.
Cowen, Joseph, M.P.
Dalrymple, Dr. Donald, M.P.
Davies, Richard, M.P.
Dickenson, S. S., M.P.
Dimsdale, Robert, M.P.
Egerton, Hon. Wilbraham, M.P.
Esmonde, Sir John, Bart., M.P.
Ewing, Archibald O., M.P.
Fletcher, Isaac, M.P.
Fordyce, W. Dingwall, M.P.
Graham, William, M.P.
Gray, Lieut.-Col. William, M.P.
Grove, T. Fraser, M.P.
Hambro, Charles, J. T., M.P.
Harris, J. D., M.P.
Henry, J. Snowden, M.P.
Hoare, Sir Henry A., Bart., M.P.
Holland, Samuel, M.P.
Holms, John, M.P.
Johnston, William, M.P.
Lewis, Harvey, M.P.
Lindsay, Col. Hon. Charles H., M.P.
Locke, John, M.P.
Malcolm, John W., M.P.
Manners, Right Hon. Lord John
Maxwell, W. H., M.P.
Milbank, F. A., M.P.
Miller, John, M.P.
Monk, Charles J., M.P.
O'Reilly, Major M. W., M.P.
Peek, Henry W., M.P.
Pell, Albert, M.P.
Samuelson, Henry B., M.P.
Sartoris, J. G., M.P.
Sheridan, Henry B., M.P.
Simeon, Sir John, Bart., M.P.
Sykes, Col. William H., M.P.
Walpole, Hon. Frederick, M.P.
Waterhouse, Major Samuel, M.P.
Wells, William, M.P.
Whalley, George H., M.P.
Whitworth, Thomas, M.P.

CANTOR LECTURES.

ON THE SPECTROSCOPE AND ITS APPLICATIONS.*

By J. Norman Lockyer, Esq., F.R.S.

Lecture III.—Delivered Monday, December 20th, 1869.

On the last occasion, the subject which we dealt with was the radiation or giving out of light by bodies in different states, that is to say, by solid or liquid bodies, or gaseous or vapourous ones. We have now to deal with the action of the prism upon light under some new conditions—conditions which I purposely withheld from you in the last lecture. Light is not only given out, or radiated, but it may be stopped or absorbed in its passage from the light source to our eye, if we interpose in the path of the beam certain more or less perfectly transparent substances, be they solids, liquids, gases, or vapours. I will repeat one or two of the experiments which you saw on the former occasion, in order that you may see exactly how the perfectly distinct classes of phenomena due to radiation and absorption really run together. You will recollect that I pointed out to you that radiation, or the giving out of light, might be continuous or might be selective, and I am anxious now to show you that radiation is exactly equalled by absorption in this matter; that absorption may also be continuous or selective. Mr. McLeod will be good enough to show on the screen a continuous spectrum, that is to say, an example of the general radiation which you get from an incandescent solid—the carbon points of which the poles of the lamp are composed. We next have a spectrum of a vapour, in the first instance of strontium and then of thallium, and you see that the continuous spectrum is altogether changed, and that, in the place of that beautiful rainbow band, continuous from the red end of the spectrum to the violet, we really only get lines here and there, which are due to the selective radiation, and opposed to the general radiation which we got in the continuous spectrum just now. I might have chosen other substances besides strontium and thallium, but I showed you the spectra of these substances when we were considering the question of radiation. What I have to dwell on now is, that the absorption or sifting of light by different bodies is very like radiation in its results, that is to say, in some cases we have an absorption which deals equally with every part of the spectrum, and in other cases we have absorption which only picks out a particular part of the spectrum here and there to act upon. But there is one important point to be borne in mind; when dealing with absorption we must always have a continuous spectrum to act upon. If we had a discontinuous spectrum to act upon, the thing would not be at all so clear. Having this continuous spectrum, the problem is, what the action of the different substances on the light will be. Let me give you an instance of general absorption. We will first show you a continuous spectrum on the screen. You will find that the substance which we shall introduce will cut off the light and deaden the spectrum, so to speak, throughout its whole length. We have there, you see, a continuous spectrum shorter than usual, because we are only employing one prism instead of two. Mr. McLeod will now show us what general absorption means; you will find that, in consequence of something which he will interpose in the path of the beam, the spectrum will be deadened throughout its whole length, though not throughout its whole depth, in order that you may see the effect more clearly. We have a something there which has the faculty evidently of keeping off light, red, yellow, blue, green, violet, and so on; the something is a piece of neutral tinted glass. Now, I propose to show you the action of something else, which action, instead of being general throughout the spectrum, will be limited to a particular part of it. I have interposed something which has cut off nearly all the light except the red; and now I will have something else interposed that will cut off everything except the extreme violet. By putting both these things together in the beam, it is entirely obliterated. In these cases we have instances, not of general, but of selective absorption, one substance cutting off everything but the red, and the other cutting out everything but the violet. When I tell you that that absorption is simply due to the interposition of two pieces of coloured glass in the path of the ray, you will see, I think, the possibility of a very practical application of spectrum analysis in the manufacture of coloured glass. To take an instance. If astronomers could find a glass of a certain red and glass of a certain green colour, we should be able to see the solar prominences every day as well as or even better than we see them during eclipses. But we have not yet got the practical application of the spectroscope, as I hope we shall have some day, in the manufacture of coloured glass, and, therefore, for the present, we must wait for this desirable result.

The very first practical application which springs out of this great law of absorption is this, that as different substances are determined by the effects which they produce on radiation, so also chemists find it perfectly easy to discover and to detect a small quantity of different substances by means of their absorption; for instance, I will show on the screen the absorption spectrum of nitrous fumes. Here is, first, our continuous spectrum which we must always have to start with, and now that some nitric peroxide is introduced, you see indications of absorption which are evident to every one in the room. We are not limited to this substance; we will try something else—blood, for instance, about which I shall have something more to say presently. You will find that the action of blood upon the light is perfectly distinct from the action of those fumes which you have seen; and instead of having typical lines in the green and blue parts of the spectrum, you see we have two very obvious lines in the more luminous part of the spectrum. The colour of a solution of blood is not unlike the colour of a solution of magenta; but if, instead of putting into the hollow prism—which is a very important element of success in these experiments, the introduction of which is due to Dr. Gladstone—a solution of blood, we use a solution of magenta, you see at once we have only a single line, and I should tell you that the intensity of the indication of absorption on the screen really depends on the amount or quantity of the solution through which the light passes, the solution being contained in the hollow prism. The absorption spectrum of permanganate is another beautiful instance of this great law of which I am speaking. You see here something totally unlike anything you have seen before. Instead of the two bright bands, which alone were left us in the case of the blood, or the single bright band in the case of magenta, we have four very definite absorption bands in the green part of the spectrum. So that you see the means of research spectrum analysis affords as far as regards radiation is entirely reproduced in the case of absorption, and it is perfectly easy, by means of the absorption of different vapours and different substances held in solution, to determine not only what the absorbers really are, but to determine the presence of an extremely small quantity.

I told you I had something more to say about the spectrum of blood, and this is not only an instance of the way in which the spectrum acts and deals with several important questions which, at first sight, do not seem at all connected with each other, but it shows the enormous power of research that is open to us. The colouring matter of blood, for instance, is found, like that of indigo, to exist in two perfectly different states, which give two perfectly different spectra. I have not time to-night to show you both of these, but they have been named by Professor Stokes red and purple cruorine. Previous to the introduction of spectrum analysis, red and purple cruorine were perfectly unknown. Further, if by means of a spectrum microscope, such as I have already described, a blood-stain is examined, Mr. Sorby asserts that the thousandth part of a grain of blood—that is to say, a blood-spot so small that it only contains $\frac{1}{1000}$ of a grain, is perfectly easy of detection by means of this new method.

In the case of radiation, as you know, we are able to determine the existence of new elements altogether. This is reproduced in the absorption spectrum. Mr. Sorby has, quite recently, announced the discovery of jargonium, which he found associated with certain zircons, and this, curiously enough, in the hands of Mr. Sorby, will most probably throw light on a good many interesting problems which have baffled every other line of research. Let me give you another practical application of this principle. Dr. Thudichum, who has lately been working admirably for the Medical Department of the Privy Council, has recently communicated to the Royal Society a paper, in which he narrated the result of his researches on the yellow organic substances contained in animals and plants; and at the present moment it is impossible to say what important practical results may be expected as we come to know more about these substances, especially in the matter of dyes, which I am sure is a thing that will commend itself to you. Again, Mr. Sorby, in a communication to the Microscopical Society, brings the matter still nearer home. He shows us that, in the case of wines, he can even, by means of the absorption bands, determine the very year of vintage, and this, you will see at once, is a matter of very great importance. We have, in fact a definite method of analysis of animal and vegetable colouring matter, and also of the colouring matter of decayed wood. Nor is this all, for, in a recent communication — for these things are now beginning to crowd upon us, and they will continue to do so much more by-and-bye; Dr. Phipson asserts that this new method is perfectly competent to indicate any artificial colouration of wine. Mr. Sorby, on the other hand, has given his attention to beer, so that you see, if I have been taking you occasionally to the stars, I sometimes have the opportunity of travelling a great deal nearer home. Let me read you an extract from one of Mr. Sorby's reports. He says:—"The difference for each year is at first so considerable that wines of different vintages could easily be distinguished; but, after about six years, the difference is so small that it would be difficult or impossible to determine the age to within a single year. After twenty years, a difference of even ten years does not show any striking contrast, and the age could not, therefore, be determined to nearer than ten years by this process. However, up to six years, I think it quite possible to determine the age to within a single year. I took specimens of various ports from the casks, of different ages up to six or seven years, and labelled them in such a manner that I did not know the age of any, but could ascertain it afterwards by reference. I then made the experiments with great care, and found that, by proper attention to the details described above, I could correctly determine the year of vintage of each particular specimen." (*Chemical News*, December 17, 1869, p. 295.) So that you see, on the whole, at the present moment, I think we may be full of hope that the new process may gradually lead to many more practical applications; but really we cannot say much about them at present, because the introduction of spectrum analysis is so recent. We are, however, already furnished with another instance of the close connection there always must be between any great advance in physical inquiry and the application of the skill of our opticians to aid us in the inquiry. We have the Sorby-Browning spectrum microscope, and then a large number of people can study the beautiful phenomena which this new method of research has opened up to us, where formerly it was almost impossible to imagine that science, or even the practical affairs of earth, should in any way benefit.

Having thus dealt very briefly with some of the more practical applications of the subject, I must now take you a somewhat distant journey to the sun and to the stars; and I must, in the first instance, attempt to connect the two perfectly distinct classes of phenomena which I have brought to your notice, the phenomena, namely, of radiation and the phenomena of absorption; and this connection between radiation and absorption is an instance of the slow growth of science. I remarked to you in the former lecture, that Fraunhöfer, at the beginning of this century, had a very shrewd suspicion of the perfect coincidence of place in the spectrum between certain lines which he saw in the spectrum of the sun, which I promised to explain to you on this occasion, and the spectrum of sodium. If I show you how very simple the spectrum of sodium is, you will, perhaps, think it very strange indeed that such a simple thing was not explained very long ago. But Fraunhöfer at the first suspected, and after him many of our greatest minds suspected, that there

was some hidden wondrously strange connection between that yellow line which you now see on the screen, and a certain double line which exists among the strange black lines of the solar spectrum, which I begged you to banish from your minds on the last occasion, when we were merely dealing with radiation. But now I must ask you to bear with me while I attempt to make clear to you all the strange facts concerning these black lines. I have been favoured by Dr. Gladstone with an extract from Dr. Brewster's note-book, dated St. Andrews, October 28th, 1841. In it Brewster says:—"I have this evening discovered the remarkable fact that, in the combustion of nitre upon charcoal, there are definite bright rays corresponding to the double lines of A and B, and the group of lines a in the space A B. The coincidence of two yellow rays with the two deficient ones at D, with the existence of definite bright rays in the nitre flame, not only at D but at A, a and B is so extraordinary that it indicates some regular connection between the two classes of phenomena." The double lines A and B refer to some of these dark Fraunhöfer lines in the solar spectrum, which for convenience of reference were at first called after the letters of the alphabet; we now find that their number is so enormous that it is absolutely impossible to attempt to grapple with them in any such method, but these names are still retained.

Now, let me explain to you how this discovery was made. In my notice of the spectroscope in the first lecture, I had so much to say that there were several details it was absolutely essential I should omit. One of these details, however, was the scale by which the positions of the different bright or dark lines which are seen in the different spectra are registered, so that we may say that such a line occupies such and such a position, and such another line occupies such another position, with regard to something else. When Kirchhoff and Bunsen, two German chemists, were engaged in mapping the spectra of the elements, which had nothing whatever to do with the sun—of mapping the bright lines of various metals, they came across this difficulty of a scale. How could they get a good scale? You see there are several very obvious arrangements that might determine the actual position; for instance, the observing telescope might be made to move along a graduated arc, so that by moving the telescope for the different rays and fixing it when in a proper position to see a particular ray, you might read off the index placed on the arc to a great nicety, by means of a graduated vernier working on the curve of the arc; or you might, by a modification of the frame of the instrument, get here a reduced photographic picture of the scale, so that the thing to be measured and the actual scale would appear in the field of view at the same time. Kirchhoff and Bunsen tried these methods, but they did not like them. Then it suddenly struck them that, as they made their experiments in the day-time, they might use as a scale the black lines in the solar spectrum, which had not been known to change since the time of Wollaston, who discovered them. When working in the day-time, they had the solar spectrum visible in one half of the field of view of the telescope, which was easily managed by placing a right-angled prism over one half of the slit, so as to light one half of the slit by the sun, and the other half by whatever substance was under examination. With this arrangement they set to work with infinite care, and made a map of the solar spectrum. Such was their proposal, first, to map the unchangeable solar spectrum, and then having this unchangeable scale always visible, about which there could be no mistake, they would be able to refer to the dark lines in it all the unknown phenomena they were about to investigate in the bright lines of different vapours, gases, and other bodies. Before I go any further, I will read a short extract, containing a beautiful episode in the history of science, from Professor Roscoe's book on "Spectrum Analysis," which I hope you will all read, for it is worthy of perusal by every lover of nature. He says that, having got this idea of the scale well into their minds, they were exceedingly anxious to test this question, which, as I have told you, was raised by Fraunhöfer and many other men before them, of the asserted coincidence of the bright sodium line with the dark solar sodium lines, with a very delicate instrument, Professor Kirchhoff made the following remarkable experiment:—"In order," says Kirchhoff, for these are his own words, "to test in the most direct manner possible, the frequently asserted fact of the coincidence of the sodium lines with the lines D"—(that is to say, of the bright line of sodium which I have just shown you on the screen with the double line D of the solar spectrum)—"I obtained a tolerably bright solar spectrum, and brought a flame coloured by sodium vapour in front of the slit. I then saw the dark lines D change into bright ones." That is to say, in the spectrum of the sodium which was burning in the flame were bright lines so exactly coincident with the two dark lines in the solar spectrum that the bright lines of the sodium spectrum put these dark lines out altogether, so that they seemed to vanish, as it were, from the solar spectrum. He goes on, "In order to find out the extent to which the intensity of the solar spectrum could be measured without impairing the distinctness of the sodium lines, I allowed the full sun-light to shine through the sodium flame." Here he varies the experiment. In the first instance he used a very feeble beam of sun-light, but he now allows the whole glare of the sun to enter the slit. What was the result? "To my astonishment, I saw that the dark lines D appeared with an extraordinary degree of clearness." That is to say, the lines which came from the sodium in the first instance, were sufficiently bright to entirely eradicate the dark lines from the solar spectrum, but the two lines D were now so utterly powerless compared with the light of the sun, that they actually appeared as black lines, and coincident with the two lines D in the solar spectrum.

Mr. McLeod will be good enough to show you something like this on the screen. A few minutes ago, we showed you the bright line due to the radiation from sodium vapour. We will now pass the continuous light coming from the carbon points through sodium vapour, part of which you see issuing from the top of the lamp. The result is, that we get on the screen a black absorption line. This is Kirchhoff's crucial experiment, which at once determined not only that the dark line in the sun was absolutely coincident with the bright line of sodium vapour, but that, under certain conditions, bright incandescent sodium vapour could actually be made to absorb the light coming through it, and reverse its own spectrum. Kirchhoff goes on:—"I then exchanged the sun-light for the Drummond or oxy-hydrogen lime-light, which, like that of all incandescent solid and liquid bodies, gives a spectrum containing no dark lines." When this light was allowed to fall through a suitable flame, coloured by common salt, dark lines were seen in the spectrum in the position of the sodium lines." You may imagine that this conclusive experiment—perhaps the most wonderful experiment that has been made during the century—gave Kirchhoff food for thought, and at once his genius travelled to a possible explanation of this strange fact he had observed; a fact, as you know, entirely in accordance with the previsions of Professor Stokes, Dr. Balfour Stewart, and Foucault. Kirchhoff said to himself, "I have now got the bright lines in the spectrum of the vapour of sodium coincident with the two dark lines in the solar spectrum. What does it mean?" And again the philosopher was not at fault. He said to himself—it is almost possible to see the train of his reasoning in his memoirs. "Sodium has a most simple spectrum; suppose I take the most complicated spectrum I can find." Mr. McLeod will be good enough to show you on the screen the spectrum of iron, which I think you will acknowledge to be one of sufficient complication. It is rather a difficult one to manage,

but you see the spectrum traversed by lines throughout its whole length, and I may tell you at once that no less than 460 lines have been already mapped, and their positions are now thoroughly well known to us, as well known as the position of any star in the heavens. Kirchhoff tried the iron spectrum as you have seen us try it in that lamp, and he found, absolutely corresponding in position in the spectrum, and in width and darkness to the bright iron lines which he saw, black lines in the solar spectrum. He waited no longer; he instantly convinced himself, and soon convinced the world, that he had discovered this very remarkable fact, that gases and vapours have the power of absorbing those very rays which they themselves give out when in a state of incandescence. So that if you take sodium, and get its bright lines, and mark their positions on the screen, and then observe a continuous spectrum, and interpolate sodium vapour in the beam, you will find a black line absolutely corresponding with the bright one; that is to say, that the sodium vapour has the faculty of entirely eating up, absorbing, or stopping, that light which would otherwise go on to the screen. In the case of iron it is worthy of notice that when Kirchhoff made his discovery, he was only able to obtain a spectrum of iron, consisting of something like 90 lines, but since then the spectrum of iron has been mapped to the extent of 460 lines, and sure enough there are 460 solar lines corresponding absolutely to the 460 bright lines which we are able to get in our laboratories, and which you have seen on the screen to-night. This grand discovery of Kirchhoff's met with immediate acceptance, and with it you see at once the explanation of the wonderful black lines discovered by Wollaston, about which I said something in my first lecture. The riddle of the sun was read to a certain extent, and Kirchhoff read it in this way. He said:—There is a solid or a liquid something in the sun, giving continuous spectrum, and around this there are vapours of sodium, of iron, of calcium, of thallium, of barium, of magnesium, of nickel, of copper, of strontium, of cobalt, and aluminium; all these are existing in an atmosphere, and are stopping out the sun's light. If the sun were not there, and if these things were observed in an incandescent state, we should get exactly these bright lines from them. Kirchhoff further imagined that he had reason to believe that the visible sun, the sun which we see—and we may take the sun as an example of every star in the heavens—was liquid. Mr. McLeod will be good enough to show an image of the sun on the screen, and I shall then be able to show you another assertion of Kirchhoff's, which was of extreme importance, and, if it had only been true, would have made things very much more simple than they had hitherto been. Here is an image of the sun, and there is some little interest connected with it, for I owe it to the kindness of the American astronomers who observed the eclipse of this year. It is a photograph of the sun, taken before the eclipse, which was so admirably observed in America. You see we have, first of all, this bright, shining orb, dimmed to a certain degree at the edge, and here and there, over the sun, we see what are called spots, though the largest of them is very small compared to some that are seen. Kirchhoff wished, not only to connect his discoveries with the solar atmosphere, but was anxious to connect it with this dimming, which you see nearer the limb. He said that the solar atmosphere, to which all these absorption-lines were due, was really outside the sun, and that this dimming of the limb was really due to the greater absorption of this newly-demonstrated atmosphere, owing, of course, to the light of the sun travelling through a much greater length of atmosphere at the limb than from the centre of the disc. Furthermore, he said that these sun-spots which astronomers, from the time of Wilson, had asserted to be cavities, were nothing but clouds floating in this atmosphere of vapour. Such was the very bold hypothesis put forward by Kirchhoff—an hypothesis which you see at once explains all these strange observations from Wollaston upwards, including Fraunhofer's observations of the spectrum of the sun and stars, and the brilliant ideas of Professor Stokes, Dr. Balfour-Stewart, and others in other lands. A little simple experiment, made by means of a little sodium vapour and a beam of sunlight, with the powerful aid of that little prism, gave us this tremendous knowledge about distant worlds, so immeasurably remote that it seemed absurd for men to try and grapple with any of the difficulties that are presented to us. Such, then, is Kirchhoff's theory of the sun, which I hope I have been able to make clear to you. There is a something—Kirchhoff said it was a liquid—which gives us a continuous spectrum, and between our eye and that incandescent liquid surface there is an atmosphere built up, so to speak, of vapours of sodium, iron, and so on, and the reason that we get these dark lines is, that these substances absorb these lines, because when those substances are in an incandescent state they give them out. This brilliant idea of Kirchhoff's was soon carried, as you know, to the stars, by Mr. Huggins in our own country. I will now show you on the screen the spectra of two stars, so distant that it is absolutely impossible to measure their distance from us. We know a great deal about our own sun, but these suns are so lost in the depths of space that it is quite impossible that we can get anything like a correct knowledge of their size, or know much of their belongings. By means of the prism, however, we learn in a moment a great deal. In this first star, we get three lines of magnesium vapour, as we get them in the sun. We know, therefore, that magnesium vapour is present in the atmosphere around that sun (Aldebaran) in exactly the same way as our own. We also get some of the iron lines and the lines of sodium. At the base of the picture you see indications of the elements, with the bright lines of which Mr. Huggins has compared the black lines which you see in the spectrum of these heavenly bodies. You see there three dark lines, which appear to be very nearly identical with the three lines of magnesium which we know to be in the sun. By means, therefore, of the star spectroscope and of the induction coil, a picture of which I showed you on the last occasion, Mr. Huggins at once tests these three lines, as Kirchhoff did in the case of the sun, by actually getting the vapour of magnesium visible at the same time in the spectroscope; and thus you see in a moment that there is no difficulty at all in determining their coincidence, when you have the two things brought so closely side by side. If I had time, I might remark on the presence of some elements here and the absence of others; but there is one remarkable fact about this lower star (*a Orionis*) which I must mention. As far as its spectrum goes, it appears that the gas hydrogen, which is a very important element in our sun's atmosphere, as we gather from the great distinctness of the hydrogen lines in the solar spectrum—and not only in our sun, but in a great many others—is absolutely absent.

So far, then, you see that this little prism has enabled us to read a great many secrets of the sun and of the more distant stars; and we must acknowledge that Kirchhoff's hypothesis was a very magnificent one, and we can but wish that there were more men like Kirchhoff, who, undismayed by the failure of those who for very nearly a century before his time had been endeavouring to unravel these secrets, was still prepared to go on, and endeavour to find them out by means of a prism and a simple sodium flame.

Now, astronomers, who, as I told you, from the time of Wilson had imagined that the sun spots were cavities, very soon began to quarrel with this hypothesis of Kirchhoff's, who said that the sun spots, instead of being cavities, were really clouds floating above the atmosphere. They remarked, and I think with truth, that to make such an assertion was altogether opposed to the evidence of the telescope. And I think I may say that the astronomers have now carried the day, for another line of independent research altogether, I mean the

researches into the constitution of the sun, as far as we can extend it in those rare intervals at which our great luminary is eclipsed, has come to the aid of the astronomers, and it looks very much as if we must still hold to the opinion that Wilson in his observations, now more than a century old, was perfectly right, and that Kirchhoff's analysis, as far as it deals with the sun spots, is susceptible of improvement. In the remarks I made in my former lecture on radiation in connection with the red prominences visible during eclipses, I drew your attention particularly to the hydrogen lines, and told you that the red flames are, for the most part, composed of hydrogen. There the prism comes to our aid in a very remarkable way indeed. It is clear to you, I think, after what I have said about absorption, that the darkening of the sun's surface, which we call a spot, is really a thing about which the prism can tell us a great deal. For instance, take a sun spot, such as Mr. McLeod will now throw upon the screen, in which you see the usual brilliancy of the sun in the other parts of its disc is altogether wanting. You see not only great darkness here and there, but wonderful turnings and twistings, and bendings of this solar envelope, which I have already told you Kirchhoff asserts to be a liquid one, but which I think a mere inspection of this photograph will show you is more probably gaseous, or cloudy, than liquid. It is obvious, I say, in this case that there was a great probability of the spectroscope being able to tell us something about this absence of light, for an absence of light means one of two things; it means either that there was a defect in radiation, or that there was some excess of absorption, and I may say that this distinction—which I hope you now all thoroughly understand, will account for the spots in one case by defective radiation, and in another case by some kind of absorption —really formed the battle-ground between the English and French astronomers until a few years ago. Long after Kirchhoff's experiment, M. Faye, a distinguished member of the Institute of France, went all over the work again, and declared that the sun-spot was dark, because we there got the light, not from the brightly shining envelope, but from some feebly radiating gas inside the sun; that the sun was a gigantic bubble, the bubble part of which was nothing else but this photosphere—this liquid sphere of Kirchhoff—and that the interior was gas, glowing at such a tremendous temperature that it was dissociated to such an extent that the light we got from it was extremely feeble. You must see in a moment that, if the sun spot were really due to the radiation from gas, we should get from that sun-spot a selective spectrum, that is to say, a spectrum with bright lines. The English astronomers said "No;" a sun spot is not due to defective radiation at all; there is something over the bright portion of the sun which eats away the light; whether the light was eaten away generally—whether, in fact, we had an instance of general or selective absorption, was not stated, but what they did distinctly state was, that the sun-spot was simply an indication of absorption. So that you see here was a thing which a simple prism might settle almost at once, provided always that a good sun-spot could be obtained for the experiment. I now throw on the screen the result of the observation of a small sun-spot, but I think it is one which is full of meaning. Here is a very magnificent image of the solar lines near the double line D, and here is the double line D itself. If it were possible to have given you the whole of the sun's spectrum on the same scale as this, not only would it require a room many times larger than this, but it would be almost impossible to make any meaning clearer than I hope I can by this small portion; and I must, therefore, ask you to take for granted, that the dark line which you see running along this yellow portion of the spectrum would really run along the whole length, from the extreme red to the extreme violet. This, then, you see in a moment, was an indication of general absorption; that is to say, by the way in which the light shows itself to be reduced by means of the prism, we have the problem settled in an instant, that the sun-spot is due to general absorption at all events. Further, if I were able to show you several photographs of different sun-spots, I should be able to show you that the spectrum of the middle of the sun-spot is much darker than the outside. So that you see this simple experiment tells us, not only that the sun-spot is due to general absorption, but that there is more general absorption in the middle of the spot than at the outside. This is the way in which this little prism is able to deal with these great problems.

But I have not yet done with this image on the screen. Not only is there this general absorption, but there are indications of increased selective absorption in the case of the line D, as I could also show if I were dealing with the iron lines, the magnesium lines, or the other well-known lines of the solar spectrum. Not only, then, have we a general absorption, increasing as the middle of the sun-spot is approached, but this sodium line D is also thickened, so that we have, as a result of a single examination of a single sun-spot, the fact that sun-spot is due to general absorption, *plus* special absorption in some particular lines.

Now, in what I said the other evening on the radiation of hydrogen, I pointed out to you that the F line of hydrogen was different from the C line—in fact I showed that it widened out towards the sun—and I also told you that Dr. Frankland and myself have asserted that that widening out is due to pressure, and we have been able artificially to widen out this F line of hydrogen by increasing the pressure. Now it struck us that possibly we might find some connection between that widening out of the F line of hydrogen and the widening out of the sodium line in the spot which I have just shown you on the screen. We have an experiment there which I think will show you that it is perfectly easy for us to reproduce this artificially, so that you see we can begin at the very outside of the sun by means of hydrogen, and see the widening of the hydrogen lines as the sun is approached; and then we can take the very sun itself to pieces, and, by examining the pieces, see that the sodium lines vary in thickness as the hydrogen does in different parts of the spot, because the pressure is continually increasing down in the spot exactly in the same way as it increases in the hydrogen envelope.

What Mr. McLeod is doing is this: We have there a tube containing some metallic sodium, sealed up in hydrogen, in order that the ray may pass through it without any great difficulty. You see at present the incandescence of the sodium vapour in the lamp is indicated by that bright yellow line. If you look at that place, it is quite possible you will see something else by-and-bye, and it will be this: By heating the metallic sodium in the tube which is placed in front of the slit, we really fill that tube with the vapour of sodium; and as the heating will be slow, the sodium vapour will rise very gently from the metal at the bottom, so that we shall get layers of different densities of sodium vapour filling that tube, and you will find that the thickness of the sodium absorption line will vary with the stratum of the tube through which it passes. I hope you all now begin to see that we have a delicate line of absorption intruding itself on the screen. Mark how it slowly thickens as the heat is continued. We reproduce the solar spectrum at the bottom of the spot where the layers of sodium vapour are very dense, and the very fine delicate line of the sodium vapour when thrown up into the sun's chromosphere. From that experiment I think we may gather a great deal of instruction in the matter of the solar economy.

I will next show you what happens in the case of the magnesium lines. A very obvious magnesium line is lettered B in the solar spectrum. It is a triple line separated by different intervals. I now show you that part of the spectrum which contains the magnesium lines, and also a very important fact connected with

them, when magnesium vapour is thrown up into the envelope which I have called the chromosphere. By means of the new method of research, it is quite possible to see, as I explained to you on a former occasion, what passes, which the eye could not possibly see. For instance, although this represents the spectrum of the limb of the sun, it is quite possible, by means of the spectroscope, to detect the existence of magnesium vapour outside the sun altogether, although you know that, except during eclipses, we are never able to see these vapours. What I wish to call your attention to in the present case is this. We have there three magnesium lines, and you can see at once that two of them are much thicker than the remaining one. If this diagram were correctly drawn, you would see that these two lines travel very much higher into this outside region than does this third one. Now, you will see in a moment that that indicates to us a fact something like this. That the spectrum of magnesium, such as is generally at work, when it cuts out these very black absorption lines in the solar spectrum, where the sodium gives us the yellow line D, is really a thing which is competent to give us three lines. This vapour, I say, is a thing, generally speaking, competent to give us three lines in this position, but if it so happens that when the magnesium is thrown up here at a particular height, we simply get two lines, and tho third stops short, I think you will see that there is some force in one's reasoning, when one suggests that possibly those regions where we find the hydrogen F line thin instead of thick, as I have shown it to you, and when the magnesium lines become reduced to two instead of three—it is possible, I say, that in these regions the spectrum of magnesium vapour, like the spectrum of hydrogen, becomes very much more simple by the reduction of pressure, and that we really can artificially, therefore, as in the case of hydrogen, and as in the case of sodium, reproduce this result. In fact, it is perfectly easy to reproduce it, but, unfortunately, it is absolutely impossible to show it to you this evening. I am sorry that these delicate experiments do not lend themselves better to lectures of this kind, but the fact is this. We find by reducing the pressure of magnesium vapour we really can reduce that triple line of magnesium to a double one, so that you see we have three distinct lines of research, all leading us to the fact that where Kirchhoff placed an immensely dense atmosphere around a liquid sun we really have vapour of extreme tenuity, by no means so dense as he supposed. There is another thing of very great interest which I should bring before you.

Mr. Huggins, who has done so much in this kind of research, told us some few years ago that the spectrum of that wonderful variable star which had been just discovered indicated that over and above the light which we got from the star generally, we get indications of incandescent hydrogen in the spectrum, so that the spectrum was a thing such as had never been seen before, for we got in addition to the ordinary evidence of absorption visible in the spectrum of a star, as in the spectrum of the sun, indications also of selective radiation. Here, on the screen, is a carefully reduced drawing of Mr. Huggins' map of this wonderful variable star, called by astronomers *T Coronæ*. There are indications of bright lines superposed above the others. Now, let me tell you—and this is a very important part of the question—that by observing the various changes that take place in our central luminary—and I shall shall show you by-and-bye that it is quite possible to see on the sun almost any day evidence of its being violently agitated—that there are certain regions of the sun which appear exactly as that variable star did, that is to say, in addition to the ordinary absorption lines visible in the solar spectrum, the spectrum of these regions indicates to us that the hydrogen instead of being black, instead of reversing the spectrum, as you have seen it, in these spectra that I have shown you, really is bright, or else the hydrogen lines cease to be visible altogether. I will show you the types of stars which we owe to Father Secchi, and I think we must congratulate ourselves that we have in Rome an astronomer who, under those clear skies, has been enabled, during the last few years, to observe something like 600 stars, roughly of course; that is to say, he has not examined them with the close care and accuracy of Mr. Huggins, and he has not determined the actual positions of so many lines, but he has examined a large number, and has got them roughly grouped into the classes which you see in this diagram. You see, first of all, a spectrum of the sun, and the hydrogen lines which you see there, although so obvious, are really fine as compared with some of the lines in the other stars. Just below you see a type of stars in which several of the lines are much blacker and broader than they are in the sun, and here again are types of other stars in which evidently we have a difference in the characters of the surrounding atmospheres. Here, again, is a spectrum indicating channelled spaces instead of lines. I believe a continuation of research into the different spectra will show that these variations are due merely to changes in pressure, and will throw an enormous light on all these types of stars, and it will turn out very much as if Father Secchi, without knowing it, had classified these stars according to their pressures.

I have to give you, as the last application of spectrum analysis, the power which the prism gives us of determining, so to speak, the meteorology of the sun, the velocity with which the different stars are moving through space, and the velocity with which the storms are travelling over the face of our central luminary. Many of you know, no doubt, that Mr. Huggins, in his observations of the spectrum of the star Sirius, which I will show on the screen, saw that the hydrogen lines were much developed, and in a further examination, carried on by the method in which the spectrum of hydrogen and other vapours which he wished to examine, were absolutely visible in the field of view at the same time as was the spectrum of the star, Mr. Huggins was astonished to find that the hydrogen lines no longer occupied their usual position, but that they were all jerked, so to speak, a little to the side of the place which they occupied in the spectrum of the hydrogen which he rendered incandescent in his tubes. The F line of hydrogen which he observed in the spectrum of Sirius he found did not exactly occupy the same position in the spectrum as did the actual F line of hydrogen, the incandescent hydrogen with which he compared it. Owing to a physical law, which I have not time to explain to you now, it is perfectly easy, by means of the prism, to determine the velocity with which the light source is moving to or from us; and, therefore, if this holds good for absorption, we could determine the velocity with which any absorbing medium is rushing to or receding from us. In the case of Sirius, for instance, Mr. Huggins determined that the velocity of the star in a direction from the eye, the measure of recession, was something like 30 miles a second. I am very sorry I have not time to fully explain this very beautiful adaptation of the spectroscope, but I may say that the position of a line, bright or dark, in the spectrum depends upon its wave length; and I think when I mention that, you will see at once the possibility of determining any alteration of velocity—for an alteration of wave velocity we have, or appear to have, whether we move towards an object, or whether an object moves towards us, just in the same way as in the case of sound, and in the case of a wave reaching the shore. Suppose yourself a swimmer carried on a wave; if you are going with the wave it seems long, but if you attempt to swim against it it seems short. So with all these waves, beating from all these orbs, peopling the depths of space on to the earth. If by their own motion, or by our motion, the waves are crushed together, we get an alteration in the light, which the prism alone is able to determine. In this case the

star was approaching us, and we got shorter waves, and the lines are nearer the violet end of the spectrum; but if, on the contrary, it is going from us, receding, the waves are drawn out, they are thrown nearer to the red end. Mr. McLeod will now show us on the screen a spot spectrum, in which, instead of the sodium line D, we have the F line of hydrogen, and this strange crookedness which you notice is really a crookedness due to the fact that in one place we have incandescent hydrogen rising up with tremendous velocity, and in another we have it rushing down cool with tremendous velocity; again, we have hydrogen in a different condition altogether. We know that in this case we have a variation of velocity, because we get distinct changes in one direction or the other, and we get changes in both directions. We can determine by the amount of crookedness of the hydrogen, whether bright or dark, how far it is driven from its normal condition, and then how fast per second the hydrogen is travelling. In one case the velocity was something like 38 miles a second; in other words, we had heated hydrogen coming up at the rate of something like 38 miles a second, and cool hydrogen rushing down at something like an equivalent rate. Now, we are not only enabled, by a practical application of the prism, to determine these up and down rushes on the sun, by which we are enabled to learn much of its physical constitution, but also the rate at which storms travel in horizontal motion over the sun—what we should call a whirlwind. The way that has been done will be perfectly clear on an inspection of the next diagram. It may appear strange to you that we should be able to observe a cyclone on the sun, but I hope to be able to prove to you that this is really a cyclone. Here is a spectrum of the region of the sun near the limb, and here is the hydrogen line. It is clear, if what I have said is true, that the incandescent hydrogen is there receding from us as the line inclines to the red. It is evident also, that in this case, when we get the line lengthened out towards violet, it is coming towards us; therefore we have the thing travelling in both directions from this black line. It is obvious to you, I think, that if the slit enabled us to take in the whole cyclone, we should get an indication of two alterations; we should have it lengthened both towards the violet part of the spectrum, in the case of the hydrogen rushing towards us, and towards the red in the case of the hydrogen rushing away from us in this circular storm, and the extreme velocity will be determined by the extreme limit to which the hydrogen line extends. In this case, the storm was moving with a velocity of something like 100 miles a second, which, I dare say, strikes you as something terrible; but if you compare the size of the sun with that of the earth, I think you will see it was nothing very wonderful after all. In further evidence of the truth of this, the last application of the spectroscope, I will show you two pictures of solar prominences 27,000 miles high, drawn at an interval of ten minutes. Here you see, first, the prominence as it appeared at a particular time on a particular day last March. I wish to call your attention to the left-hand portion of the prominence, which you see is pretty straight. In ten minutes afterwards the whole thing changed, and, as you see by the next picture, that nearly upright portion is quite gone. That will give you some idea of the indications which the spectroscope reveals to us of the enormous forces at work in the sun, merely as representing the stars, for everything we have to say about the sun, the prism tells us—and it was the first to tell us—we must assume to be said about the stars. And I have little doubt that, as time rolls on, not only will the spectroscope become, in fact, almost the pocket companion of every one amongst us, but it is utterly impossible to foresee what depths of space will not in time be gauged and completely investigated by this new method of research.

Mr. Seymour Teulon at the conclusion of the lecture moved a vote of thanks to Mr. Lockyer for his admirable series of lectures, which was carried unanimously.

Mr. Lockyer, in acknowledging the same, thanked his audience for the attention they had bestowed, and also said that his thanks were due to his friends, Mr. McLeod, of the Royal College of Chemistry, and Mr. Pedler, for the able assistance they had rendered him in illustrating the lectures; and he also expressed his obligations to Mr. Browning for having placed at his disposal a most valuable series of spectroscopes to illustrate the different parts of his discourse.

ANNUAL INTERNATIONAL EXHIBITIONS.

The *Journal* having been made the official record of Annual International Exhibitions, under this heading will appear for the future all communications, announcements, and notices in connection with them.

The offices of the Commissioners are at Upper Kensington Gore, London, W.

The first of the series of Annual International Exhibitions of selected works of Fine and Industrial Art and Scientific Inventions will be opened at South Kensington, London, on Monday, the 1st May, 1871, and closed on Saturday, the 30th September, 1871.

The Exhibitions will take place in permanent buildings, now being erected, adjoining the Royal Horticultural Gardens.

The productions of all nations will be admitted, subject to their obtaining the certificate of competent judges that they are of sufficient excellence to be worthy of exhibition.

The first Exhibition will consist of objects in the following Divisions:—

- Fine Arts applied or not applied to Works of Utility.
- Manufactures, Machinery, and Raw Materials, including Woollen and Worsted Fabrics, and Educational Works and Appliances.
- Scientific Inventions and New Discoveries of all Kinds.
- Horticulture.

The attention of artists and manufacturers is especially called to Division No. 1. Hitherto the exhibition of works of fine art has been too much limited to the display of pictures and sculpture, disassociated from purposes of utility; and it may be doubted whether a picture on enamel or on pottery, destined to be applied to a piece of furniture, or a sculpture in wood, intended for a picture-frame, however great its merits, would find any place in the exhibitions of the Royal Academy of London, or in any of the numerous other exhibitions of the works of artists. Still less would a Cashmere shawl or a Persian carpet, the chief excellence of which depended upon its combination of colours, find in any of these exhibitions its proper place. Such a complete separation of artistic work from objects of utility may indeed be said to be the only characteristic of modern times; for in the ancient and mediæval periods the highest art is to be found in alliance with the meanest materials of manufacture. The Etruscans painted on vases of clay subjects which still charm us by their beauty of composition and skilful drawing; and the finest works of Raffaelle were designed as decorations for hangings to be made of wool. It is intended that these exhibitions shall furnish the opportunity of stimulating the revival of the application of the artist's talents to give beauty and refinement to every description of object of utility, whether domestic or monumental.

Every work in which fine art is a dominant feature will find proper provision made for its display. Painting, on whatever surface, or in any method—sculpture in every description of material—engravings of all

kinds—architectural design as a fine art—every description of textile fabric of which fine art is a characteristic feature—in short, every work, whether of utility or pleasure, which is entitled to be considered a work of excellence from the artistic point of view, may be displayed in the exhibitions under the division of Fine Art. While the arts and manufactures which fall within Division II. will have been brought under review in a series of seven years, the Fine Art division will recur annually, so that the greatest possible encouragement may be given to progress in the application of art to objects of utility.

Every artist workman, moreover, will be able to exhibit a work of merit as his own production, and every manufacturer may distinguish himself as a patron of art by his alliance with the artistic talent of the country. In the Fine Art Section the artist may exhibit a vase for its beauty of painting, or form, or artistic invention; whilst a similar vase may appear in its appropriate place among manufactures on account of its cheapness, or the novelty of its material.

The following is a list of the trades engaged in the production of educational works and appliances, each of which is eligible to exhibit productions in the first Exhibition, in 1871:—

List of Trades in the United Kingdom engaged in the production of Educational Works and Appliances:—

1.—School Buildings, Fittings, and Furniture.

Abacus frame makers.
Black board makers.
Diagram stand makers.
Easel makers.
Ink well makers.
Object lesson cabinet makers.
Reading frame makers.
School apparatus makers.
School building model makers.
School clock makers.
School desk makers.
School fitting makers.
School form makers.

2.—Books, Maps, Globes, Instruments, &c.

Chart sellers.
Copy book publishers.
Globe makers.
Ink powder makers.
Inkstand makers.
Map and chart sellers and publishers.
Map and print colourers.
Map engravers.
Map mounters.
Map printers.
Mathematical instrument makers.
Music copyists.
Music engravers.
Pen makers.
Pencil makers.
Penholder makers.
Publishers.
Quill and pen manufacturers.
Raised map makers.
School slate makers
Slate pencil makers.
Steel pen manufacturers.
Topographers.
Writing ink makers.

3. Appliances for Physical Training, including Toys and Games.

Archery tackle makers.
Backgammon board makers.
Ball and balloon makers.
Bowstring makers.
Bicycle makers.
Chess board makers.
Cricket bat, ball, and stump makers.
Croquet manufacturers.
Dissected map makers.
Doll makers.
Foot ball manufacturers.
Gilt toy makers.
Glass toy makers.
Gymnasium makers.
Hoop makers.
May dissectors.
Marble manufacturers.
Pedometer makers.
Puzzle makers.
Rocking horse makers.
Skate makers.
Skittle makers.
Target makers.
Top makers.
Toy makers.

4.—Specimens and Illustrations of the Modes of Teaching Fine Art, Natural History, and Physical Science.

Anatomical figure makers.
Aquaria makers.
Artists' colourmen.
Barometer makers.
Bird and beast stuffers.
Black lead pencil makers.
Botanical collectors.
Camel hair pencil makers.
Chemical apparatus makers.
Coloured saucer makers.
Crayon makers.
Drawing board makers.
Drawing instrument makers.
Drawing model makers.
Electric apparatus manufacturers.
Fossil dealers.
Galvanic apparatus manufacturers.
Geological collectors.
Magic lantern manufacturers.
Magnet makers.
Makers of musical instruments for schools.
Mechanical figure makers.
Microscope makers.
Mineralogists.
Naturalists.
Nautical instrument makers.
Optical instrument makers.
Orrery and tellurian makers.
Philosophical instrument makers.
Pink saucer makers.
Plaster cast figure makers.
Preparer of botanical specimens.
Preparers of microscopic objects.
Stereoscope makers.
Sun dial makers.
Telegraph instrument makers.
Telescope makers.
Thermometer makers.
Ward's case makers.
Zoological artists.

EDUCATIONAL NOTES.

The representatives of the League having laid their views before Her Majesty's ministers, at an interview referred to last week, a similar course was taken, on the 11th inst., by the Union, who also mustered a very numerous and influential deputation. The Right Hon. W. F. Cowper-Temple, after explaining generally the objects of the Union, said they thought it was not the province of the State to determine what form of religious education should be given, nor, on the other hand, ought religious education to be prohibited. The religious convictions of the parents ought to be respected, and they ought to have perfect liberty to withdraw their children from religious teaching to which they objected. It was feared that, if a heavy expense was cast on the rates, and any form of compulsion was enforced without respect to the place in which it was exercised, there would be great danger of rendering education unpopular. In conclusion, he expressed the approval with which the Union regarded the main principles embodied in the Government Bill. These views having been further urged by the Rev. Dr. Barry, Mr. Baines, Col. Akroyd, Lord Harrowby, and others, Mr. Gladstone, in reply, said the main principle upon which they appeared to insist was, he conceived, that religion should not be compulsorily separated from education, while, at the same time, they were willing that there should be the fullest admission of the rights of conscience. Of course, with regard to the mode of applying these principles, there would necessarily be involved much consideration of detail, which could be considered in committee. They would then, he hoped, grapple with the questions at issue in a way which would secure the establishment of those main principles on which all parties, to a very considerable extent, were agreed.

On the following day, a deputation from the Congregational Union, consisting of Mr. S. Morley, M.P., Mr. Winterbotham, M.P., and others, had an interview with Mr. Forster. They strongly deprecated the extension of the denominational system, and especially protested against the power given to local boards to establish new denominational schools, or to take under their management and support those at present in existence:—1. Because of the opening thus afforded for the introduction of religious strife in the various parishes; 2. Because of the sanction thus given to the principle of concurrent endowment; 3. Because the action of the compulsory clause will thus be greatly complicated, and under its

operation children will, in many cases, be forced into schools of sects to which their parents are opposed.

A Union meeting has been held in the Birmingham Town-hall, which, it is said, was as largely attended as the recent League meeting. Mr. Sampson Lloyd presided, and resolutions were passed in favour of the Government Bill, urging them to reject any amendments which opposed its main principles.

The objections put forward by the League to certain clauses of Mr. Forster's Bill have been supported, at meetings, most of which are described as "large and enthusiastic," held at Bromsgrove, Nottingham, Bolton, Leeds, Ipswich, Bath, and other places, but the views expressed are now of so stereotyped a character, that no special account need be given of them. An important League meeting is announced for Friday evening, the 25th inst., at St. James's-hall, Sir Charles Dilke, M.P., in the chair, to support the objections taken by the League, viz.:—1. That school boards are not provided for every part of the country. 2. The partial and uncertain manner in which education is to be made compulsory. 3. The extension of the denominational system.

The Nonconformists have had meetings at Southampton and at Newcastle-on-Tyne, to express their views on certain points in the Bill. These appear generally to be in accordance with those put forth by the Congregational deputation to the Vice-President, above referred to.

The Liverpool Town Council, at a recent meeting, adopted a report to the effect that the system of rating proposed by the Bill would operate unfairly and oppressively in all large towns, and in an especial degree in Liverpool, to which a large proportion of indigent and destitute population is attracted; that the duty of providing elementary education for the children of those who are unable, unaided, to supply it, should be undertaken as a national obligation; and that it should be urged upon Parliament "to make the taxation Imperial, and the education compulsory throughout the country."

At a large meeting of Roman Catholics, held at Liverpool, the chairman, Sir R. Gerard, advocated compulsion as necessary, owing to the debased condition of Roman Catholics. Mr. Maguire, M.P., moved a resolution, which was carried, that religious education alone would be acceptable.

Several of the Chambers of Agriculture have discussed the Bill, their recommendation almost invariably being that the limit of age at which attendance at school should be enforced ought to be reduced from twelve to ten years.

The Executive Committee of the Society for the Liberation of Religion from State Patronage and Control, have resolved that, inasmuch as the government Bill contravenes the society's principles, it should exert its influence to secure a modification of it.

It is stated that the English Catholic Bishops, now all except two in Rome, met together at the English College in that city on the 28th ult., to consider the best steps to be taken with regard to the Education Bill. The Archbishop presided, and the meeting continued discussing the measure for nearly three hours.

It appears by a parliamentary return, that the Committee of Council on Education have now 62 inspectors of schools, and 18 inspectors' assistants; the last year's salaries of the inspectors amounted to £23,250, and their allowances to £16,221, and the salaries of the assistants to £2,429, and their allowances to £320, besides the sums spent "on locomotion in the public service."

With regard to the education question in France, it appears that a committee has been formed at Strasbourg, for the purpose of starting an agitation in favour of the principle of gratuitous compulsory primary education. The movement seems to be progressing favourably. Public meetings are being organised even in towns which, until now, have never thought of availing themselves of the right of meeting, as at Metz, Colmar, &c. At Metz, 2,000 signatures have been obtained, and at Strasbourg, 3,000 persons have joined in one week. The *Opinion Nationale*, speaking of this movement, says:—"It is now no longer permissible to indulge in the common-place arguments of the liberty of the father of a family. Now, some thought is given to the liberty of the child, of the minor, of the weak, and especially is attention given to the necessity of enlightening in the future that universal suffrage which is henceforth the indisputable arbiter of our political destinies. It may, therefore, be said that the principle of compulsion is now almost universally admitted."

THE EDUCATION BILL IN PARLIAMENT.

On Monday evening, Mr. Dixon, President of the League, moved as an amendment to the Bill, a resolution "That no Bill will afford a satisfactory or permanent settlement which leaves the question of religious education in schools, supported by public funds, to be determined by public authorities." His chief objection to this part of the Bill was, that it would introduce strife into all districts of the country, and that in the end the minority would be called on to pay for teaching the religion of the majority. He warned the House that if the denominational system were adopted here, it could not be refused in Ireland. A conscience clause, however well drawn, he thought would be unsatisfactory and unworkable.

Mr. Forster in reply, complained that the point at issue was not fairly raised by the resolution, inasmuch as it suggested no alternative mode for disposing of the religious difficulty. He admitted that the mode proposed by the Bill was open to objection, but he maintained that it was the least objectionable. If the determination of the question of religious education were not left to the local authorities, it must be decided either by the government or by Parliament. It was hardly likely that the country would have sufficient confidence in any executive to leave such a matter to them; and, as to the second alternative, he showed that all who had attempted to deal with the religious difficulty, either in amendments to the Bill, or in Bills of their own, had been obliged to leave a certain discretion to the local authorities. The only other alternative of settling the question was secularism, which he decided against because the vast majority of the people believed morality to be based on religion, and valued the Bible; and nothing could be more unpopular than a statutory exclusion of religion from the schools. In replying to the charge that the Bill had "shirked" the religious difficulty, Mr. Forster asserted that these local authorities had been chosen because it was thought that they were the persons most concerned; and, so far from producing quarrels, he expected that the arrangement would lead more rapidly than any other to a peaceable settlement. He denied that the Bill gave exceptional advantages to the Church, or that the rights of Dissenters were left unprotected. He pointed out that every dogma of the League might be carried out under the Bill if the majority in any district were in favour of it.

The debate having been adjourned, was continued on the following evening by Mr. Winterbotham, who, in a singularly clear and able speech, expressed the views of a large section of the dissenting bodies, who were in favour of a secular system. He was followed by Lord Robert Montagu, Mr. H. B. Samuelson, Mr. Corrance, and Mr. Beresford Hope, who all supported the Bill. Mr. Miall vindicated the promoters of the amendment, but denied that they wished to overthrow the Bill, or to repudiate it as the basis of a settlement. He urged on the government to consider whether, by some kind of concession, they would not have the religious question settled by the House, and not relegated to the local authorities. He was followed by Sir Roundell Palmer, who warmly advocated religious education. The Hon.

Auberon Herbert supported the amendment, and the debate was continued by Mr. Lowe, who admitted as Mr. Forster had done, that there were objections to the clause against which the amendment was aimed—that it would lead to controversy, and so on—but no solution could be found which was not also full of objections. The government were willing to listen to any better suggestion for meeting the difficulty, and he hoped the House would go into Committee. The debate was adjourned to this (Friday) evening.

CORRESPONDENCE.

THE DESTRUCTION OF THE BREAKWATER AT WICK.

Sir,—Destruction, which has happened, more or less, to every breakwater on the English and French coasts, may be mainly attributed to two fundamental errors of construction. The most prominent is the persistent attempt, in defiance of nature's laws, so to combine small matters, whether of stone, wood, or iron, as to produce a structure that shall be capable of resisting the utmost fury of Atlantic storms. If we look round our stormy coast, we shall everywhere see large boulders, or detached masses of rock, which have never been disturbed since the memory of man. Such loose but immovable blocks may be generally estimated to be not much less than ten tons each, while smaller fragments are frequently knocked over in heavy gales. In forming a breakwater, therefore, that may defy the heaviest storm, we must lay down a series of rough blocks, not less than 10 tons each estimated weight, to the entire exclusion of all smaller rubble. This system is strictly economical because, by not filling up the vacant places, the least cubical measurement will complete the work. The sea may fill up the vacancies, but if not, no harm can result, because no rollers can pass, and merely broken water will take place inside the protecting barrier. The Plymouth breakwater is no exception, for it was many times injured during the construction. It was originally planned to be a mound of rough stone, forming a right angle at the vertex, with slopes at the ideal angle of repose of 45°; but the first storm settled the mass down to 130° at the vertex, with the real slope of only 25°, and owing to successive storms, many times the original estimate of materials, with a greatly increased outlay beyond the first estimate of the cost, was required to complete the work. Small rubble was allowed to be deposited, much to the benefit of the undertakers at the quarries, but to the great detriment of the work, and profitless expenditure of public money.

A secondary cause of failure has arisen from the false economy of attempting to combine a wharf or landing-pier with a breakwater proper, whereas true economy will teach us to obtain, first of all, smooth water by means of a line of rough rocks, and then we may construct a landing-pier, both at less expense and with perfect security, of any fashion required; but it must be entirely independent of the rough rock protection, appropriately termed "Scoyliera" in the Mediterranean, where numerous examples may be seen, which have endured for ages, composed of rough rocks, many over thirty tons each, and wholly unconnected with the landing wharf or pier inside.

The Eddystone Lighthouse is not a case in point, because, from its peculiar form, the Atlantic rollers split, and fall harmlessly upon that monument of engineering science and skill.—I am, &c.,

Henry W. Reveley.

Reading.

DRILL IN SCHOOLS.

Sir,—I find in our *Journal* of the 11th instant a report of the Committee on Drill. For the last fifteen years, I have been at the head of a military school, and it is with experience that I can speak on this subject. Drilling does not make a soldier; nay, drilling may prevent a young man from becoming a soldier. Although my pupils were exclusively military, and left me to join the army as ensigns and cornets, I had to give up drill; and my observations agree with those contained in the report of the Royal Commission on Military Education. This report recommends that the Sandhurst cadets should have as little drill as possible, because the colonels of regiments found that the cadets had to learn it afresh on joining. At first young men like it, then they grow tired of it, and at last they hate it. If the intention of the Committee is to support Mr. Cardwell's views, and to foster a military spirit, something else besides drill should be encouraged.

Eton, Harrow, and Rugby, &c., have long had their volunteer corps, but has it caused any change in the military capacity of the embryo cadet? I think not. In my opinion, drill and spade should be combined, and I should recommend the Council to seize the opportunity of the forthcoming review to induce the heads of public schools to adopt the teaching of fortification and military drawings. Cheltenham has already done it. Unless these professional subjects are begun in youth, we cannot expect great proficiency in after-life. The government intend having military instruction in all garrison towns, but unless a great amount of time is given to studies the results will be discouraging.

In the same number of the *Journal*, I see mention of a conference on the "Relation of the State to Science." I quite admit the necessity of fostering the study of science, and I believe that this is far more important than fostering a military spirit.

With regard to the army, however, a step is likely to be taken in the wrong direction. Geology was lately placed among the voluntary subjects of examination for Woolwich, Sandhurst, and direct commissions. The report of the Royal Commission recommends that geology should no longer be retained. Now, considering that our officers are spread all over the globe, I think that geology should be strongly recommended, and that the country could derive great benefit from the splendid opportunities which a "geological" officer possesses of increasing our knowledge of the formation of distant lands.

I shall not, for the present, trespass further on your ground.—I am, &c.,

A. F. Lendy (Captain).

THE ASYLUM FOR IDIOTS.

Sir,—I beg to call attention to an error in the article on "The Asylum for Idiots," in your number of the *Journal of the Society of Arts*, of the 4th inst. The writer states, "The Earlswood Institution, in the year ending March, 1869, provided for 291 pupils, that is, 164 boys and 127 girls." It should have been 472, that is, 313 boys and 159 girls.—I am, &c.,

William Nicholas, Secretary.

March 8th, 1869.

NEW PUBLICATIONS.

The following works are announced by—

Cassell, Petter, and Galpin, La Belle Sauvage-yard, Ludgate-hill:—
- Animal Kingdom. By Ellis A. Davidson. 2s. 1 vol.
- Thorwaldsen's Triumph of Alexander. 42s. Folio.
- Drawing for Carpenters and Joiners. Ellis A. Davidson. 3s. 6d.
- Natural History of Commerce. Dr. Yeats. 7s. 6d. Cloth. 1 vol.

Charlton Tucker, 21, Northumberland-street, Strand:—
- Medicine as a Profession for Women. By Charles Drysdale, Physician to the North London Consumptive Hospital, &c. 6d.

Religious Tract Society, 56, Paternoster-row:—
- Madagascar and its People. By J. Sibree, jun.
- The Midnight Sky. By Edwin Dunkin, F.R.A.S.

GENERAL NOTES.

Mr. Cooper, the Explorer. — This gentleman, who started to travel by way of Assam from India to China, has been stopped on the Thibet frontier, and compelled to return.

An Inch of Rain, so often mentioned in meteorological reports, means a gallon of water spread over a surface two feet square; in other words, an inch of rain means a fall of 100 tons of water upon an acre of land.

The Largest Organ in the World.—The largest organ in the world will be the organ now building by Willis, for the Hall of Arts and Sciences, South Kensington; it will have 111 sounding stops, independent of 14 couplers.

The Human Heart.—Professor Haughton, of Dublin, has calculated that the total daily work of the human heart (the ventricles only) is 124,208 foot tons. It does 50,876 foot pounds of work per minute for every ounce of its weight.

Medical Education Commission.—The General Medical Council has declined the proposal, put by Sir D. Corrigan and seconded by Dr. Rumsey, to have a commission of inquiry into the diverse and conflicting methods of medical education.

The Postal Telegraph System.—A scheme is said to have been submitted to government for extending this system to the colonies, and by one continuous cable, 24,000 miles in length, uniting all our colonies with each other, and with the United Kingdom.

South Kensington Museum.—By the death of Mr. William Gibbs, which took place at Faversham, on the 28th of February, the South Kensington Museum acquires the collection of Roman and Anglo-Saxon antiquities in the possession of that gentleman.

Sulphuretted Hydrogen.—M. Boillot states that, after he had placed sulphur in some jars which he had filled with hydrogen, and had passed an electric spark through the sulphur, which was thus ignited and volatilised, a perceptible quantity of sulphuretted hydrogen was produced.

Art Workmanship.—On Thursday evening, the 10th instant, a large party of the Society of Wood Carvers visited the rooms of the Society of Arts, by special permission of the Council, for the purpose of inspecting the specimens of art-workmanship sent in this year, in competition for the prizes.

Picric Acid and Ozone.—If picric acid be projected into a jar of ozone, it is found that an instantaneous explosion takes place. This may lead to new applications of ozone as an explosive agent for powders prepared for the purpose; although the whole question of the existence and properties of ozone is still very obscure.

Lighting Life-Buoys.—Experiments have been recently made at Toulon to try to attach to life-buoys another floating body provided with phosphide of calcium, which, on becoming wet, gives off spontaneously combustible phosphuretted hydrogen, thus emitting light to guide the man who might have fallen overboard and be in search of the life-buoy.

Purification of Glycerine.—When glycerine has been some time in use, it may be purified by the addition of 10 lbs. of iron filings to every 100 lbs. of the impure liquid. They must be occasionally shaken together, and the iron stirred up. After a few weeks, a black gelatinous mass will collect on the bottom of the vessel, and the supernatant liquid will become perfectly clear, and can be evaporated to remove any excess of water that may be added to it. Glycerine ought to be perfectly pure, as it is extensively employed to improve the taste of wine, being, unlike sugar, incapable of fermentation.

Munificent Bequest.—The late Mr. Thomas Smith, of Glassingall, who died lately at Avignon, has bequeathed £5,000 for building a museum, picture and sculpture gallery, and artizans' reading-room and library in Stirling, for the district, with nearly 500 oil paintings, water-colour drawings, and articles of vertu, valued at £6,000, and £14,000 to endow the institution.

Russian Gold Mines.—In 1866, the 1,043 gold mines belonging to Russia produced, through the labours of 60,000 workmen, 26,560 kilos. of pure metal. Siberia alone possesses 500 auriferous sources, employing 34,000 persons. The various Russian silver mines produced 18,000 kilos., whilst from the seven platinum mines 1,712 kilos. were extracted. The Ural mountains and other places yielded 4,320 tons of excellent copper.

Silk Cultivation.—An elaborate series of experiments on the subject of silkworm growth, health, and nourishment, is to be carried out this year on an estate of the Prince Imperial, between the Gulf of Trieste and Camero. Two tons of silkworm eggs, consisting of seventy-eight packages, valued at 800 dollars each, are said to have left Yokohama on December 2, and have passed on the Pacific railroad from California eastward, bound from Japan to France.

Dynamite.—Half-a-ton of dynamite, after being conveyed to the port of Rio de Janeiro, and from thence to the mines of the St. John del Rey Mining Company (300 miles), first by the government railway and then in mule waggons, and then finally over the mountains on mules' backs, has been safely received and found very effective. It met in the transit with much rough handling, but has not shown any of the dangerous qualities of nitro-glycerine which some feared that it possessed.

Ozone.—A method has been exhibited by Mr. Loew, at a meeting of the Lyceum of Natural History in New York, by which he claims to be able to obtain ozone in any quantity. He assumed that, during a certain stage of combustion of gas, ozone was generated, which was afterwards destroyed in the upper part of the flame. By tapping the cone of light at the right point ozone can be drawn off. This was done by blowing through the flame of a Bunsen burner, and collecting the product in a long glass jar. There was sufficient gas collected in the jar to prove, by its odour and the usual tests, that ozone was present.

Picric Acid.—This acid is recommended as a red dye for leather, iron, wood, &c. Dissolve 4 grammes of picric acid in 250 grammes of boiling water, and add, after cooling, 8 grammes of ammonia. For the second bath dissolve 2 grammes of crystallised pichsine in 45 grammes of alcohol, and dilute with 375 grammes of hot water, and finally add 50 grammes of ammonia. When the red colour of the pichsine has disappeared, mix the two baths, and immerse the articles to be dyed. For ivory and bone the bath ought to be made slightly acid with nitric or hydrochloric acid. On adding gelatine to the bath, it can be used as a red ink.

Progress of Queensland.—In 1860, Queensland had 28,000 inhabitants; now it has 110,000. In 1860, there were 41 schools, attended by less than 2,000 children; there are now nearly 200, with about 13,000 pupils. Nearly 2,000,000 of acres are now leased, more than 13,000 planted with cotton, and more than 5,000 under sugar. Sheep have increased, between the two periods, from 3,000,000 to 9,000,000, and horned cattle from less than half a million to more than a million. In mineral productions the increase has also been marvellous. More than 200 miles of railway are in use, and about 2,000 miles of telegraphic lines. The imports have risen from three-quarters of a million to two millions, and the exports from half a million to nearly two millions and a quarter. The revenue has increased to more than £750,000, from £178,000 in 1860; and the expenditure, apart from loans, has swollen in about the same ratio.

Discovery of Coal in the Brazil.—R. von Brause (in *Cosmos*) states that he has discovered coal of very good quality in the Santa Cartharina, near Ararangua. The seam which crops out has been explored for a distance of some 30 miles, and found to be of an average thickness of one metre. This coal has been thoroughly tested and analysed by Dr. Netto, of Rio de Janeiro, and is interesting as one of the very few instances of a true coal occurring in a recent geological formation, although in the United States and in Hanover (on the very borders of the Netherlands), two or three such occurrences are on record. The coal here alluded to is an excellent quality of gas coal.

The Suez Canal.—"There is," says the *Homeward Mail*, "quite an excitement, it seems, on the part of our continental neighbours, to secure coaling stations in the Red Sea for steamers working through the Suez Canal. The Prussians, we learn, are surveying the Arabian coast in the hope of obtaining some convenient spot for opening a new port and establishing a Prussian station; and the French, if they have not already secured the port of Synd Bunder, are in treaty for it. The permanent success of the canal becomes more evident every week. The first mails have passed through by the French packet, and this month the transport *Jumna* is to attempt the passage."

Secret Telegraphy.—Mr. Robert Slater, secretary to the French Atlantic Telegraph Company, has perfected the following system. Opposite a vocabulary of common words, he has placed combinations of five figures, each determined upon a principle which does not directly affect the result. By deduction or addition, on a system pre-arranged, the receiver of the message arrives at the numbers which stand for the words really intended by the sender. Meanwhile, the telegraph clerk finds the message a chaotic combination of non-sequent terms. The system of interchanges is comprehensive, and nothing is needed but that the receiver should know in which of the keys the sender has pitched his communication.

Post-office Statistics.—A recent Parliamentary return says that the estimated number of inland letters posted in the United Kingdom, in 1869, was 772,000,000 (exclusive of official correspondence), realising £3,438,183 in postage. It shows that the loss that would be produced if, on all letters reaching 2 oz. and not exceeding 16 oz., the charge did not exceed 4d., and if all others exceeding 16 oz. were charged at the book-post rate, should there be no increase in the number transmitted, would be £65,247. Should the reduction lead to double the number transmitted, the gain would be £1,440; if treble the number were thus transmitted, the gain would be £68,127. No fewer than 55,000,000 newspapers and book packages passed through the post in 1869, producing £408,792.

Aylesbury Dairy Company's Buildings.—The new establishment of the Aylesbury Dairy Company, in St. Petersburgh-place, Bayswater, will be open for public inspection for one week from to-morrow (March 19th). The whole of the business is concentrated under one roof, somewhat after the fashion of a railway station, the line of rails being occupied by the milk vans, which drive in underneath a glass-covered shed, and deposit their burden on the platform. At the street end (where the booking-offices would be) are the business offices and the manager's residence, while the upper story, parallel with the platform, is occupied by the *employés* of the company, with their wives and families. Every attention has been paid to their comfort in the arrangements of the rooms and offices, as also in the milk-cooling and cream rooms, which are panelled with glazed tiles, and appear perfectly impervious to damp. The range of buildings opposite the dwellings is occupied by stabling, all the minutiæ of which are carried out with the most recent sanitary improvements.

Portable Motive Power.—A correspondent of *Nature* draws attention to an important discovery made by an American, which bids fair to supply the want of a portable motive power for machinery. At the last exhibition of the American Institute, it seems there was shown an elliptic lock-stitch sewing machine, driven by an electric engine small enough to fit into a common hatbox. A series of eight magnets are set on the periphery of a circle, and around these revolves an armature of steel, which is continuously propelled by the magnetic action, and thus operates the machinery that moves the needle. Connection with this motor is had by means of a small slide within reach of the operator, at whose will the current may be cut off entirely, or the speed of the needle graduated as may be desired.

Spectrum of the Fire-fly.—The spectrum given by the light of the common fire-fly of New Hampshire is, according to Mr. C. A. Young's observations, perfectly continuous, without trace of lines either bright or dark. It extends from a little above Fraunhöfer's line C in the scarlet, to about F in the blue, gradually fading out at the extremities. It is precisely this portion of the spectrum that is composed of rays which, while they more powerfully than any other affect the organs of vision, produce hardly any thermal or active effect. Very little, in fact, of the energy expended in the flash of the fire-fly is wasted. It is quite different with our artificial light. In an ordinary gas-light, it is proved that not more than one or two per cent. of the radiant energy consists of visible rays, the rest is either invisible heat or actinism; in other words, more than ninety-eight per cent. of the gas is wasted in producing rays that do not help in making objects visible.

The Manufacture of Marbles.—Marbles are chiefly manufactured at Oberstein, on the Nabe, in Germany, where there are large quarries and agate mills. The substance used is a hard calcareous stone, which is first broken into blocks nearly square, by blows with a hammer. These are thrown, 100 or 200 at a time, into a small sort of mill, formed of a flat stationary slab of stone, with a number of concentric furrows upon its face. A block of oak or other hard wood, of the same diametric size, is placed over the small stones, and partly resting upon them. This block or log is kept revolving, while water flows upon the stone slab. In fifteen minutes the stones are turned to what are henceforth termed "marbles." One establishment, containing only three of these rude mills, will turn out as many as 60,000 marbles in each week. Agates are made into marbles by skilfully chipping the pieces nearly round with a hammer, and then wearing down the edges upon the surface of a large grindstone.

Statistics of Sugar (France).—The Administration of Customs (France) have published the Statistics of Commerce for 1869. The following figures have been republished from the *Journal Officiel*, with remarks by M. Dureau, in the *Fabricant de Sucres* (Paris and Compiégne):—

Exportation of Beet Sugar.

	To England. kilos.	Other countries. kilos.
1869	22,585,966 ..	26,160,046
1868	24,094,850 ..	28,063,983
1867	24,223,496 ..	27,774,980

Exportation of Refined Sugar (France).

	To England. kilos.	Other countries. kilos.
1869	24,804,248 ..	99,354,463
1868	17,580,014 ..	84,091,729
1867	18,447,498 ..	90,847,390

The increase of exportation of refined sugar from France to England being upwards of 7,000 tons, in 1869, over 1868.

Popular Instruction at the Public Museums.—The Working Men's Club and Institute Union have, with permission of the authorities, arranged for a series of visits to the national museums on Saturday afternoons for the members of workmen's clubs. The important feature connected with these visits is, that in each case the party will be under the guidance of some gentleman specially qualified to afford instruction in some particular branch of science and art. To enable the great majority of visitors to these valuable national collections thus to learn something of the history and nature of the objects they see there, is a real service to the cause of popular instruction. A party of 50 workmen paid a visit to the Egyptian department of the British Museum on Saturday, under the guidance of Samuel Sharpe, Esq.

The Architecture of the Human Body.—Professor Humphrey, in his fourth lecture on this subject at the Royal Institution, said that as the tail diminishes in animals, the hinder limbs seem to grow out. Thus, the serpent is nearly all tail and no limbs; the whale, with its shortened trunk, has a broad flat tail; also, as the tail of the tadpole disappears, the hind legs of the frog take its place. Man has the bones of a small incipient tail, with three flat sides; this tail turns inwards, so that the human being is really the only animal in creation who can occupy an arm-chair in comfort. The head of the thigh-joint rests in a socket so very shallow that it is only held in its place by atmospheric pressure and the ligaments surrounding the joint; and the leg swings to and fro below this shallow socket very much like a pendulum.

Oxidation of Iron.—Dr. F. C. Calvert, in a paper published in *Comptes Rendus*, gives a full description of a series of experiments made with the view to establish precisely the causes of and conditions under which iron rusts. The author comes to the conclusion that the carbonic acid, as well as the watery vapour, contained in the atmosphere concur jointly in causing iron to rust. Prof. Chevreul makes the following observations on this subject:—Claude Bourdelin was the first who observed (in 1683) that ammonia is formed when aërated water acts upon steel. In 1720, E. F. Geoffroy found that iron rust formed in the air contains moisture and ammonia. Vauquelin found ammonia in the specks of rust formed upon a chopper, of which it was suspected that it had been used for murdering somebody; the presence of ammonia in iron rust should, therefore, be cautiously dealt with in medico-legal questions. According to Dr. Calvert, pure iron does not decompose pure water at the ordinary temperature; and if this is correct, the fact observed by Prof. Chevreul, that the white hydrated protoxide of iron decomposes water, becomes more interesting.

Exhibition of Industrial Art at Liege.—Contributions to the international exhibition are to be sent in not later than the first day of May, addressed *à la Société de Union des Artistes, au Théâtre Royal, à Liége.* The commission undertakes the charge of carriage by railway goods train, up to the weight of 25 kilogrammes (55 lbs.) Each contributor is required to furnish a declaration that the contribution or contributions he sends are of his own production, and if any one has aided him in his work he must give their names and addresses; he may also affix a selling price to the articles, and the commission undertakes to effect sales, should purchasers offer, without charge for commission. Designs are admitted as well as manufactured objects, but they must be framed or affixed to boards or cards; small objects of jewellery and goldsmiths' work should be placed in jewel boxes, and enclosed in locked show cases. A silver-gilt medal will be awarded to the author of the collection of designs which exhibits the greatest progress in industrial art; and silver medals for series of three designs for any branch of artistic industrial work. The commission will purchase a number of the objects exhibited, and distribute them by means of a lottery.

Statistics of Victoria.—The total quantity of land sold, during 1868, was 275,648 acres, which realised £359,702 12s. 7d., or an average of £1 6s. 1d. per acre. The total quantity of land sold in the colony, up to the end of 1868, was 6,675,246 acres. The total quantity of uncultivated land is 48,967,803 acres. During 1868, 1,403 selectors leased 303,557 acres, the rent on which was £15,222. There were 1,050 squatting runs, the approximate area of which is 27,034,785 acres. The quantity of wheat raised during the year was 817,565 bushels, and 6,743 bushels of other cereals more than in 1867, whilst there were 74,949 bushels of oats, 3,203 bushels of barley, 37,843 tons of potatoes, 17,792 tons of hay, 323 cwts. of tobacco, and 10,525 gallons less than in 1867. The agricultural implements and machinery upon farms is valued at £1,144,489. There are 136 flour and grain mills, 127 of which are worked by steam. The quantity of flour made during the year was 98,809 tons. The number of persons employed upon farms was 60,711, and on stations 7,591, making a total of 68,302 persons in agricultural pursuits. The following is the estimate of the live stock:—Horses, 143,934; cows, 181,854; cattle, 571,828; sheep, 9,756,819; pigs, 136,206. There were 83 stone quarries, which yielded 416,329 tons blue stone, 325 tons granite, 2,000 tons slate, 5,085 tons sandstone, the approximate value being £57,680. There are 107 breweries, and 17,156,282 gallons of beer were made during the year. There are 222 brickyards and potteries, from which 60,980,000 bricks, valued at £120,985, were turned out, besides pottery valued at £10,456. There are 853 manufactories, employing 14,253 hands. There are 2,651 distinct quartz reefs, and the ground worked upon is 884 square miles; the estimated value of the gold mining claims is £8,869,504. The quantity of gold obtained was 587,694 ozs. from quartz veins, and 1,069,804 ozs. from alluvial working; total quantity, 1,657,498 ozs.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. Benjamin Paul, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light."
Institution of Surveyors. Adjourned discussion on Mr. Squarey's paper, "A Plea for Culture in the Profession of a Surveyor."
Social Science Assoc., 8. Mr. James Lewis, "On National Returns of Sickness."
Entomological, 7.
Medical, 8.
Asiatic, 3.
Victoria Inst., 8. Mr. S. R. Pattison, "On Geological Proofs of Divine Action."
London Inst., 4.

Tues ...Royal Inst., 3. Prof. Rolleston, "Nervous System."
Social Science Assoc., 8. Mr. R. H. Hutton, "On Reciprocity." (At the House of the Society of Arts, by permission.)
Civil Engineers, 8. 1. Continued discussion upon Mr. Fox's paper "On the San Paulo Railway." 2. Mr. Robert Briggs, "On the Conditions and the Limits which govern the proportions of Rotary Fans."
Ethnological, 8. Mr. Campbell, "On Current British Mythology and Oral Tradition."

Wed ...Society of Arts, 8. Adjourned discussion on Mr. Bridges Adams's paper on "Tramways in Streets."
Geological, 8. 1. Mr. R. J. Lechmere Guppy, "On the Discovery of Organic Remains in the Carribean series of Trinidad." 2. Mr. Ralph Tate, "On the Palæontology of the Junction Beds of the Lower and Middle Lias in Gloucestershire." 3. Mr. T. H. C. Hood, "On the Geology of the district of Waipara River, New Zealand."
R. Society of Literature, 8½.

Thur ...London Inst., 7½.
Royal Inst., 3. Prof. Odling, "Chemistry."
Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Royal Society Club, 6.

Fri ......Royal Inst., 8. Prof. Rolleston, "Anglo-Saxon Conquest."
Quekett Club, 8.
East India Assoc., 8. Lieut.-Gen. Sir Arthur Cotton, "On the Additional £100,000,000 proposed to be Expended for Railways in India."

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Mr. Lockyer, "The Sun."

Journal of the Society of Arts.

FRIDAY, MARCH 25, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS

Wednesday evenings, at eight o'clock :—

March 30.—"On Submarine Channel Communication." By Thomas Page, Esq., C.E.

April 6.—Adjourned discussion on Mr. W. Bridges Adams's paper "On Tramways for Streets." On this evening Chas. Hutton Gregory, Esq., will preside.

INDIA COMMITTEE.

On Friday evening, April 1st, 1870, Hyde Clarke, Esq., will open a Conference "On the Through Route to India." The chair will be taken at 8 o'clock. Members and their friends are invited to attend.

CONFERENCE.

The Council have decided to call a morning conference at an early date* to discuss the question of the "Relations of the State to Science, and the Necessity for Official Inquiry into the subject by Royal Commission." Col. Strange, F.R.S., will open the discussion by reading a paper on the subject. Members and their friends are invited to attend.

CANTOR LECTURES.

The second course of Cantor Lectures for the present Session, by Dr. Benjamin Paul, F.C.S., was continued on Monday last, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," The concluding lecture will be delivered on Monday evening, next, the 28th of March, at 8 o'clock.

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum on Wednesday evening, the 27th of April. Cards will be issued shortly.

DRILL REVIEW.

The Council have the pleasure of announcing that the review of schools drill will take place in June, as stated in the *Journal*, p. 343, in the presence of his Serene Highness Prince Teck and her Royal Highness the Princess Mary of Teck.

* Notice of the day and hour, when fixed, will appear in the *Times* and other newspapers.

EDUCATIONAL ORGANISATION.

The attention of those specially interested in the great educational question now before the public, is requested to two reports received by the Council this week, the one a report by Mr. Bartley, a member of Council, on one square mile of the East-end of London, issued this week as a supplement to the *Journal;* the other a report by Mr. Allen, on a first-class suburban district, comprised in a radius of three miles round Richmond, Surrey, which will be issued with next week's *Journal.*

POSTAL COMMITTEE.

The following gentlemen have authorised their names to be added to the list of this Committee :—

Bentall, Edward, H., M.P.	Hornby, Edward K., M.P.
Brewer, Dr. William, M.P.	Loch, George, M.P.
Brown, Alexander H., M.P.	Richard, Henry, M.P.
Cave, Thomas, M.P.	Sherriff, A. Clunes, M.P.
Dalway, M. R., M.P.	Stevenson, James C., M.P.
Fielden, Henry M., M.P.	Tite, Sir William, M.P.
Grosvenor, Capt. the Hon. R. W., M.P.	Whitwell, John, M.P.
Hick, John, M.P.	Williams, Watkin, M.P.

POSTAL SERVICE.

The Council have placed the following Petition in the hands of Lord Henry G. Lennox, their Chairman, for presentation to Parliament :—

To the Honourable the Commons of Great Britain and Ireland in Parliament Assembled.

The Humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, Incorporated by Royal Charter.

Sheweth,

I. That the Society, in common with kindred associations, and with persons engaged in Arts, Manufactures, and Commerce, is limited in its operations, and especially in its gratuitous weekly distribution of between three and four thousand copies of its *Journal*, by over-taxation for the conveyance by post of circulars, small packages, and parcels, a service which is now cheaply and efficiently performed by the post in Switzerland and in Prussia, and by the government railway authorities in Belgium.

II. That, in this country, the Post-office has a public agency of some twenty-six thousand officers, and of upwards of twelve thousand postal stations for the collection and distribution of letters, small book and sample parcels, and for the collection and distribution of money, —which agency acts by upwards of forty-nine thousand miles of daily railway conveyance, and beyond this of thirty-three thousand miles of daily conveyance by coach, omnibus, and mail-cart, and also by upwards of seventy-two thousand miles of daily conveyance by foot messengers from the twelve thousand postal stations.

III. That the postal establishments, with service of collection and distribution, nearly cover the whole country, and constitute a public agency capable of rendering service with profit, for the distribution of small parcels, whilst extra payment might be allowed to the distributors. That no private, and therefore separate, establishment can render such service except at a loss, unless under exceptional circumstances in crowded town districts.

IV. That the recent adoption by the Post-office of the

telegraphic post has recognised and confirmed the principle long since expounded and demonstrated in the discussions which have taken place in this Society, and that the successful practice of Belgium, Switzerland, and other administrations, has shown that the principle may be adopted at reduced charges with replacement of revenue.

V. That it may be confidently predicated, from the relative greater activity of business in this country, that a considerable further successful result, in a pecuniary point of view, may be anticipated, by any improved systems of intercommunication adopted here.

VI. That your petitioners, by letter last year to the Board of Trade, endeavoured to draw attention to the Continental advances and experience beyond our own in these respects.

VII. That your petitioners submit that Continental experience has shown that not only printed matter but other matter, with the limitations as to size and weight which are placed upon the transmission of samples by post, may be carried at a rate of twopence per pound, and of a halfpenny for every quarter of a pound or under.

VIII. That your petitioners repudiate the notion, as false in political economy, that the public should abstain from utilising its own establishments to any extent for its own service—and that it should do so for the maintenance of separate and private establishments at extra and wasteful expense, to the detriment of the great elements of free trade, cheap, uniform, convenient, safe, and free transit. Your petitioners, nevertheless, submit that the proposed limit of twopence per pound would not interfere, or would interfere only in a very inconsiderable degree, with the distribution by parcel delivery, by railway or other companies, which now carry at much lower rates than a halfpenny per pound; and that the proposed measure for postal conveyance would only come into regular operation in those instances where, from railway stations being only as about one to every seven or eight of postal stations, it is necessary to send a single parcel by a separate messenger, in which cases the expense, in a large proportion of cases, is prohibitory.

IX. That it was demonstrated in the evidence of Sir Rowland Hill, that the additional goods traffic by railway producible by the utilisation of the postal agency for the distribution of books or parcels would, in the augmented traffic, be beneficial to the railway companies, who may, therefore, in the interests of the shareholders, be fairly compelled to carry mail packages at a small fixed per-centage above their rates of carriage for private goods packages.

X. That the more the public distributing agency has to do, under a competent administration, the better it may do all parts of its work, producing the greater net revenue; that to limit the reduced charge to merely one sort of printed matter, or to any one sort of matter now comprehended in the sample post, would be to augment the proportion of the establishment charges on that one sort of printed or other matter, and diminish thereby the return of profit, in service or of revenue to the public.

XI. That, where the augmented traffic may become too heavy for foot messengers, it will pay for delivery by horse or mail cart—and thus speed the general delivery of other matters.

XII. That your petitioners are of opinion that all extra service on the part of the highest officers, as well as the lowest foot messengers, should be accompanied by extra remuneration, your petitioners fully recognising the value of the opinion expressed by Sir Rowland Hill on this subject, that the introduction of a proper system of parcel postage would afford a means of augmenting the payment and improving the condition of the inferior officers of the post, and of inducing a higher and better class of persons to enter that branch of the public service.

XIII. That your petitioners, regarding the years that elapsed after the principles of the telegraph post had been demonstrated, both inside and outside the postal department, with the sanction and entire support of Sir Rowland Hill, before attention and adoption was gained for it; considering also the grievous expense that has been incurred by the delay in the growth of interests which it has been necessary to buy up; viewing also the fact that the parcel post question formed part of Sir Rowland Hill's scheme some years ago, as he states; seeing further that it is now eleven years since it was completely examined and expounded in a report by a special committee in this Society, which received the general support of the Chambers of Commerce throughout the country; and that recognition is as yet only got for a small portion of the principle, to be applied to a part of one sort of matter for which it is required; and further, viewing the fact that these elaborations and expositions of administrative principle in this country have been for the advantage of the commerce of rival states on the Continent, such as Prussia, Switzerland, and others by whom the principles have been early adopted and got into most successful action, and where astonishment is expressed that England, which is generally so clever and advanced in Manufactures and Commerce, should nevertheless be so negligent and backward in its means of internal communication;—submitting these facts,

Your Petitioners therefore humbly pray that your Honourable House will take the premises into your consideration, and make such alterations as in your wisdom you may deem meet for bringing up the action of the postal department on the matters in question to the administration of other countries, and to the increased freedom of transit which is needed for the progress of the Arts, the Manufactures, and the Commerce of this country.

Sealed with the Seal of the Society for the Encouragement of Arts, Manufactures, and Commerce, this twenty-first day of March, One thousand eight hundred and seventy, in the presence of (L.S.)

P. Le Neve Foster, Secretary.

METROPOLITAN PUBLIC WORKS AND BUILDINGS COMMITTEE.

The following notice has been given by Lord Elcho on this subject:—

On going into Committee of Supply on Civil Service Estimates, Lord Elcho to move:—"That no general control over works and buildings in the metropolis, constructed under Parliamentary sanction, being at present vested in any government or public officer or department, other than that now exercised by departments of government over the buildings that are under their superintendence; and the design and execution of unsightly works, such as the Charing-cross Railway Station and the railway bridges across the streets and roadways of the metropolis, as well as the juxtaposition of the London, Chatham, and Dover Railway-bridge and the new Blackfriars-bridge across the Thames, being reasonably attributable to the fact that railway, gas, water, and other public companies, or corporate and chartered bodies, have not been hitherto required to deposit designs, elevations, or models of projected works or buildings when applying for Parliamentary powers; it is the opinion of this House that, having regard to the improvement of the metropolis, and as a security against its further disfigurement, it is desirable that whenever any public company or corporate body applies for Parliamentary powers to enable it to execute any works, or erect any buildings in the metropolis, or to raise money for the execution or erection of such works or buildings, it should, as recommended by the Thames Embankment Committee of last session, before coming to Parliament, deposit at the office of the Commissioners of Her Majesty's Works and Public Buildings, plans and eleva-

tions, designs or models, in like manner as railway companies are now obliged to deposit plans and sections at the Board of Trade, and that the Standing Orders be amended so as to effect this object. And it is further the opinion of this House that the First Commisioner of Works should, as also recommended by the same Committee, report to Parliament on such plans and elevations, designs, or models, and that such reports should be referred to the Committees on Private Bills, in the same manner as the reports from the Board of Trade and Admiralty are now referred, and that they be also laid before both Houses of Parliament along with the plans and elevations, designs, or models on which they are based.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

SIXTEENTH ORDINARY MEETING.

Wednesday, March 23rd, 1870; Charles Hutton Gregory, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Bourdeaux, John, 7, Clarence-place, Dover.
Cracroft, Bernard, 4, Austin-friars, E.C.
Cuthbertson, James, 30, Newgate-street, E.C.
Day, Arthur, Lifford-lodge, Barnsbury-park, N.
Harding, James, 20, Nicholas-lane, Cannon-street, E.C.
Sartoris, Edward John, M.P., 9, Park-place, St. James's, S.W.

The following candidates were balloted for, and duly elected members of the Society:—

Brunton, John, C.E., 19, Phillimore-gardens, Kensington, W.
Crawley, J., 23, Thavies-inn, E.C.
Edwards, Frederick, 49, Great Marlborough-street, W.
Gay, F. W., F.R.M.S., 113, High Holborn, W.C.
Hamilton, Rowland, Oriental Club, Hanover-square, W.
Lever, J. O., 18, Palmerston-buildings, Old Broad-street, E.C.
Welch, Stanley Kemp, 9, Christchurch-road, S.W.

The adjourned discussion on Mr. W. Bridges Adams's paper on "Tramways for Streets," was opened by—

Mr. Greaves, who stated that a more important question had never come before the Society of Arts than the present one. From the commencement of the metropolitan system of railways, in 1863, to the end of 1869, they had carried 150 millions of people. He found that the tramways in New York carried 100 millions in one year, 1869; and they had a population of only two millions in New York, whilst in London there was a population of three millions. He saw that Mr. Le Fevre, in his speech on introducing the Public Tramway Bill, said that he understood that the Liverpool tramway was a success, and so it might be in a financial point of view, but he was sure it was not an engineering success, nor was it successful from a humane point of view. First of all, with regard to the permanent way and the carriages. Such a system as that adopted in Liverpool was bad in many respects, and even if a flange-wheel system was good in itself, it was badly carried out. In the first place, the permanent way was totally insufficient to carry the traffic, and in about six months it would present the same appearance as that of Salford did now, which, when he was there a few weeks ago, looked like two small canals all through the street, it being a wet day; and to his knowledge it had presented the same appearance during the last five years. The road there was just like that now being laid down on the Bow and Stratford road, about 4 inches broad by 6 inches deep. The rail was 4 inches broad at the top, $1\frac{1}{2}$ or $1\frac{3}{4}$ inch deep; but it had an unfortunate defect. It was made of the weakest possible kind of iron. It was about 48 inches a foot forward per rail, but the American practice, as followed by Train, had a bearing surface of 84 inches per foot forward, and that made an efficient road. There were longitudinal sleepers 5 inches broad, and cross-sleepers 4 inches by 4 inches, 6 feet apart, which gave 84 inches per foot forward per rail. At Liverpool they had adopted only 48 inches, which was totally insufficient. With the iron system of sleepers it was possible to do with less than that, for in his own practice he had done with $10\frac{1}{2}$ inches, and had sent out some thousand of miles of iron sleepers to India to construct a road on this system, which had answered very well. The centre part of the road was no use at all, and was rather a weakness than a strength to the rest of the road. This clearly proved that the bearing surface of the Liverpool tramways was deficient; and he had no doubt that if the Whitechapel-road sleeper were examined, it would be found that the bed of concrete would be broken right under the sleepers. In the Dublin and Kingston Railway, when it was first opened, Mr. Vignoles, thinking to make a very strong road, instead of putting isolated blocks, according to the general practice, put stone blocks right across the line, but it had not been opened many months before every block broke right up the centre; and he had no doubt that the concrete under the Whitechapel-road would be found to be broken in the same way. Then, again, as to the carriages. He called them the most clumsy, ill-contrived things possible. No doubt they were roomy; in fact, they were too large, for in the streets of London they did not want anything like a width of 6 feet 6 inches, which would absolutely block them out of many streets which it would be desirable to go through; and not only that, but they had within themselves the elements of destruction. The body was 16 feet long; and with the two end platforms of 3 feet each, it was about 23 feet over all. The wheels were 6 feet apart, and they were very small. In America these cars carried 120 people, which, with the weight of the cars, was about 11 tons, or about $2\frac{3}{4}$ tons on each axle, and the effect was, that after running five or six years, the carriage hogged or bent down at each end, and the water got into the joints, and the American ash very soon gave way, and they tumbled to pieces. That had now been attempted to be remedied by the introduction of iron truss girders, one under each seat, and two also inserted above, but still the build of them was diametrically opposed to what English experience showed to be the proper method. Even 13 years ago the engineer of the London General Omnibus Company reported that it was desirable that the axle should be made to radiate, and that radiation of the axle was, he believed, one of the most important things to be insisted upon. In fact, he calculated that the rigidity of the axles in these cars, that is, their being retained in a position parallel to each other, together with the smallness of the wheels, was equivalent to an additional weight of two tons, or, in other words, the same tractive power would draw two tons more with a properly-built carriage. Of course, the grand thing in all tramways would be to reduce the friction to a minimum. Mr. Greaves then exhibited a model, showing the two axles of a vehicle connected together by the centres, or what

he called the neutral axes, and these would run either in a straight line, or follow any necessary curve, with the least possible friction. This system was applicable to a grooved rail, although he did not recommend it, as he thought it was fraught with several evils. It had been found in America, that with chilled wheels the rails were very soon ground away by the road grit. Of course, the chilled wheel-tires were very hard and wore a long time, but they soon knocked up the wrought-iron rails. He proposed, therefore, to do away with flanges for the wheels altogether, and to introduce a something in the shape of an inverted Y, having three surfaces, each of which could be used in succession, and he calculated the rail being chilled a quarter of an inch deep, it would live for forty-four years. It had been said that iron rails would last for fifteen years, but experience showed differently, seven years being about the extreme limit, for if they lasted longer at the top the other parts would wear out, as well as the wood upon which they were laid; and this reminded him that wood was a material which should be avoided altogether in the construction of a permanent way. There was no need for the flexibility it was supposed to give the springs of the carriage, for when the speed was only 8 or 10 miles an hour it was quite sufficient to prevent any undue vibration. The cost of such a rail as he proposed would come out much less than the present wood and iron combined, being only 85 lbs. per yard forward per rail, or 130 tons per mile. The present grooves were used three-quarters of an inch deep, and the flange was half an inch deep, which gave a quarter of an inch to wear on, but with his rail he could wear off half an inch before the rail was done, which, taking the life of a rail at 7 years, would give him 14 years for each surface. It might be said that this was cast iron, which would not wear like wrought iron, but he could not agree to that, for he remembered the old cast iron rails on the Stockton and Darlington line, which were better than any wrought iron rails he had seen lately. It might be said, again, that cast iron rails had been used in America, and wrought iron ones had to be substituted, but then they were cast iron on wood sleepers, and there was no strength in them. However, he was not tied to the use of cast iron, for wrought iron on one of his sleepers would answer the purpose quite as well, and the expense would not be much greater. It might be thought that they could not work well on a curve, but he had proved that this could be done, for with a tyre of five inches there was a longitudinal traverse of ten inches, which would be amply sufficient even in the sharpest curve. The top of that rail being always clean, there would be no friction, and at junctions where several roads met he should propose to do away with the rails altogether, and have a flat surface for the vehicles to turn upon, for rails would always be found inconvenient where there was a junction of macadamised road with pavement. At such places, therefore, he should leave the road open, and run on the plain road. There would also be this advantage, that where they were denied permission to lay the trams over bridges, communication might be kept up by an ordinary omnibus, as was now done at Waterloo-bridge. In the same way the vehicles might come down the branching side-streets, such as those running out of the Uxbridge-road, and join the main tram road without difficulty. This system had been worked in Liverpool with great success. The first tramway laid down in Liverpool was on the dock line, which was made for railway purposes, about four or five miles in length, and 'busses now ran upon it from end to end. He had proposed a similar system in connection with the Manchester and Liverpool Railway when it was first opened, and his suggestion was well received, although it was thought the time had not yet come for its adoption. He believed that such a scheme would give the greatest satisfaction to all concerned.

Mr. Edwin Chadwick said:—It appears to me incumbent to say something on the administrative bearings of the question, in its relation to the country generally, and to the metropolis specially. Some years ago, I had to make official preparatory inquiries, with the view to the demand for the improved government of the metropolis, when I found that the question of the freedom and cheapness of transit, by which the aggregations and massing of populations and overcrowding are reduced, has a very important sanitary bearing. London has less than half the population per house that Paris has; and until the late improvements in Paris, had, with an inferior site and climate, nearly one-third better death-rate. If all who do business in the centre of the metropolis, who are carried by one form or other of conveyance to the suburbs beyond it, were retained to sleep within it, as of old, the death-rates would be greatly augmented. As it is, anyone who spends one-ninth of his daily working time to go out and sleep in a well-conditioned house in a good suburban atmosphere will gain some fourth more of duration of working ability and life. The cheapening the means of doing this is an object, therefore, of sanitary as well as of economical importance. At the time to which the inquiries refer, I had to describe the principle of the prevalent modes of paving as laying down big stones to resist the shock of heavy carriages, and of building heavy carriages to resist the shock of big stones. On examining the principles of road construction and management in the metropolis, it appeared that, by improving the surface pavement, for which some trial works were prepared and by improving the gradients, for which, as well as for drainage purposes, an Ordnance survey was obtained, and by the use of trams for the outskirts and wider thoroughfares,—of stone in some instances, and of iron in others,—the great mass of metropolitan transit, of goods as well as passengers, might be effected by at least one-half the existing horse-power. The reduction of the horse-power for transit is the reduction of a not inconsiderable sanitary evil. The amount of dung on the surface of the streets between Regent-street and the Quadrant, or on about three-quarters of a mile of crowded street trams, was, if I remember correctly, about three loads of horse-dung removed daily. Persons who come to the metropolis with unsophisticated rural noses, complain that at times our streets smell like stableyards. From some analyses I got made of the surface washings, or the rainfall from streets, I found that until after very heavy storms indeed, when the people are surprised at how sweet the atmosphere is, the proportion of manurial matter in solution was even greater than the proportion derived from the drainage of the houses. In wet weather it is the complaint that our streets are seas of mud; in dry weather we are assailed by clouds of dust; but what is most objectionable is that a very large proportion of it is dung dust that we have to breathe, and that befouls the skin and the clothes. If Mr. Bridges Adams' forecast as to the use of hot-air engines be correct, as I trust it is, it will be a most important means of carrying still farther the improvement of the sanitary condition of the principal thoroughfares. As it is, however, the French government directed experiments to be made with tramways, with the result that a horse can, on a level tramway, draw three and a-half the weight at the same speed, and that up a gradient of 1 in 100, he is capable of drawing two and a quarter the weight he can do up the same gradient on a common road. As a general rule, two horses, instead of drawing twenty persons in an omnibus, will draw sixty. The wages of artisans may now be reckoned at sixpence per hour, and the ordinary walking time for six or seven miles may be said to cost one shilling; but by omnibus-power it is effected for fourpence, or for threepence; but by horse railways it might be done for twopence, or for less. These facts indicate the economy of time obtainable, which, in great cities, is money. Mr. Adams calculates that about four hundred miles of trams would be required for the

metropolis. It has some fifteen hundred miles of streets, and, on the analogy of New York and other American cities, as well as by the reason of the matter, it might be found expedient to tram, perhaps, a third of that distance—the more extended radiations into the suburban districts. If this design had been executed, or if it were now executed, I may ask what would have been the economical, and social, and sanitary improvement effected by it? In Paris, I met a very able French administrator, M. Foucauld, who, from the experience of France, had made a study of the circulating system of our metropolis, and laid down a plan on that of France. He would have trammed the whole of the metropolis except the crowded centre, more completely than Paris, and he would have connected the street system with the river steam-boat conveyanee. He would have instituted a system of correspondence more eomplete than that in Paris, and have made it the interest of omnibus proprietors and steamboat proprietors to coalesce; he would have increased speed, have reduced fares, and have increased the comforts of carriages and conveyances. He did succeed in getting up the General Omnibus Company, which was a part of the plan, but vestralisation was too powerful, and disunity of administration an obstacle that did not exist in Paris. But by the system of tramway alone, intercommunication would be far more completely speeded and cheapened than it can be by any system of railways alone, which can only act directly upon the circumference. By a system of trams, which you can spread through centres, the people are brought nearer to their own doors, and more speedily as well as eheaply. Let me say something more on the engineering and mechanical question, as affecting the administrative question. It appeared elear, and will appear clear on any proper examination, that the works for the drainage of roads, and the surface-cleansing and repair of the roads, and the drainage of houses, and the supply of water and gas for houses, are connected works whieh must, for eeonomy and efficiency, be administered by one and the same authority, and that authority a public one. I should have apparently to go far away from the present question to prove this proposition to many in the manner they would deem satisfactory. But in this metropolis, with its divided vestral jurisdictions and vestral rule system, the efficiency and economy of systematic intercommunication is impraeticable. A step in the direction of unity of metropolitan administration was proposed, by the consolidation of the seven metropolitan sewers commissions into one, by which a general survey would have been obtained and works doue whieh would have been impracticable to accomplish by the separate commissions. But the spirit of vestralisation prevailed against it, and all but trunk lines of drainage were thrown back with the roads into the hands of thirty-six sets of vestries. Until that most absurd, most costly, most disgraceful measure is rescinded, there ean be no systematie and economical communication or improvement in the metropolis. Suppose a line of tramway to be carried from Paddington to Greenwich, it must originate within the jurisdiction of the Vestry of Paddington, then through that of the Vestry of St. George's, Hanover-square, then through that of St. Martin's-in-the-Fields, then through that of Lambeth, then through that of St. Mary, Newington, then through that of Camberwell, then through that of St. Paul, Deptford, then through that of Greenwieh. I need not characterise these jurisdictions. You see outcries in the papers against the barbarous practice of macadamising roads by sharp stones, to be got into compactness by the grinding of earriage wheels and the treading of the horses; and reference is made again and again to the use of steam rollers, on the example of Paris. But are the seven vestries through which, in the instance I have given, each to purchase steam engines and set up establishments only for the manipulation of its own bit of road? The steam power, for the application of which an outcry is made, could only be economically applied over a line traversing several of these districts. On the occasion of heavy falls of snow, there are outcries in the press as to the barbarous condition of the thoroughfares, from the neglect of the local authorities. But the evil, the separate and weakly, yet expensive vestral establishments, would, under unity of management, be met by an immediate concentration of available forces of machinery and men. But on the immediate question, I assume that tramways—cheaply constructed tramways—will not be dear as compared with the expenses of the present, more espeeially considering the expense of dirt on goods in shops, on furniture and clothes, and scavengering. But what will be the eost of agency in fighting through seven or eight vestries and through eommittees of local aets? What, too, will be the expenses of separate secretaries, separate engineers, and separate directorates, all to be charged upon the public if not upon shareholders, and that in contravention of the economical principle of charging the expenses of roads upon the property that benefits by it? Compare the eonvenience of a system of well-constructed trams, branching into the eentre, with the outside underground railway running on the outer circle, one mile of which costs half a million of money. My persuasion from the evidenee is that, if the trams be economically construeted, from the saving in the cost and repair in roads of heavy traffic, and of dirt, it will pay to a district and to the property to construct and maintain them, and that there is as little economical ground, under a good administration, for giving them up as a eommercial speculation for dividends, as there is for the abandonment of paved roads to such commercial conditions. Under existing circumstances the Metropolitan Board of Works, though not the best possible, may be the best available authority for the purpose. Let me say a few words on the horse tramway question, as applicable to the general railway system of the country. Now, I stated the other night at the Institute of Civil Engineers, that there appeared to me to be about as much work to do, in the formation of branehes, the capillaries of our system, as there has already been done. Our postal system is of forty-nine thousand miles of mail conveyance by railway, whilst there is yet thirty-three thousand miles of mail eonveyance by omnibus, coach, and carts, which, I apprehend, will hereafter be conveyed by tramway; and there is seventy-two thousand miles of daily eonveyance by foot messengers, much of which, also, I imagine will hereafter, as traffic increases, be conveyed by tram, when the administration of our means of communieation is placed upon its proper economical footing. The natural formation of what I term the capillaries of a railway system are after the traffic has made it worth while to form a road at all; then, on an increase of the traffic, laying down bare timber trams; then, as traffic increases, arming the timber with light iron; as traffic increases further, strengthening the iron; then, as the traffic gets beyond horses, putting on locomotives; and now we shall have steel. This is the course of the development of feeders for main lines with advanced tramways, which Mr. Adams tells us may be laid down in single lines at £1,000 a mile for single lines, and which, at expenses adjusted to the traffie, may be charged on the eontiguous land which benefits by it, as is done by voluntary agreement in Canada and elsewhere. But the practice of the railway companies is to make their branches on a scale with their trunks, and for locomotives only, at twelve or at twenty times the expense of tramways—at expenses which benefit neither shareholders nor any one else but those who eonstruct them, and which makes them ever after suckers. You heard the justification put forth here the other evening of great trunk lines, running from the same place to the same place at the same time with through traffic, perhaps at thirty thousand pounds a mile each or more, that they served to benefit intermediate places. Let

any one examine how a system of branch tramways and other ways, such as I have described, as proportioned to natural conditions of traffic, would have covered completely the intermediate spaces now left to be provided for as they may, and calculate the saving that would have been effected by it, and an appropriate commentary will be deduced on the legislation and the administration of the day.

Captain Tyler said that, whatever the number of the miles travelled per day, the number of miles of railway constructed in England was only about 14,000, though additions at the rate of 400 or 500 miles per annum were going on, until the panic of 1865 put a check to it. It was pretty clear, therefore, that there were a good many railroads yet to be made. There was a little difficulty in defining what was a tramway, and in saying where a tramway left off and a railway began. There might be railways worked by horse-power, and tramways worked by locomotives, and there might be tramways for country roads as well as for crowded streets, and he was by no means certain that they would be exactly alike. Again, some might be required to carry goods and passengers also, and others passengers alone; some to work a single vehicle, and others trains of carriages; some to be worked by horse-power, some by steam-power, or, as Mr. Adams had suggested, by hot air. He had not yet seen a hot-air engine working on rails, but that might be the solution of the difficulty about frightening horses, which had occasioned so much opposition to street railways; but he was not very sanguine that this system would be found to answer. Then, again, tramways might be worked either on what was called the on-and-off or the rigid system. In America tramways were very much used, although he could not say that he had ever seen 120 persons in one carriage, as had been stated by Mr. Greaves. In the generality of cases people only rode inside, and then it was a matter of difficulty to cram 40 or 50 into them, though sometimes persons stood up between the seats, and stopped up the passage through the vehicle. In America, however, there was hardly a city or town of any importance without tramways, and yet in this country they were hardly known. There were some obvious reasons for this difference, the distances in America being much greater, and the ordinary roads, as a rule, not nearly so good as in England, owing in a great measure to the much greater mileage which had to be maintained. Still there was no reason why the example of America should not be followed. The other day he took the opportunity of going down to Liverpool and Manchester and inspecting the tramways there, the former being worked on the rigid and the latter on the on-and-off system. The former seemed very successful, although, from carrying passengers on the roof as well as inside, the vehicles were found rather heavy. The Manchester people, having seen the working of the rigid system in Liverpool, were about to exchange their system for it. At present, the plan of operation in the borough of Salford was this. The vehicle was very much like an ordinary omnibus, with wheels turning on flat surfaces, and a small wheel in front, working in a groove which kept the carriage in its position on the rails, this little wheel being so constructed that it could be raised out of the grooved rail and dropped into it at pleasure. The road was at present in a bad state, because the corporation, intending to change the system for that of Liverpool, with which they were much pleased, did not think it worth while to repair it. Then there was the question which had been raised by Mr. Chadwick—under what authority had the tramways been constructed? Of course, there was everything to be said in favour of unity of administration; but then unity of administration did not always answer, and he was afraid that, under that system, tramways would not get constructed so rapidly as by the energy of private enterprise. He was therefore very glad to see that many companies were being formed for the construction of tramways, and he did not doubt that some system would be devised under which they would all be properly controlled, so that the double advantage would be attained of unity of administration with the additional energy of private enterprise. As to the engineering question, he might say that only one idea seemed to have entered the minds of people in this country, that of laying iron rails on timber sleepers between blocks of granite, as was done in Manchester, Liverpool, at Whitechapel, and Brixton: but there was no reason why this system should be so slavishly followed. He had seen Mr. Adams on one occasion inspecting the asphalte paving lately laid down in Threadneedle-street, and he must say that material seemed admirably adapted for tramway purposes. It seemed to answer very well where it was laid down, fitted nicely on to the iron gutters and gullies in the streets, and did not wear in holes by the side. It appeared to him it would be a much cheaper material for tramways than the ordinary granite, and would be much more easily repaired. And in his opinion the great difficulty, and that which had given tramways a bad name in this country, was that the tramway preserved its surface whilst the loose stones on either side got into holes, so that in crossing you sometimes got such a jolting as would almost take your wheel off. He had noticed this difficulty himself, and therefore any material which could be easily repaired and kept level would offer many advantages. It was of importance, as the system extended, that tramways in different parts of the same locality should all be constructed on one system, at any rate as regards guage, wheels, &c. The guage was not a matter of primary importance, because the vehicles would be in almost all cases wider than the guage, and the inconvenience or otherwise in the streets would depend on the width of the vehicles themselves. In some localities, particularly in mountainous countries, a narrow guage would present many advantages, though where the vehicles were intended to carry passengers on the roof, it would not do to have it too narrow, or there would be a danger of over-turning. He believed the 4ft. 8in. guage would answer very well, and saw no necessity for exceeding it. England seemed to have passed through the stages of no roads, bad roads, good roads, and railroads, and now we were on the verge apparently of the tramroad period. He had no doubt that before long tramways would run along the sides of all our streets and roads, and even the happy proprietors of country seats and castles might carry them up through their private parks to their own doors. They might then turn their coachmen into stokers, and instead of ordering out their four-in-hand, they could order out the engine, and steam down their own private road until they joined the public roads of the country. He was not by any means sure that this would not be the state of things in the not distant future, and however this might affect those whose business was their pleasure, he was quite sure that those whose enjoyment consisted in their business, the great mass of the people, to whom time was money, and easy and cheap means of communication all-important, would be vastly benefited by such a change as now seemed likely to be introduced.

Mr. Robert Briggs (of Philadelphia) said he would attempt to give the audience an account of the American system of street railways, although in so doing he might not speak directly to the paper which was before the meeting. That paper divided itself into three distinct portions—first, the practice of tramways; secondly, the particular tramway which was proposed in the paper, and which differed from any other of which they had yet had any experience; and thirdly, the propriety and the general adaptation of tramways to the wants of the country. The first portion of the remarks he proposed to make would refer to the American experience of tramways, and it was upon this portion that he felt more competent to speak than upon any other. The Americans had a very large and extensive experience in

this matter. Every city in the Union, almost or quite without exception, had adopted more or less the system of tramways. They were generally used by the community, and were the most popular means employed for transporting the people from place to place. They had usurped and occupied the ordinary roads, and had driven out all the pleasure vehicles and all other means of communication from the streets, with the exception of one single street in the city of New York, and with some exceptions in the city of Boston, where the streets were properly preserved. They had, as a matter of course, excluded the omnibuses; they had excluded the private carriages, embarrassed the traffic, and obstructed the general commerce of the cities. The street railways were, in fact, peculiarly the popular means of communication. He would attempt to describe their working, and in so doing would take a stranger's license, which was that of telling a very large story, while the license which the audience had, on the other hand, was that of believing it. He would take for a moment the Second and Third street line of street cars in the city of Philadelphia, which were the most used and the most crowded. Every three minutes a car was started, which ran along the whole length of the city, a distance of about four and three-quarter miles, and there was also an intermediate car, which ran every minute and a-half upon one-half of the length, so that on a portion of the line cars ran every minute and a-half. The cars were occupied by all sorts of people. When a person got into the car he found that it was immediately crowded, and there were perhaps market-baskets, a brace of fowls, a couple of buckets of paint, a woman with a pad of butter, and he had seen in one car forty baskets of peaches, each basket holding three-quarters of a bushel. The seats were greasy, and the whole thing was dirty. Every passenger could take into the car just whatever he or she chose to carry, and they were crowded in as thickly as they could possibly be. The baskets were placed upon the floor in front of the seats, and as many as could stand between them or could hang on any how did so. There were often as many as 80 or 90 crowded in, and he did not doubt that the 120 which had been spoken of was sometimes reached, but recently, through the influence of a Society for the Prevention of Cruelty to Animals, the number allowed in a car had been limited to just as many as could squeeze into the seats and could inconveniently stand up. It was found necessary to stop only at the corners of the streets, which, as Philadelphia is a city of squares, were at regular distances of 450 ft. There, perhaps, the conductor helped out three ladies with their pads of butter on one side and then assisted three others in with their children or market baskets on the other side. The car then proceeded on its journey at about the average rate of three and a-half miles an hour, until it reached its destination. As to the method of working, according to the laws of America the street tramways had a right of passage prior to all others, and in exercising that right of passage the driver made use of a call or bird-whistle. Whenever he overtook any other carriage on the track the driver, in order to drive it off, first blew his whistle, and then, if that was not immediately attended to, ran his pole up to the rear end of the front carriage and ran it into it, and then, having successfully got the carriage off the track and got it behind him, he immediately relapsed into a walk, and went at that pace for the rest of the way as long as he dared. That was the general course of proceedure. He wished next to give an account of the tariffs, and the most striking and extraordinary one he had ever met with was in Pittsburgh, and that was a remarkable one even to a Philadelphian. As a general rule the cars took, without any extra charge, all the luggage that a passenger could carry, regardless of its cumbrousness or unsuitability. In a street railway car at Pittsburg he had regarded with some interest, not to say astonishment, a placard announcing special rates of fares. The notice ran as follows:—"Pittsburg and Lawrenceville Street Passenger Railway—Rates of Fare:—Single passengers, 5 cents; children under 10 years, 3 cents (there is never any charge for children in arms); basket, bandbox, bundle, 3 cents; trunk, barrel of flour, or sewing machine, 10 cents; dressed hogs, 15 cents." When he got off the car he demanded of the driver whether they carried many dressed hogs, and whether the man understood him or not he did not know, but the reply was that they took "a many of them," and judging from his remembrances of Philadelphia, he fully believed they did. This, then, was the popular means of travelling, and he had described it literally. It was no better in New York city, but rather worse. In one particular part of that city, the business portion below Fulton-street, the cars ran with such extreme slowness, on account of the amount of heavy traffic, that nobody ever thought of getting into them, and there were often no more than four, or, at the outside, ten in them at any time. After the business portion of the city, however, had been passed, there were about four miles of buildings and one mile partially built upon—something in the same manner as Kensington—and in those districts eight or nine different lines ran in parallel avenues, and the cars, which ran about every minute, were morning and evening crowded to excess, and there the passengers and traffic were treated in the same way as he had described. There was one single street in New York —Broadway—which by dint of great exertions on the part of the inhabitants of New York, and the utmost endeavours of the enlightened and intelligent citizens, had been kept free from street railways. In that street there were lines of omnibuses, and those were the only comfortable things to travel in in the whole city, and every citizen or traveller sought Broadway and its omnibuses. Every city in America was in the same condition. The street railways in engineering, financial, business, and other senses, had been an incubus upon their cities, a burden to their traffic, an incumbrance in their way, and had been incommodious instead of advantageous. As an engineer, he did not think he could speak in sufficient animadversion about them. They had destroyed their roads, ruined their cities, as far as travelling in them was concerned; had embarrassed the business of the country, and had merely enabled some unscrupulous speculators to engross the public streets for their own private interests. So far as the roads themselves were concerned, the agreement that was always made in America, when this important franchise was granted, was that the street railways should maintain them in proper travelling condition, but this agreement they always failed to carry out. Practically they did not do it, but it had to be done by the cities. The companies avoided it by saying sometimes that the gas company had disturbed the streets, and at others that the water companies had done it, and therefore they were not responsible, but the general result was that the railway companies generally did nothing but run their cars, and collect as much of the fares as the honesty of the conductors would allow There was formed by degrees along each side of the tramway a deep, irregular rut, which it was next to impossible to drive any private carriage along or diagonally across, and this rendered the roads almost impassable, except for heavy traffic. On the other hand, the thing was rendered tolerable for those who were engaged in commerce, and who had to employ heavy traffic—and this was the only concession which the tramways had made to the public—by furnishing a broad flat rail, about four inches wide on the face, upon which carts or waggons could be run. The whole width of the rail would be abut six inches, the remaining two inches of surface being elevated about one inch, with a slight bevil upon the rebate surface, which would permit heavy luggage to be turned off it without meeting with any serious obstacle. The rise was quite sufficient to take the wheels off a light vehicle without any trouble

at all; but with heavy traffic, where the wheels did not mind it, the thing answered very well indeed. In Philadelphia, all the heavy traffic was carried in this way, and thus there was less objection, in a commercial sense, than there otherwise would have been. In New York, on the other hand, where the streets were very much embarrassed with traffic, the burden was almost too great to be borne; and if it were possible for the people of New York to shake of the incubus which had been created by legislative action granting to special companies the privilege of using the streets—a more valuable privilege than would be granted to a railway—they would shake it off in a moment, and every single street-railway in that city would be abolished at once. There were some advantages connected with the American street-railways. They certainly did afford some means of communication, and some greater facilities for travelling, and they did enable two horses to pull a somewhat heavier load than they otherwise could. In Philadelphia this did not much matter, because it was a city with no very great extent of business, and was of no commercial importance whatever; it was an extensive city, with a million and a quarter of inhabitants, but it had no commercial standing at all. But in New York, if they could have there one or two railways like the London Underground, or Metropolitan Railway, it would relieve the city at once, and there would be an instant stoppage of the street cars. He had no doubt at all that one single line of railway such as that running through New York, would absorb almost entirely nearly every street car in the city. He wished to add another word or two about another obstacle, and that was the way in which street tramways affected the ordinary traffic of the streets. There was no more serious tripper, and nothing more likely to throw down horses, than a little piece of straight line upon which they could slide sideways. It was like a man treading on a piece of ice on a side-pavement. The moment a horse was driven diagonally across one of these street roads, it was laid over on its side very comfortably. If a horse were tripped on its knees it would rise instantly, but if it were tripped sideways it was impossible for it to do so, and as soon as ever they got these tramways into their business streets they would be in the position of Gaffer, who said that when his horse got its hind-leg into the stirrup he thought it was time for him to get off.

The Chairman said that before Mr. Briggs left this part of the subject, he thought it would be interesting if he would kindly say how far he thought the evils which he had so graphically described were inherent to tramways, or how far they might be due to bad administration, want of central supervision, or jobbing, because there were tramways and tramways.

Mr. Briggs said his reply would be that they were inherent to tramways. He did not think that he had ever yet seen anything which equalled a macadamised road when under proper administration. He believed that if they had in London roads such as he had seen in Paris, macadamised roads, properly picked up at the proper times, properly rolled down with heavy rollers, rolled down in the night, so that next morning they would find them ready for use and in perfect order, they would have a level road, and that sort of road which was necessary to carry on a large and heavy traffic. It seemed to him that the direction in which the inventors, and especially the engineers of England, ought now to look was that of an improvement first in the roads, and, secondly, in the carriages. The same ingenuity which he was happy to see had been displayed by Mr. Adams in preparing an extraordinary carriage of unusual construction—which he would not now criticise, though he believed it to be open to criticism—if the same ingenuity had designed a large omnibus with large wheels, and with the convenience of turning without bringing the forward wheels underneath the omnibus, and thereby rendering it possible to obtain large forward wheels—would, he believed, have accomplished the end which they ought to have in view, not as projectors, but as engineers, namely, the end of enabling a larger number of passengers to be carried at a less cost in the ordinary streets without incommoding the ordinary traffic, but in point of fact improving it. He did not know how far the india-rubber wheel arrangement, which had been described as being so successful in Edinburgh, might have succeeded, but that was one step in advance, and there were a variety of others. While the paper which had been read described with considerable care the improvement of the present omnibuses over the former means of communication in London, it seemed to him that it was possible to go still further in the same direction, and so to improve the carriages of London as that it would be possible to convey passengers for half of the present cost, and perhaps, by adopting the plan which was found necessary in America, of stopping at only the street corners, also to convey them at a somewhat higher speed than they were now carried. One of the lessons which had proceeded from the street railway carriages was that the use of a wide footboard in the rear of the carriage, with side entrances, gives the opportunity of getting on or off a moving vehicle with great facility and comparative safety. He only threw these hints out as suggestions in response to the chairman's solicitations.

Sir Joseph Heron said he had received that evening some very interesting, although somewhat contradictory, information. The subject of tramways was very interesting just now to the large towns, and perhaps no place had been more violently attacked by the promoters of tramway schemes than the city of Manchester. They had had three or four companies wishing to take possession of their streets, and seeking to obtain enormous privileges. He confessed that he was somewhat alarmed when he heard Captain Tyler express so confidently his opinion in favour of these tramways. For his own part, he certainly had no very decided opinion against them, but, at the same time, he had very great misgivings. He had no faith in models, and still less faith in promises and in Acts of Parliament, because those who were seeking to obtain bills for the purpose of carrying out their schemes put into their acts almost any clauses, and promised nothing more eagerly than that the streets should always be on a perfect dead level, and that there should be no wrenching off of wheels, and no interference of any kind with the ordinary traffic. He confessed that he had grave doubts and misgivings as to the advantages of tramways when introduced into densely-populated towns like Manchester, and, therefore, as he had said, he listened with some little anxiety when he heard Captain Tyler express himself so strongly, knowing as he did how very considerable that gentleman's influence was with the department which would no doubt have a great deal to do with this question. But he was greatly relieved by the speaker who followed—the gentleman from America—and certainly he had not heard for a long time observations which he had listened to with more surprise than the descriptions which that gentleman had given of the working of the system in America, which descriptions he had no doubt were perfectly accurate. They were always told to look at what tramways had done in America, and the enormous advantage which they had been in New York. He confessed that that gentleman was extremely ingenious in the first part of his speech, for he really thought he was going to make a speech decidedly in favour of tramways, but the concluding observations convinced him that the tramways really had monopolised all the traffic and excluded all other means of communication. He thought it was a very fortunate thing that all the private tramway schemes that had been laid before Parliament this session had been stopped, and that a public bill, by which very different regulations would be enforced in connection with tramways, was likely to be passed by the government. With reference

to the question of authorities, he quite agreed with Mr. Chadwick, that enormous difficulties would necessarily arise in making arrangements, assuming tramways to be made, whilst there were so many local authorities of one kind and another that would have to be consulted, and whose consent would have to be obtained in connection with carrying out the works. He did not know how they would get over the difficulty, but to him it seemed to be an impossibility. London he did not profess to understand. It was a place the peculiar government of which people in the country considered to be such as no man could understand. Whenever any Act of Parliament was proposed for the general good of the country, London, for some reason or other, was always to be excepted. Still, the same difficulty arose in country districts. In Manchester, for instance, a tramroad, to be useful to the public generally, must necessarily pass through a number of districts, and he did not see how it was possible to get over this difficulty. The Government Bill, however, had certain provisions upon the subject which he had no doubt, after they had been duly considered and discussed in Parliament, would be satisfactory.

Mr. W. Haywood, C.E., said that this subject was really a very wide one, and he scarcely knew what part of it to begin with, but he would take up the point with which the last speaker had finished, namely, the question of administration. What stood in the way of a fundamental change in the complete reorganisation of the metropolis was the indifference of the Houses of Parliament, and the dread lest a large and powerful municipality should get to itself its fair share of power in the empire, which up to the present time it had never had. That it was which laid at the root of the present—if they chose so to call it, though he did not call it so—defective administration of the metropolis. What was wanted was a full determination on the part of the legislature to give the metropolis what most intelligent people had wanted, certainly as long as he had had anything to do with it, a thorough and well-organised scheme of metropolitan administration, with no vestries at all. The tramway question was one of the very greatest importance. It was a matter to be very fairly balanced, and was not to be spoken of lightly. It was a matter in which the wants of the many would have to be weighed against the inconvenience of the few. To his mind it was a question of democracy against plutocracy, and he would venture to say that democracy would beat. He would venture to say that they would have tramways, whether they were convenient for those persons who rode in their own carriages or not. Nobody who had ridden on tramways, whether in the American street cars, or from Paris to St. Cloud, or who had, in fact, ridden anywhere slowly, at the rate of eight or ten miles an hour, over rails, could doubt that tramways would be an enormous advantage to the whole of the metropolitan population. Given that the first ten or fifteen miles were successful, and within the next five years they would have at least 300 miles of tramway in London; and it would not and could not stop there, but it would end, if it succeeded at all, in a complete articulation of tramways throughout the length and breadth of the land. He had riden in these street cars as much as most ordinary people, and, generally speaking, he agreed with nearly all that Captain Tyler had said, although, as his own opinions happened to be in print at the present time, it could not be said that he had borrowed them from Captain Tyler. One of the inherent defects of tramways or street railways in all towns was that it led to bad paving. In every place he knew, except the tramways in Paris, near which there was no difficulty on account of other traffic, the tramways caused a deterioration of the pavement at the point where the pavement and the rails joined. Nothing could be more miserable than the state of the pavement in most of the towns where he had seen tramways in operation. It was almost as bad as St. Petersburgh, and that was saying a good deal, because there every man paved the street in front of his own door, and he did not exaggerate when he said that he had seen a man there lay large paving stones before his house a foot above the rest of the pavement. Liverpool was a well-paved and well-cared for town. He had gone there the other day, for the purpose of looking at the tramways, and though he had no doubt that the thing had been done with great care, yet he noticed that the pavements were already subsiding and wearing in ruts. Liverpool, it was true, had a large traffic, judged by ordinary standards, but it was nothing to be compared to that of the metropolis; indeed, there were only two places whose traffic approached that of London, and they were Paris and New York; but neither of them was anything like equal to the metropolis. He found that in some places at Liverpool the rails were below the pavements already. The general tendency was to wear outside and immediately alongside the rail a long rut, and this was the real objection to tramways. There was very little vehicular traffic in any of the American towns, and what there was was very dear, and the tramways being so cheap, of course the latter had it all their own way. But in London the case was very different. If they were to run the whole of the omnibuses off the road, they would not save Cheapside from the vast amount of other traffic. Omnibuses did not form one-half of the whole traffic, even in Cheapside, and a much less part in other streets, and therefore, if all the omnibuses were gone, they would still have a very large vehicular traffic, and that traffic would drive the paving stones away next the rails, and thus the pavement would always be in a bad state. He had ridden in the Philadelphia, the Toronto, the New York, and the Boston cars, and though he had seen a great many of them crówded unnecessarily, yet he confessed he had never seen what had been described by Mr. Briggs, although of course he did not venture to contradict him. His own experience was that the cars were very clean and very comfortable, though they certainly were slow. If they were ever adopted in this country he did not believe they would have very great speed, but they would have more than they had now with the omnibuses, and that would be something. They could not have any very great speed, because if they were to be of any use at all they must go through the heart of London—the City. He had no doubt that three-fourths of the promoters of tramway schemes, if they were talking to them confidentially, would tell them that although they proposed to stop at the other side of Blackfriars-bridge with one line, and at Whitechapel with another, and at Finsbury-circus with another, yet the real object of the whole of them was to come to tho City, because that was the heart of the circulation of London. 750,000 persons went to and fro from it daily. That was where the omnibuses were, and that was where the tramways wanted to get, and they would not be successful unless they did get there. There was not time to go into minute details, but he wished them to understand that his view was this, that upon the whole street tramways would be a very large comfort to the great mass of the people who now rode in omnibuses, and that they would induce a large number of people who now rode in their own vehicles to ride upon them, or, as he should like to say, in the "cars." With regard to regulating the traffic of the tramways, there would be no difficulty at all in doing that. They would be able to regulate the tramways just the same as they did the omnibuses, and, therefore, they might dismiss any idea of inconvenience on that ground from their minds. There was another question, which was a very serious one, especially in certain parts of the metropolis, and that was the question of sewers, and gas and water pipes. All he could say was that this seemed to point more and more to the necessity for the construction of subways. They might depend upon it that every omnibus would very soon be run off the streets, for nobody would get into an omnibus who could get into a

car, and thus they would be depending upon the cars; and, in order to prevent inconvenience, they would be obliged to have subways for the gas and water. If they took care of themselves, they might arrange that it should be at the expense of the companies. There was another thing he wished to mention. He was a middle-aged man, and should not perhaps live to see it, and he was half inclined to say he was glad that he should not, but others, he believed, would live to see steam carriages rattling through the streets. He had seen them in America, and they certainly jarred his nervous system most terribly. He had not heard any one present allude to it, but it was a fact that in one of the American towns there was now at the present time a steam engine dragging an omnibus car along the streets, and that was in Baltimore. He believed that tramways would spread throughout the length and breadth of the land, and that steam engines, or engines of some sort, would drag goods, merchandise, and passengers along the streets.

Mr. Malcolm said he came there under the impression that a tramway was a thing which the people of this country were prepared to say was a good thing, relying principally upon the example of America; and he must say that he was very much surprised to hear, not only from the evidence of an eye-witness, but a witness who had had very great experience, that the tramways of America were a very great nuisance. It startled him to hear that tramways were in themselves and in their nature such very bad things, when at the same time in nearly every great capital in Europe they had been tried, and had not been given up, and to hear at the same time that the people of New York were living under an intolerable tyranny of tramways. Why, he would ask, if that were so, did they did not rise, and at once do away with them? However that might be, he thought that at present we had "gone and done it" in England, and the only question to consider was, what was the best form of dealing with these tramways. Mr. Chadwick said that they must have a central authority to deal with them. Captain Tyler contended for an independent spirit of competition between the companies. What was the system which had been adopted in legislation with regard to railways, and what system ought to be adopted in dealing with these tramways? The system with regard to railways had been in every case that the people who laid out the plans of a railway had always been the people who had worked the railway afterwards. Was this a system that ought to be pursued with regard to tramways, or ought not the two things rather to be separated? For his own part he would suggest that the proper mode to be pursued was that the laying out of the tramways and the working of them should be placed in separate hands. The supplying of a system of tramways in any given area, he thought anybody who had studied the subject at all would agree with him, should be placed in the hands of all the local authorities. The roads belonged to the local authorities, and they had to repair and manage them, and he thought it would be most unworkable to let any body of concessionaires come into those roads apart from the local authorities, to break them up and do what they liked with them. He would, therefore, give the local authorities the power to prepare the road for the tramways, and then go into the market and let the making of the tramway out to anybody who would choose to take it. He contended that although the owners of the road were the proper people to say under what conditions the tramway should be made, they were not the proper people to work the tramways when they were made. Let them lay out the road, manage it, repair it, and keep it in good order, for they were the only people who could do so, but then let them lease or let out the tramway, to be worked by a company, or any one who would take it. By that means he thought they would get the centralisation which was sought by Mr. Chadwick, and the independent companies which were advocated by Captain Tyler, and in this way he thought they might get a system of tramways which would work satisfactorily for everybody.

The debate was then adjourned to Wednesday, April the 6th.

CANTOR LECTURES.

On Monday, the 7th inst., a course of lectures on "The Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," was commenced by Dr. Benjamin Paul, F.C.S. The following is an abstract of the first lecture:—

Combustion, or the act of burning, is a phenomenon familiar to everyone. In some form or other, it is connected with most of our daily experiences. We burn fuel for the purpose of maintaining warmth, for cooking food, for producing the motive power of the steam-engine. It is by means of combustion that we extract from their ores various useful metals, and fashion them into the requisite forms to be serviceable. A multitude of other industrial operations are also dependent on combustion for their performance.

For these reasons alone, the phenomena of combustion present an aspect of utilitarian interest to those engaged in manufacturing pursuits, and to everyone whose business requires the use of fuel; for it is only by means of a knowledge of those phenomena, and of the conditions by which they are influenced, that we can hope to control and regulate them, to ensure the economic use of fuel, and to make it subservient to the objects desired.

In regard to the nature and effects of combustion, everyone knows that when a thing burns it gradually changes. So far as ordinary experience goes, we might say that in burning a thing it disappears, for when a mass of coal or a candle burns that seems to be the case. The solid material of the coal or of the candle gradually dwindles away until no more of it is left. This disappearance, however, is but apparent. Though we are in ordinary language accustomed to say that in burning a thing is consumed, and though this mode of expression is a correct statement of what is obviously recognisable, it does not represent the true nature of the change which constitutes combustion.

Formerly, that change was believed to result from the disengagement of something from the material burnt, and though the conception of that something was extremely vague, it received the name of *phlogiston*, which for a long time occupied an important place in chemical theory. Modern chemistry has, however, destroyed that doctrine, and has shown that, in place of anything being lost in combustion, there is always an increase of material. The product of combustion is invariably greater than the thing burnt, that is to say its weight—the chemist's test of quantity—is increased by combustion.

The further study of combustion showed that it is always a case of combination—that the visible change of the thing burnt consisted in its union with something else which was equally changed. That kind of combustion with which we are most familiar, such as the burning of fuel or illuminating materials, consists in the union of the material burnt, or of its constituents, with oxygen. In the language of the chemist, it is a case of oxidation. There are many other kinds of combustion analogous to this, such as the union of metals, &c., with chlorine, sulphur, and the like. These all agree essentially with the kind of combustion most generally known, in being attended with evolution of heat and light in various degrees. There is also the same change in the thing burnt, and a similar addition to its weight.

There are several different modes in which combustion takes place. Under suitable conditions, a solid com-

bustible substance that cannot be converted into vapour burns at its surface, becoming hot and luminous, or, as it is termed, incandescent, as in the case of coke. A combustible substance that is gaseous burns with a flame; liquids or solids that are convertible into vapour also burn with flame, since the heat generated by combustion has the effect of vaporising them, wholly or partially, as they burn. The combustible vapour thus produced burns exactly in the same way as a gas. Bituminous coal, pitch, or oil burn in this way.

There is another mode of combustion, which is not gradual and progressive, but instantaneous; this is termed explosion—an explosive material being one which contains within itself all the elements requisite for combustion. Gunpowder and gun-cotton are of this nature.

Lastly, combustion takes place in some cases so slowly, that the increase of temperature is moderate, and there is no luminous effect produced. This mode of combustion obtains in the decay or rotting of wood and other vegetable or animal substances. But the principal instance of this mode of combustion is that taking place in the bodies of animals, and consisting in the oxidation of the blood of the lungs. This is the immediate source of animal heat and of muscular power.

From the fact already mentioned, that combustion consists in the mutual change and union of two substances, it will be evident that, besides the material burnt, something else is necessary for the maintenance of combustion. This may be seen by placing a lighted candle under a bell-jar, just so as to prevent the access of any more air than is contained in the bell-jar. Under these circumstances, the flame of the candle gradually decreases, and after a few seconds it is extinguished. The reason of this is that in the kind of combustion which we have to do with in the use of fuel and in the production of light, oxygen is the substance that unites with the material burnt. The chemical change involved in the burning of fuel, or of any illuminating material, consist in the production of carbonic acid and water vapour, by the union of oxygen with the carbon and hydrogen contained in those materials.

The oxygen requisite for the purpose is, under ordinary circumstances, supplied by atmospheric air, which contains nearly one-fourth its weight of oxygen. In the experiment above-mentioned, the oxygen of the limited quantity of air in the bell-jar is soon used up, and when that is the case combustion is no longer possible. This is sufficient to illustrate the necessity for a constant supply of air for burning fuel, that being generally termed the supporter of combustion, while the material burnt is termed the combustible.

Among other conditions requisite for combustion, is a certain degree of heat or temperature in the substance to be burnt. Some few substances enter into combustion at once by mere contact with atmospheric air; others do so when they are in a state of minute subdivision; while others require to be very intensely heated before they will unite with atmospheric oxygen. This is especially the case with iron, though iron burns very slowly at the ordinary temperature, or, as it is termed, rusts, yet, when sufficiently heated, a rod of iron will burn in air as freely as a piece of wood.

In an atmosphere of oxygen gas, combustion takes place much more readily than in air. This may be readily shown by dipping into a jar of oxygen gas a piece of stick which has been charred in a flame, and is just about to be extinguished, when it immediately bursts into flame, and burns intensely. The circumstance to which this difference between combustion in air and oxygen is due is the presence of nitrogen in the one case, and its absence in the other. The way in which the presence or absence of nitrogen affects the result is a matter of great importance as regards the economy of fuel; but it would be out of place to enter upon an explanation of it just yet.

The mention of heat-units and quantities of heat must now be explained. Heat, or the result of combustion, being only a condition of energy of natural substances, it cannot be weighed or measured like those substances themselves, therefore quantities of heat can only be determined indirectly, by comparison of the effects they produce.

One of the effects which is applied for this purpose, is alteration of temperature. A pound of water, heated to the boiling point, contains a quantity of heat which is almost exactly the same as that contained in 100 pounds of water at the temperature of 1°, or that contained in two pounds of water at 50°. But two pounds of iron at 50° do not contain the same quantity of heat, although the metal is as hot as the water, or has the same temperature. It takes less heat to produce an equal alteration of temperature in iron than in water; consequently, it is necessary, in taking alteration of temperature as the measure of quantity of heat, to express the result in reference to one particular substance. For this purpose water is chosen, and the quantity of heat that raises the temperature of a pound of water, 1° C. is termed the unit of heat. Thus, the 33,881 units of heat generated by combustion of one pound of hydrogen is a quantity capable of raising the temperature of that number of pounds of water 1° centigrade.

There are other effects of heat which may be applied as the measure of quantities of heat. These are the changes of state produced in substances by heat, that is to say, the conversion of a solid or liquid into vapour, or the melting of a solid. In both cases heat disappears, and is expended otherwise than in causing rise of temperature.

When water is placed over a source of heat, it continues to become hotter until the temperature is raised to the boiling point. When that is reached, the continued application of heat has no further effect in raising the temperature, but another action takes place—the water evaporates; it is gradually converted into steam, and the heat applied to the water is expended in producing the change of state. Measurement of the quantity of heat required for doing this work, has shown that for converting a pound of water at the boiling point into steam, there is needed about 5·5 times as much heat as is necessary to heat a pound of water 100°. Consequently, as will be seen from the table, while the heat generated by combustion of one pound of hydrogen will heat 338 pounds of water one degree, it will only convert 61 pounds of water into steam at the boiling point.

In melting solid substances, there is a similar expenditure of heat which does not cause rise of temperature. Thus, for instance, when a pound of ice is immersed in three-quarters of a pound of boiling water, the ice is melted. At the same time the water is cooled, and the result is, two pounds of water at the freezing point, or 0° C. In this case, the quantity of heat expended in the liquefaction of the ice is equal to that capable of heating three-quarters of a pound of water from 0° C. to the boiling point. A reverse illustration of this is afforded by the condensation of steam. If steam be passed into water at 0° C it is liquefied, and eventually the water acquires the boiling temperature. On weighing the water when that is the ease, it will be found to have increased in weight by about one-fifth, for, as before stated, the quantity of heat required to vaporise a pound of water is about five times as much as that required to heat a pound of water from 0° to 100°C, and that is the amount of heat set free, or made sensible, by the condensation of steam.

In what has been stated respecting the temperature produced by combustion, I have spoken only of combustion in oxygen. That, however, is a case which never takes place in practice. In the use of fuel, it is by means of atmospheric air that combustion is supported, and that contains only about one-fourth its weight of oxygen, the remaining portion being an inert gas called nitrogen, which takes no part in combustion, and is merely an absorbent, to some extent, of the heat generated.

In burning hydrogen in air, the quantity of nitrogen which thus becomes mixed with the products of combustion amounts to nearly 27 pounds for each pound of hydrogen burnt; and in burning one pound of carbon there is nearly nine pounds of nitrogen mixed with the product of combustion.

In consequence of this large addition to the quantity of material through which the heat of combustion is in both cases distributed, the temperature produced by burning carbon or hydrogen in air is very much less in both instances than it is when those substances are burnt in oxygen. In the combustion of carbon in air, the temperature produced is 2648°C.; and in the combustion of hydrogen it is 2676°. Thus, so far as practical effect is concerned, there is no greater result in the one case than in the other. The larger amount of material resulting from combustion of hydrogen obliterates the apparent advantage of a greater amount of heat being furnished by hydrogen.

I have taken these two extreme cases of hydrogen and carbon to illustrate this fact, but the same thing obtains with all kinds of fuel which are essentially composed of different amounts of carbon and hydrogen. It is by reason of this circumstance also that it has been customary to measure the value of fuel according to the amount of fixed carbon it contained, or, in other words, by the amount of coke it yielded. For practical purposes, and in reference to the very rude way in which fuel has generally been used, that mode of estimating the relative value of fuel was sufficiently accurate, but it is only with these limitations that it can be regarded as satisfactory.

In speaking of temperature, it must be remembered that although differences of temperature in the same substance represent equally different quantities of heat, still this is by no means the case as regards different substances. Temperature is, in fact, not always a measure of the quantity of heat, as will be evident from the illustration just given of the results produced by burning hydrogen and carbon in air. Though the temperature differs very little in these cases, there is a vast difference in the quantity of heat produced by combustion of equal weights of hydrogen and carbon.

It is these features of the general phenomenon of combustion which require to be understood by those who use fuel, and who have to apply it for special purposes. Without a knowledge of them, it is only by chance that any improvement can be made in the use of fuel, or that its application can be regulated with a view to economy, so as to obtain the maximum result it is capable of producing, and to do that most conveniently according to circumstances.

The difference already pointed out in regard to the quantity and intensity of heat is of especial importance to be borne in mind whenever it is an object, in using fuel, to produce a very high temperature. In working iron, for instance, it is imperative to produce almost the highest temperature attainable, for since the operation of puddling can only be performed at a very high heat, the products of combustion must necessarily pass away at that temperature, and consequently it is only the heat corresponding to the excess of temperature above that point which can be usefully applied. According to actual observation, only one-eleventh part of the total heat generated by the fuel used in puddling iron is usefully applied; the remaining ten-elevenths is lost, and therefore ten times as much fuel is used as would be requisite except for this circumstance. However, there are ways in which this excessive waste may be obviated, and these will form the subject of a future lecture.

The evolution of heat and light are generally characteristic features of combustion. Heat is always evolved, even when the combustion is slow, but the evolution of light does not always accompany it; indeed, this effect of combustion is dependant on the existence of certain conditions, among which the chief seems to be the presence of solid substance intensely heated. The luminosity of flame is generally ascribed to the presence of minute particles, which are so much heated by the combustion that they act like little suns. A good illustration of this is afforded by the flame of hydrogen gas; this contains no solid particles. The product of combustion also is a vapour, and at the same time hydrogen gives out more heat, weight for weight, than any other substance known. But the flame of hydrogen is almost destitute of luminosity. However, if a little fine charcoal powder be shaken into the pale blue flame, it immediately becomes luminous. The same kind of difference may be shown with ordinary coal gas. This, when burnt in the usual way, gives a bright white light, but when it is first mixed with air, it burns with a pale blue flame, scarcely at all luminous. In the former case the brilliancy of the flame is due to the presence of intensely heated particles of carbon, which are constantly being produced by the decomposition of the gas as it is heated by burning. In the latter case, there is no such separation of carbon, because the admixture of air with the gas facilitates combustion. There are, consequently, no solid particles to be heated, and the flame is non-luminous.

It has recently been shown by Dr. Frankland that the luminosity of flame depends very much on the density of the atmosphere supporting combustion, and probably on the density of the combustible vapour in the flame. For example, the pale flame of carbonic acid, and even of hydrogen, may be rendered luminous by increasing the pressure of the atmosphere in which the gases are burnt.

However, the presence of solid particles certainly adds to the brilliancy of flame, and the higher the temperature of a flame in which there are such solid particles, the more luminous it is. The influence of solid particles is well shown by burning some substance which yields by combustion a solid product, such as magnesium, for instance, which yields magnesia, the oxide of that metal, and burns with intense brilliancy, because the entire product of combustion consists of minute solid particles heated intensely.

The quantitative relation of the phenomena of combustion requires special attention. In the first place, the union of substances in combustion take place in definite proportions of weight which are constant for the same substance. In the following table it will be seen that the proportion of oxygen required for burning different combustible substances varies considerably. Thus, for instance, one pound of hydrogen requires eight pounds of oxygen, while one pound of carbon needs only 2·67 pounds. There is, of course, the same difference between the weights of the products in the two cases; the water vapour produced by burning one pound of hydrogen, weighs nine pounds; the carbonic acid produced by burning one pound of carbon weighs only 3·67 pounds.

Passing on now to the column showing the amount of heat generated by the combustion of these substances, we find that one pound of hydrogen gives more than four times as much heat as a pound of carbon. The heat generated in each case, as in all other cases of combustion, is distributed through the products formed; they become the vehicle by which the heat is transmitted to any object it is desired to heat, and we have now to consider what is the result of this distribution of the heat generated in any case through the products of combustion. In the case of hydrogen, we have 33881 units of heat distributed through nine pounds of water vapour; in the case of carbon, we have 7900 units of heat distributed through 3·67 pounds of carbonic acid. The consequence is, that though the amount of heat generated by combustion of hydrogen is so much more than that generated by combustion of an equal weight of carbon, the product of combustion is also much greater in the case of hydrogen, and for that reason the temperature produced is nearly the same as in the combustion of carbon.

This is a circumstance of great importance to be

Combustible.	Composition.			Required for combustion.		Products.			Generated heat,	Thermal effect.		Quantity of water heated.	
	C.	H.	O.	Oxygen.	Air.	CO^2.	HO.	N.	units.	In oxygen.	In air.	from 0° to 100° C.	Converted into steam at 100°.
Hydrogen ..	—	1·	—	8·	34·78	..	9·	26·78	33,881	6,717°	2,676°	338·	62·9
Marsh gas ..	0·75	·250	—	4·	17·39	2·75	2·25	13·35	13,108	7,100°	2,413°	131·	23·
Olefiant gas..	·857	·143	—	—	—	3·16	1·26	11·45	11,942	8,739°	2,761°	119·	21·
Carbon......	1·	—	—	2·67	11·60	3·67	—	8·98	7,900	9,952°	2,648°	79·	14·7
Carbonic oxide	0·430	—	0·57	0·57	2·47	1·54	—	1·90	2,431	7,159°	3,025°	24.	4·
Coal:—													
Best	·838	·048	·041										
Inferior ..	·779	·053	·095										
Peat:—													
Air dried ..	·461	·046	·246										
Kiln dried.	·600	·060	·307										
Wood:—													
Air dried ..	·404	·049	·327										
Kiln dried.	·503	·061	·407										

borne in mind in regard to the effects of fuel, especially when it is an object to produce very high temperatures; and I shall have occasion to illustrate afterwards the way in which this circumstance exercises an influence.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

Prince Christian of Schleswig-Holstein presided, on Wednesday, at a meeting of the committee appointed by her Majesty's Commissioners for the Exhibition of 1851, to consider the question of the musical performances at the forthcoming Annual International Exhibition of 1871, which are intended to take place in the Royal Albert Hall and Royal Horticultural Gardens. There were present—Earl de Grey and Ripon, Lord Gerald Fitzgerald, Hon. Seymour Egerton, Sir J. S. Packington, Sir Stafford Northcote, Sir Francis Sandford, Mr. Cole, Mr. W. H. Gladstone, Dr. Playfair, and Lieutenant-Colonel Scott (secretary.)

The four divisions of the Exhibition of 1871 will be divided into classes as follows:—

Division I.—Fine Arts.

Fine Arts applied or not applied to Works of Utility.

Class 1.—Painting of all kinds, in oil, water colours, distemper, wax, enamel, and on glass, porcelain, mosaics, etc.

Class 2.—Sculpture, modelling, carving, and chasing in marble, stone, wood, terra-cotta, metal, ivory, glass, precious stones, and any other materials.

Class 3.—Engravings, lithography, photography, etc.

Class 4.—Architectural designs, drawings, and models.

Class 5.—Tapestries, carpets, embroideries, shawls, lace, etc., shown not as manufactures, but for the fine art of their design in form or colour.

Class 6.—Designs for all kinds of decorative manufactures.

Class 7.—Copies of ancient or mediæval pictures, mosaics, enamels, reproductions in marble, fictile ivory, electrotypes of fine ancient works of art, etc.

Division II.—Manufactures.

Manufactures, Machinery, and Raw Materials.

Class 8.—Pottery of all kinds, viz., earthenware, stoneware, porcelain, parian, etc., including terra-cottas used in building; with any new raw materials, new machinery, and processes for the preparation of such manufactures.

Class 9.—Woollen and Worsted Fabrics, with any raw produce from new sources or prepared by any new process, and new machinery for woollen and worsted manufactures.

Class 10.—Educational Works and Appliances:—

- Section *a.*—School buildings, fittings, furniture, etc.
- Section *b.*—Books, maps, globes, instruments, etc.
- Section *c.*—Appliances for physical training, including toys and games.
- Section *d.*—Specimens and illustrations of modes of teaching fine art, natural history, and physical science.
- Section *e.*—Specimens of school work, serving as examples of the results of teaching.

Division III.—Scientific Inventions and New Discoveries of all Kinds.

Detailed rules and lists of the separate trades engaged in the production of objects of manufacture will be issued.

In divisions 2 and 3 producers will be permitted to send one specimen of each kind of object they manufacture, such object being distinguished by novelty or excellence.

Division IV.—Horticulture.

International exhibitions of new and rare plants, and of fruits, vegetables, flowers, and plants showing specialities of cultivation will be held by the Royal Horticultural Society in conjunction with the above exhibitions.

Special rules for horticultural exhibitions will be issued by the Royal Horticultural Society.

General Rules.

The arrangement of the objects will be according to classes, and not, as in former international exhibitions, according to nationalities.

One third portion of the space in each class will be assigned to such foreign exhibitors as shall obtain certificates for the admission of their objects from their respective governments. Foreign countries will appoint their own judges. The remaining two-thirds of the space will be filled with objects produced either in the United Kingdom or abroad, and sent direct to the building for the inspection and approval of judges appointed for the purpose. Objects not accepted for the exhibition must be removed according to notices to be given, but no objects exhibited can be removed until the close of the exhibition.

All objects must be delivered at the building, into the charge of the proper officers, unpacked and ready for immediate exhibition, and free of all charges for carriage, etc.

No rent will be charged for space, and Her Majesty's Commissioners will provide large glass cases, stands, and fittings, steam and water-power, and general shafting, free of cost to the exhibitors, and, except in the case of machinery, carry out the arrangement of the objects by their own officers.

Her Majesty's Commissioners will take the greatest possible care of all objects, but they will not hold themselves responsible for loss or damage of any kind.

Prices may be attached to the objects, and exhibitors will be encouraged to state their prices. Agents will be appointed to attend to the interests of exhibitors.

Every object must be accompanied by a descriptive label, stating the special reasons, such as excellence, novelty, cheapness, etc., why it is offered for exhibition.

Due notice will be given of the days for receiving each class of objects, and to enable the arrangements to be carried into effect, strict punctuality will be required in the delivery of all contributions, both foreign and British. Objects sent or brought after the days appointed for their reception cannot be received.

Reports of each class of objects will be prepared immediately after the opening, and will be published before the 1st June, 1871.

Each foreign country will be free to accredit an official reporter for every class in which objects made in such country are exhibited, for the purpose of joining in the reports.

Prizes will not be awarded, but a certificate of his having obtained the distinction of admission to the exhibition will be given to each exhibitor.

A catalogue will be published in the English language, but every foreign country will be free to publish a catalogue in its own language, if it think fit.

NETHERLANDS INTERNATIONAL EXHIBITION.

A general meeting of the London committee was held at the House of the Society of Arts, on the 18th March, S. Redgrave, Esq., in the chair. There were present—Alderman Sir J. C. Lawrence, Bart., M.P., Seymour Teulon, Gilbert Sanders, G. Coster, P. Le Neve Foster, Edmund Johnson, and P. L. Simmonds.

The following general statement of accounts was submitted and approved. It was ordered that the Central Committee of the Exhibition at Amsterdam be requested to send to the Society of Arts for distribution the diplomas and certificates awarded to English exhibitors.

Accounts.

1869.—Receipts.

	£	s.	d.
Subscriptions:—			
Vote of Society of Arts	£25	0	0
T. Twining	5	0	0
Mr. Sandbach	5	0	0
Brown, Van Santin, and Gereke	2	2	0
Enthoven and Son	1	1	0
L. Vankerkaken	2	2	0
Baron Gevers	5	0	0
D. Everwyn	5	0	0
F. H. and A. Collier	5	5	0
Hodgson Pratt	2	2	0
J. W. May	5	0	0
Wingfield Digby	10	0	0
The Lord Mayor	10	10	0
Messrs. Baring Brothers	10	10	0
M. Van Thal, jun.	1	1	0
G. Coster	25	0	0
S. Morley, M.P.	25	0	0
J. H. Schröder and Company	5	5	0
W. Bunge and Company	5	0	0
Messrs. Hirstmann and Company	5	0	0
Sir J. Lubbock, Bart., M.P.	5	5	0
A. G. Robinson	5	0	0
The Corporation of the City of London	52	10	0
T. Twining (2nd donation)	5	0	0
J. M. Johnson and Sons	£10	10	0
Seymour Teulon	2	2	0
R. Hudson	1	0	0
Somerset Beaumont, M.P.	1	0	0
S. Redgrave	2	2	0
Rev. W. Rogers	5	5	0
S. Morley, M.P. (2nd donation)	5	0	0
	£254	12	0

1869.—Expenditure.

	£	s.	d.
Expended in visiting the provinces, by special order of the Committee	25	0	0
Petty cash disbursements by secretary, March to December	15	5	0
P. L. Simmonds for services rendered as secretary and manager	146	1	10
J. M. Johnson and Sons, printing circulars, forms for exhibitors, and postages	68	5	2
	£254	12	0

THE EDUCATION BILL.

The adjourned debate on Mr. Dixon's amendment was resumed on Friday, the 18th inst., by Mr. Vernon Harcourt, who supported it, and maintained that it was aimed at that part of the Bill which violated religious equality, viz., the proposal to apply, at the will of a dominant majority, the rates collected from all, to purposes in which the minority could not partake. He thought a conscience clause utterly inefficient for meeting this difficulty, and denounced it as a sham, which he was surprised religious people could accept. His view was that the religious difficulty might be dealt with in three ways; either the rates might be applied to teaching all forms of religion, or the form of religious teaching might be one on which all sects could agree, or there might be no religious teaching at all—*i.e.*, secularism. Of these solutions he preferred the second, and, if that failed, the third; but they were all three consistent with political and religious freedom, both of which were violated by this part of the Bill. Mr. Harcourt argued that the solution proposed by the Bill was not only unjust but impracticable, and vindicated the amendment, which he avowed was meant only to delay the Bill, and had, in fact, gained its object, by giving the country time to pronounce against this part of it.

Sir Charles Adderley opposed the amendment, whose supporters, he maintained, desired, under the pretext of religious equality, to impose secularism on the country, without regard to the special wants of each district. With regard to rating, he suggested that, where a denomination provided proper schools, it should be exempt from school rates, and that subscriptions should also count proportionably for them. From the compulsory clauses he did not anticipate much practical result; all that was needed might be obtained from an extension of the Industrial Schools Act.

Mr. Mundella, in a speech of considerable power, opposed the amendment, which, he thought, would substitute an irreligious for the religious difficulty. He would never be a party to excluding the Bible from schools, and the plan he would advocate was to separate religious from secular education by means of a time-table. He advocated general compulsion in preference to the permissive system in the Bill, and gave some interesting particulars as to the condition and quality of education in this country and on the Continent, showing how much had to be done in improving the methods of teaching adopted. He was followed by Sir H. Hoare, who denounced the religious teaching clauses as intended solely to conciliate the Conservatives; while Sir H. Selwin-Ibbetson argued in favour of religious education, and supported the Bill. Mr. Jacob Bright criticised the shortcomings of the Bill, particularly in the matter of compulsion, and Mr. J. Howard supported the amendment. Colonel Beresford, the new member for Southwark, commented on the Bill

at length, and objected to it as the measure of the League under a thin disguise.

Mr. H. Richard criticised the Bill in its relation to Wales, where he maintained that a conscience clause would be futile. Mr. Birley followed, and advocated religious education. Mr. Fawcett argued in favour of general compulsion, and the separation of religious and secular education. He recommended postponement of legislation to another year, when the whole question of education, secondary, technical, and University, as well as primary, could be dealt with. Mr. Cowper-Temple supported the Bill, and condemned, as a specimen of democratic despotism, the compulsory imposition of secularism on the whole country. Sir C. Dilke protested against the permissive character of the Bill, and pleaded for secular education.

Mr. Gladstone urged Mr. Dixon not to press his amendment to a division, as the government, he said, had no disposition to insist on the permissive principle, against which the amendment was aimed, further than, after full discussion in committee, might appear reasonable. But at the same time he pointed out that, in a measure depending to a great degree on local rates, it was absolutely necessary to give a certain amount of discretion to the local authorities. The great objection he entertained to the amendment was, that in discussing the religious difficulty the attention of the House had been distracted from the importance of the other parts of the Bill—points which could only be thoroughly examined and discussed in Committee, while the bases of the Bill must be taken to be firmly fixed, and the government could not consent to any change in them. Mr. Gladstone referred to various matters of detail on which he was open to consider modifications. With regard to religious teaching, he was ready to consider an arrangement something in the nature of Mr. Mundella's suggestion, by which the conscience clause (which he acknowledged had not been successful) might be replaced by a separation of religious and secular teaching, on the principle of a time-table.

Mr. Dixon, being content with these assurances, desired to withdraw his amendment, but some members insisted on its being negatived formally, which was accordingly done. The Bill was then read a second time, after a protest from Mr. Hardy, on behalf of the Opposition, against being bound by Mr. Gladstone's new ideas on the conscience clause.

STATE OF EDUCATION IN THE GREAT TOWNS.

Two most important reports have just been presented to Parliament, prepared for the Education Department by Mr. J. G. Fitch and Mr. D. R. Fearon, on the education of the poorer classes of children in Birmingham, Leeds, Liverpool, and Manchester. It appears by the report of the former gentleman that, at Birmingham, with a population of 360,846, the schools receiving aid from the Parliamentary grant had 25,203 children on the rolls, with 16,053 in average attendance. The number presented for examination was 9,923, about one-seventh of the children of the school age, and the average number that passed in reading, writing, and arithmetic, 8,753, or about one-third of those on the school-rolls, while only 256 passed in the highest standard. These schools are maintained at a cost of £20,312, out of which £7,906 is contributed by government. Mr. Fitch proceeds further to give an account of elementary schools for the poor not receiving government aid, which he pronounces almost entirely worthless; the work is done unskilfully, and scarcely one in ten of the children can be said to be obtaining any real instruction. In the private schools for the poor, the most striking characteristic is the extraordinary idleness. Mr. Fitch found three-fourths of the children sitting without any occupation whatever.

At Leeds, also visited by Mr. Fitch, the population is 253,110. His returns show an average attendance of 19,492, making the estimated total number of scholars in Leeds 22,932. The inspected public schools comprehend 11,996 children in average attendance, 6,700 of them being able to pass the examination in the Revised Code, and this number, with the 2,743 infants under six who fulfilled the conditions of attendance, may be taken to represent the number of children efficiently instructed. It amounts to only 51 per cent. of the whole number on the roll. The resources of the inspected schools amount to £15,425. The uninspected public schools have 2,261 on the rolls, and 1,745 were in actual attendance. Mr. Fitch says that not more than one-fourth can be said to reach the standard just above mentioned. The private schools in private houses he speaks of most unfavourably, but nevertheless they are preferred by a large number of the poor. The restraints of the public school, and the attempts to enforce regular attendance and cleanliness interfere with the liberty of a disorderly home; and the private schools are thought more respectable, having no air of charity about them. On the religious question Mr. Fitch adds:—"Nor must I conceal the fact that there are many parents who object to the religious character so strongly impressed upon most of the State-aided schools. I attended a large meeting of working people in Leeds, including many of unusual intelligence, and in the course of the discussion I asked how it was that, notwithstanding the existence of so many institutions on a public basis, so many parents seemed to prefer the private school. One speaker said strongly, that for his part he thought 'it was because there was too much religion in the aided school,' and the remark was very loudly and generally cheered. . . . . It is certain that there is a strong and very general feeling among the working people against any devices which seem designed to make the school an instrument for promoting what they regard as clerical or sectarian, as opposed to purely educational interests."

A comparison of the statistics of these two towns shows that, in Birmingham, the population from 3 to 13 is 83,125; the average attendance in inspected schools, 16,053; the number in attendance in other schools, 10,783. In Leeds, the population from 3 to 13 is 58,307; the average attendance at inspected schools, 12,422; and the attendance at other schools, 7,070. Thus, the existing system of State aid, administered through the agency of the religious bodies, reaches 28,475 out of 141,432, or 20 per cent. of the total population of school age.

Mr. Fearon, in reporting on Manchester, also speaks most unfavourably of the uninspected schools, pronouncing 37 out of 81 as unfit, many of them being "held in premises in which it is injurious and improper that human beings should be gathered together for any purpose whatever, and in which instruction is physically impossible. The teachers of many of them are persons physically, morally, or intellectually disqualified for any sort of office involving even the lowest degree of responsibility. The instruction given, or pretended to be given, is deplorably bad; and attendance at many of them is scarcely, if at all, to be preferred to vagrancy in the streets." Of the 44 uninspected schools which remain, he says that many teach reading very fairly; few teach handwriting well; none teach arithmetic satisfactorily. In the uninspected day schools of Manchester 4,678 scholars were found in actual attendance; in the night schools, 884. In the inspected schools there were 24,507 in actual attendance, but the quality of the education given appears to be very low. Of 14,360 children presented for examination, nearly four-fifths (11,431) were presented below the fourth standard, the standard which a child whose elementary education is not unsatisfactory ought to pass at ten years of age.

Passing to Liverpool, Mr. Fearon has no hesitation in saying that the quality of the education is, on the whole, worse in the uninspected schools of that place than in

those of Manchester. 13,530 scholars were in actual attendance in day schools, and 1,220 in night schools. In the inspected schools, 28,116 in day schools and 766 in night schools, besides 3,303 in Poor-law, reformatory, and industrial schools. The population of Liverpool is 509,000; the number of children of the poorer classes who ought to be on the rolls of schools is 90,000, but the number is only 60,003, and in inspected day schools only 37,383. The quality of the education is here also deplorable. In the inspected schools only 3,231 were presented above the third standard (the standard which a properly taught child should pass at the age of nine years), that is to say, only that number "ventured to try to read an easy narrative, to write a short and easy piece of dictation on paper, and to work sums in addition, &c., of money." Moreover, only half of these succeeded in passing an examination in these simple requirements. Finally, there are only 144 children in all the primary schools of Liverpool who, having learnt to read, write, and cipher, have gone on into a higher subject.

Such is an outline of these remarkable reports, which, however, it should be understood, are not so much intended to summarize the actual work done in the inspected or aided schools, as to show the character and quality of the instruction given in the uninspected and private schools for the poor. The reports are accompanied by maps of the four towns, showing by symbols the geographical distribution of the various classes of schools.

CORRESPONDENCE.

NATIONAL ENCOURAGEMENT TO SCIENCE AND ART.

Sir,—The same leverage, that of national emulation, which has been so much and well used in this country to establish education in science and art, might with equal propriety be applied to raise, foster, and substantially encourage science and art, not in their rudiments only, but in their higher progress and advance. It must occur to all who think, what a half-measure is the annual, although well-applied, grant to our government establishments of science and art, while to the higher and progressive branches, when this education is gained, no due government and national scope or aid is given. The time will come when this will be felt generally, and, after a period, acted on. But why is this time so long coming?

When the good Prince Consort was with us, the want of a special department or minister of the Crown to look after the interests of these advanced branches of the higher education, beyond the rudimentary, was not so much to be deplored, because he, by his love of nature and his fine taste and judgment, conjoined with his high position and personal influence, supplied, to a great extent, the want in England of such a department of government as should look after the national well-being in these respects. It was only in the latter years of the good Prince, that the nation was beginning to feel fully the impress of his large mind; and there can be little doubt, had he been long spared to us, that among those subjects that occupied his thoughts, none would have benefitted more in their encouragement and advance than the higher efforts, discoveries, and achievments of science and art.

The good Prince was our President for many years, and gave us his assistance and guidance on most of the subjects of importance in which we took action. I submit that we cannot now have a better guide for our future than to follow, as far as in us lies, in that path in which he would have led us, had he not been so early taken away. I would, for the present, in this letter, apply this remark to the subject of science and art in their higher and progressive developments, in suggesting, as I said at the commencement, the application to it of the leverage of national emulation. The whole question of education, which now worthily occupies so large a space on the national broadsheet, is, in a great degree, urged on by this feeling, and by what is done abroad in other countries being reflected and held up, as in a mirror, to the public eye. What I would say but amounts to this, let not the higher developments of science and art be neglected in this movement.

With especial propriety, the Society of Arts may turn part of its attention to direct public attention towards the supply of the complement of the present governmental fostering of national science and art, namely, that which should be given in their higher region, beyond mere instruction, and which, when it comes, will give a vitality and vigour which cannot exist without it, to the whole subject of science and art in this country. In this direction, I would submit it as highly desirable that the Society should take means, for which its relations abroad will fit it, for informing its members and the public what government advantages to the higher branches and advancement of science and art exist in France, Prussia, and other continental nations. It is evident that the acquirement and publication of such details are strictly within the province of our Society, and I am sure they would be highly interesting to the public.—I am, &c.,

Epsilon.

BUILDINGS ON THE THAMES EMBANKMENT.—HEALTH v. TAXATION.

Sir,—In relief of taxation, we are told by Mr. Lowe that portions of the space reclaimed from the Thames are to be utilised for building purposes. On the contrary, I would suggest that the principle may well be borne in mind that all the open spaces formerly belonging to the Thames should, in every case possible, be retained. As our city is becoming every day larger, the more jealously should every area of its lungs be guarded, and this is the more important near the Thames, which carries a current of fresh air as well as water through the midst of the town. Relief from taxation may be a benefit, but the relief of fresh air is a greater. Instead of encroaching, as the minister suggests, upon these open spaces of the Thames, I would rather suggest, in the opposite direction, that all other spaces that are possible should be opened out by the river-side. We have no adequate view of our great cathedral, and it would be a noble improvement to our city if all the intervening buildings between St. Paul's and the river-side could be removed, and a terraced garden there laid out, which would enable us to see one of the finest buildings in the world. Our silent highway is not silent now, and the voice of steam is heard thereon pretty continuously. It has become a great thoroughfare between what were formerly remote parts of our town; and many thousands pass by it every day, except in the depth of winter. From Westminster to London-bridge is indeed a charming excursion for those who can admire urban as well as rustic scenery, and many there are who enjoy it. This transit affords now many beautiful views, and the Embankment is enhancing them. Let us not lessen and contract these, but rather let us develop their capabilities, and make our metropolitan river-banks without a rival, as well may be if we go on in the right course. And as the sanitary and picturesque points of view in this instance coincide, let us not adopt a narrow policy by giving buildings instead of fresh air, which will be no real saving, and will be universally regretted hereafter. Health and beauty should recommend themselves, even to the most economical ministry, even though relief from taxation may be a good cry.—I am, &c.,

Epsilon.

MEETINGS.

The fourth of the series of lectures being given in connection with the Social Science Association was held on Tuesday evening, in the Society's Hall, "On Reciprocity," by H. R. Hutton, Esq., Prof. Fawcett, M.P., in the chair.

GENERAL NOTES.

The Italian Army.—The total strength of the Italian army at the 1st of January, 1870, was as follows:—officers, 11,206; men, 184,961; total, 196,167.

Railways in Tunis.—An Italian paper, the *Corriere de Sardegna*, states the Bey of Tunis has granted the concession of a line of railway from Soletta to Tunis, to a Spanish firm.

Volatile Oils.—The United States War Department has promulgated an order that no volatile oils will be issued or used for illuminating purposes at military posts, and all varieties of coal oil will be regarded as volatile. In general, lard oil will be supplied in their stead.

The Suez Canal.—A lighthouse has just been built by the Egyptian government, at the entrance to Port Said. The new light is a flashing one, flashing every three seconds, and the illuminating apparatus is electric, of the first class. The tower, built of sand and cement, is of a light grey colour.

Consumption of Frogs in France.—The *Echo du Luxembourg* states that the exportation of frogs from that country to France has increased considerably of late. Upwards of 200,000 were sent in three weeks by one dealer, and on one day 30,000 were sent by the same person. They are sent principally to Rheims, Nancy, and Paris. A thousand frogs fetch 13 francs (10s. 5d.), and weigh 50 kils., or about one cwt. No duty is charged by the French custom-house on frogs. At Rheims, 25 pairs of frogs' legs can be bought for 60 centimes. The autumn and spring are the best times of the year for frogs.

Diamond Mining in Australia.—It is stated that the ground of the Mudgee Gold and Diamond Company has yielded another very fine lot of 121 diamonds, one of which weighed $2\frac{1}{8}$ carats. The Australian Diamond Mines Company have obtained, with one machine, 171 diamonds, and 38 ounces of gold. The gold yield has more than paid the expenses of the month. This latter company has sent to England in all 179 diamonds. The six-carat diamond sent by them to Europe to be cut, has been returned to Melbourne. It now weighs $3\frac{3}{16}$ carats, and is exquisitely brilliant and pure. Its value is exceptional, as it is the first large-sized Australian gem that has been discovered.

Albert Medal.—Baron von Liebig, having received from the Society of Arts the Albert Gold Medal, which was transmitted to him by H.R.H. the Prince of Wales, the President of the Society, accompanied by a letter from His Royal Highness, has written a letter to his friend Dr. Thudichum, stating that, in consequence of the medal having been awarded to him, the German agriculturists have subscribed a considerable sum of money, for the purpose of presenting to him (Baron von Liebig) a testimonial in recognition of his services to practical agriculture. The money thus subscribed has, by desire of Baron von Liebig, been appropriated to the foundation of a medal, to be called the "Liebig Medal," which is to be awarded from time to time to that scientific inquirer who shall have made the most successful application of the science of chemistry to agriculture.

Lyons International Exhibition.—It seems at last decided that the proposed universal exhibition is to take place next year. A number of leading merchants and manufacturers of Lyons and Paris have agreed to find the means. A company has been formed, and the directors of the undertaking appointed. The site fixed upon by the municipal council is the park of the Fête d'Or, a fine, open space. The designs for the building are ready, and preliminary measures are just commenced. The exhibition is to be open from the 1st day of May to the end of October. In case of profits resulting, one-half are to be devoted to the excellent object of founding an asylum for invalid artisans.

Employment of Children.—The Society for the Protection of Apprentices and Children in Factories in France, under the presidency of the Minister of Agriculture and Commerce, is making great efforts in favour of its protégés. It has prepared two enamelled iron plates bearing the following inscriptions:—"No children employed under twelve years of age," and "Children between eight and twelve years of age are employed by the half-day, on condition of passing the rest at school." These plates are supplied to any manufacturer who agrees to adopt either plan. The employers of the canton of Schirmeck, have, as a body, determined to employ no children under twelve years of age, and fifty or more manufacturers in Paris and the provinces, including Messrs. Dollfus Mieg, of Mulhouse, M. Ponyer Quertier, of Rouen, and M. Chaix, Claye, and Dupont, printers, of Paris, have followed their example. The same rule has been laid down in the government tobacco manufactories. Many more adhere to the half-day system, believing that the eight hours of labour, the maximum allowed by law, does not allow sufficient time for education and recreation. In some schools, as in the asylum at Charenton, infants between four and six years of age are employed during a very short time every day, in carding buttons, and the practice has been found to answer admirably, amusing the children, and, leading them to habits of industry.

A New Cylindrical Iron Railway Carriage has been patented by Mr. N. Maccartney, of Glasgow. The inventor describes it thus:—It is made of wrought iron firmly rivetted in the form of a cylinder, partaking more or less of a complete circle in its cross section. This shape is the strongest into which a given weight of metal can be put, as every part of the structure has the strength of the arch, each part bracing the other, and forming a carriage of immensely greater strength and power of resistance than the ordinary box-shaped wooden carriage at present in use. The doors may be made in the side, but they are arranged at each end, opening out on to a platform, which, when the train is in motion, serves as a means of communication through all the carriages. The openings for the windows are in the same position as in ordinary carriages, and the seats can be either made across or along the carriage; in either case, owing to the slightly increased breadth, a passage is left from one end of the carriage to the other. The iron plates of the carriage, owing to the circular shape, require little if any framework. The few ribs necessary are utilised as a means of ventilation. All the interior is cushioned, except the floor, with non-conducting and non-combustible material. Stoves are provided for heating—two, surrounded by hot-air jackets, being suspended under the car, with pipes passing into the car under the floor, which are so arranged as to keep up a continuous double circulation of hot air, warming the entire carriage. The platform is utilised as a collision buffer; the roof is extended over the platform, and, while serving as a cover, is also a buffer, on the same principle as the platform beneath. The platform and roof buffers will only come into action when a collision occurs, and as they are large spaces filled with compressible material, they will gather up the momentum of the shock, and give time to distribute it evenly over the whole train of carriages.

Street Tramways.—These will soon be at work in London. The first line finished will probably be between Bow and Whitechapel. The car is to be American in style, handsome, comfortable, and roomy. It will convey 28 outside passengers and 22 "insides," with ample space and room for passage. It will be narrower externally than an ordinary omnibus, but 12 inches wider within, and very lofty. Two horses will easily draw it, as they will be equal to eight on the road. Other conveyances will be able to cross the lines without injury, as the rails are level with the surface of the road, and the narrowest wheel will be safe from becoming entrapped in the groove, as it is only three-quarter inch in width. The fare is fixed by Act of Parliament at a penny per mile.

The Brindisi Route.—The Director-General of the post in Italy publishes in the *Gazetta Ufficiale* the following particulars of the arrival of the Indian mail in London during the month of January, *viâ* Brindisi, as compared with that *viâ* Marseilles, and shows a considerable saving in time by the former route :—

Time of Arrival in London.

Via Marseilles.	*Via* Brindisi.	Gain by the Brindisi route.
1st Jan. .. 5.45 p.m.	31st Dec. .. 5.42 p.m.	24 hs. 3 min.
9th „ .. 7.5 p.m.	8th Jan. .. 7.21 p.m.	23 hs. 16 min.
15th „ .. 6.17 a.m.	14th „ .. 5.45 p.m.	12 hs. 32 min.
23rd „ .. 5.45 p.m.	22nd „ .. 5.43 p.m.	24 hs. 2 min.
30th „ .. 6.42 p.m.	29th „ .. 5.43 p.m.	24 hs. 59 min.

The Ironworks of Creusot.—The establishment at Creusot comprises three distinct departments, viz., the collieries and iron mines, the manufacture of iron, and the engineering department. This last is subdivided into two sections, the first for railway rolling stock, &c., and the second for marine engineering. The manufacture of steel will shortly form a fourth department. The quantity of coal annually raised from the Creusot coal mines is 200,000 tons, of which 14,000 tons are consumed as fuel for the machinery, 90,000 are used for the production of coke for metallurgical purposes, and 15,000 are employed for various other purposes connected with the works, whilst the surplus is sold. The annual production of the fourteen blast furnaces is 130,000 tons, the greater part of which is converted into wrought iron. The value of the plant and machinery is estimated at 20 millions of francs. The branch establishment at Châlons employs 650 workmen for making bolts and rivets. The works at Creusot turn out annually about 60,000 tons of rails, 10,000 tons of boiler plates, and 30,000 tons of mechanical iron, 120 locomotives, besides steamboats, railway bridges, and a variety of other works connected with engineering, and amounting in value to 30 millions of francs. The total number of persons employed at this vast establishment is 15,000, of which 750 are engaged at the blast furnaces, 1,500 in the collieries, 4,000 at the forge, 3,500 in the engineering department, 1,400 in the iron mines, 200 at the branch establishment at Perzeuil, 250 in the brickfields, 650 at Châlons, and 1,200 on the railways, without taking account of office *employés*, the medical staff, and those connected with the educational, provident, and charitable institutions which are so successfully managed at Creusot. As to the general condition of the workpeople at Creusot, a letter by M. Eugène Morand states that there is provided for every man, woman, or child a space equal to eleven square miles and thirty-two cubic metres, considerably more than is enjoyed by the inhabitants of Paris. No fewer than 700 gardens are let by the company at the rate of two francs per annum. The company have constructed ten miles of streets, and rather more than two miles of boulevard, and have provided public fountains yielding 500 cubic metres of water per day. Messrs. Schneider have founded five commercial and industrial schools, fifteen free schools, and sixteen nurseries for infants. The education given at these establishments comprises reading, writing, French history, arithmetic, geography, drawing, geometry, mechanics, physics, and chemistry. A library of upwards of 2,300 volumes, comprising works on all subjects, has been provided. Two Catholic churches have been built by Messrs. Schneider, who have also provided for Protestant worship. The smallest wages earned at Creusot is 3f. 45c. per day. In 1840 it was only 2f. 60c. A man may earn 8f. per day in the workshops, and 13f. in the blacksmiths' shops. The savings-bank contains the deposits of 1,700 workmen, amounting in all to 11 millions of francs. A further sum of 20 millions is invested in the works by 540 workmen, but it can be withdrawn at any time. No fewer than 450 workmen, having ceased to work, possess among them property to the value of 3 millions, and which, invested at Creusot in land or houses, realises somewhere about 7 per cent.

United States Navy.—The Secretary of the U.S. Navy, in his report just published, recommends a total re-organisation of the United States navy, the sale of the old and worthless vessels of the *Isherwood* class, and the construction of some new and more serviceable ships. The force of the navy now amounts to about 200 vessels. The Secretary will suggest that the peace footing be fixed at about 180 vessels. He is also in favour of subsidising lines of ocean steamers, and alludes to the advantages which the country would have derived in the late war from the possession of a steam flotilla, such as the British Government has at its disposal in the event of hostilities. The tonnage of England, France, and the United States is contrasted, with, as may be judged, results by no means favourable to the United States. On the subject of docks and navy yards, the Secretary has some recommendations to make. He considers the Brooklyn yard too small, and will advise that ground be purchased on the North River for a more commodious establishment. The foreign squadrons, he thinks, should be increased and strengthened. All this can be accomplished on the same amount of money as was appropriated last year.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. Benjamin Paul, "On the Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light."
British Architects, 8.
R. Geographical, 8½. Sir Charles Nicholson, "Forrest's Expedition to the Interior of Western Australia, and Goyder's Survey of the Neighbourhood of Port Darwin, with Remarks on recent Australian Discoveries."
Social Science Assoc., 8. Mr. E. Jones, "On Spelling Reform."
Actuaries, 7. Mr. W. P. Pattison, "On the Existing Legislation affecting Friendly Societies, with Suggestions for its Amendment and Extension."
Medical, 8.
London Inst., 4.

Tues ...Civil Engineers, 8. Mr. Wm. Henry Barlow, "Description of the St Pancras Station, Midland Railway."
Social Science Assoc, 8. Prof. Thorold Rogers (at the Society of Arts' House), "On Labour and Capital."
Royal Inst., 3. Prof. Rolleston, "Nervous System."

Wed ...Society of Arts, 8. Mr. Thomas Page, "On Submarine Channel Communication."
Chemical, 8. Annual Meeting.

Thur ...Royal, 8½.
Antiquaries, 8½.
Royal Inst, 3. Prof. Odling, "Chemistry."
London Inst., 7½.

Fri ......Geologists' Assoc., 8.
Royal Inst., 8. Prof. Roscoe, "Artificial Alizarine."
Archæological Inst., 4.
R. United Service Inst., 3. Capt. H. Brackenbury, R.A., "The Last Campaign of Hanover."

Sat ......Royal Inst., 3. Mr. Lockyer, "The Sun."

Journal of the Society of Arts.

FRIDAY, APRIL 1, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS

Wednesday evenings, at eight o'clock:—

April 6.—Adjourned discussion on Mr. W. Bridges Adams's paper "On Tramways for Streets." On this evening Chas. Hutton Gregory, Esq., will preside.

INDIA COMMITTEE.

This (Friday) evening, April 1st, 1870, Hyde Clarke, Esq., will open a Conference "On the Through Route to India." The chair will be taken at 8 o'clock, by W. Maitland, Esq., late Chairman of the Calcutta Chamber of Commerce.

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum, on Wednesday evening, the 4th of May.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CONFERENCE.

Yesterday, Thursday, March 31st, a Conference was held at eleven o'clock, on "The Relation of the State to Science." Lord Henry Lennox, M.P., Chairman of Council, presided, and the opening paper was read by Lieut.-Col. Strange, F.R.S. The following took part in the discussion:—Professor Williamson, F.R.S., Balfour Stewart, F.R.S. (Kew Observatory), Professor G. B. Airy, Astronomer Royal, Dr. W. A. Miller, Rev. Arthur Rigg, E. Chadwick, &c. A report of the proceedings will appear in next week's *Journal*.

SEVENTEENTH ORDINARY MEETING.

Wednesday, March 30th, 1870; Captain Tyler in the chair.

The following candidates were proposed for election as members of the Society:—

Collett, Richard, 25, Burleigh-road, Highgate-road, N.
Haden, George Nelson, Trowbridge, Wilts.
Thorpe, Alfred West, 31, Henrietta-street, W., and Stock Exchange, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

Bishop, Alfred, 17, Speck's-fields, Mile-end New-town, E.
Cotton, F. L., 29, Gracechurch-street, E.C.
Dalziel, W., Creek-bridge Copper Works, Creek-road, Deptford, S.E.
Davenport, E. G., 18, Gloucester-crescent, N.W.
Davey, Arthur Stevens, 59, Queensborough-terrace, Kensington-gardens, W.
Harris, E. Henry, 14, Devonshire-square, E.
Lamport, Chas., Clarendon-house, Upper Norwood, S.E.
Medd, Henry, 7, Alfred-place, Bedford-square, W.C.
Mitchell, Joseph, 66, Wimpole-street, W.
Phillips, Stephen S., 10, Baker-street, Portman-sq., W.
Smith, William Bickford, J.P., Camborne, Cornwall.
Vavasour, William, Hazlewood Castle, Tadcaster, York.

The Paper read was—

ON SUBMARINE CHANNEL COMMUNICATION.

By Thomas Page, Esq., C.E.

The subject which I would submit to your notice this evening is the practicability of establishing a submarine communication between the English and French coasts, to restore the two countries to that connection which they enjoyed in prehistoric times, before the denudation of the Valley of the Weald; for the French coast as well as the English offers evidence of that extraordinary convulsion which must have taken place before the English Channel (La Manche) was formed.

In connection with this object, viz., the submarine communication, I propose to bring before you the remarkable tidal action in the English Channel, from the entrance of the Atlantic waters, between the Isle of Ushant and the Scilly Islands, their flow along the Channel, and their discharge into the wide expanse of the North Sea, after passing the headland of Cape Grisnez. With this, I would refer to some proposals for establishing a new port south of Cape Gris-nez, at Audrescelles, by Messrs. Waring, and a design for a grand harbour at Boulogne by myself; the three proposals, viz., the submarine communication, the proposed port at Audrescelles, and the harbour at Boulogne, being connected with each other, the two last possessing, however, an interest less important than the former.

My object in the communications in this paper is to treat the subject in the most simple manner, in the hope that the meeting may easily follow my description, may think with me, and, I would venture to say, may come to the same conclusion.

To show that the subject before us was not a scheme of mine, I may mention that it was suggested by Mr. Newman, of the celebrated firm of Messrs. Freshfield and Newman, in 1862, who asked if I had considered the practicability of forming a railway communication across the Channel, and who assured me that if I would devise a plan, on the success of which I would stake my professional reputation, there would be no difficulty in providing the funds for its execution, to the amount of £8,000,000 sterling. I accordingly gave the subject my best consideration, and, following a course of reasoning on true engineering principles, I arrived at the result which I will now explain.

The distance between Dover, or the South Foreland, and Cape Gris-nez, the nearest point on the French coast to England, is $17\frac{3}{4}$ nautical miles. If this distance can be subdivided into nine parts, there would be, say, in round numbers, two miles in each division. If we can operate upon two miles, nine times that operation would complete the communication between France and England. Taking the Middlesex shaft of the Thames-tunnel, which was formed under my direction, as a basis, and the height of the towers of Westminster Abbey as the perpendicular height of the Channel-shafts from the deepest part of the channel in the line between Dover and Cape Gris-nez to low water, I proposed to divide the

Channel into nine parts by eight shafts, and thus determine the practicability of the enterprise by the subdivision of its length.

I then designed the shafts, varying in proportion according to the soundings, and on the principle of an inner and outer conical form of wrought-iron, braced together to form one structure, with chambers to admit water to the base of each when floated off to its proper position, between two powerful steamships, and thus bring it rapidly from a horizontal to a perpendicular position, and sink it at once to its proper place, an operation which, as soon as the shaft attained its position vertically, would be one requiring not more than ten minutes. The shafts would terminate in cutting edges, like the curb of the Thames tunnel shafts, which would faciltate their entering and being embedded in the bed of the sea. Immediately the shaft should have entered into the bed, the operation of filling the space between the two cones with concrete of Portland cement, such as I used at Westminster-bridge, would be commenced, and in one tide the operation of filling-in the concrete and making a solid structure would be completed. Besides this filling, a bank of concrete, thirty feet in height above the bed of the sea, a base of 45 feet all round the external surface of the shaft would be formed, and this would give a stability to the structure against storms. Finally, a net-work of chain cables would be secured round the shaft, the leading cables being moored at a distance of 200 feet from the base of the concrete bank, as a protection against any vessel drifting unmanageable in a storm.

These shafts, terminating in lighthouses at a height of 180 feet above low-water mark, would also have a beneficial effect in the navigation of the Channel, as especially marking the locality, by which means numerous shipwrecks and loss of life would be avoided, for it is acknowledged by all nautical men, acquainted with the circumstances under which shipwrecks occur, that they are caused by the captains of the vessels having mistaken their position, in taking one light for another; and it is certain that the subway lighthouses, lighted by the brilliant lime-light, and being seen at so great a distance, would do away with many dangers in the Channel, for, even during fogs, the bells and guns of these lighthouses would unmistakably mark the position.

The description of the operation for one shaft is the description for all; but the following table gives the weights and diameters of the several shafts, from the bed of the sea, where each would be sunk, to a height of 180 feet above the level of low water.

Channel Subway Shafts.

Weights, Quantities, &c., in each to 40 feet above High Water.

Shafts.	Height.	Outer.	Inner.	Concrete.
	Feet.	Weight in tons.	Weight in tons.	Cubic yds.
No. 1	148	405	210	8,603
No. 2	162	405	260	9,412
No. 3	174	466	292	10,109
No. 4	196	474	346	11,387
No. 5 (Cor.)	248	525	440	14,408
No. 6 (Cor.)	233	757	414	13,537
No. 7 (Cor.)	198	484	342	11,504
No. 8	126	390	166	7,320
		3,951	2,470	86,280

Of the Line of Soundings between Dover and Cape Gris-nez.

Tho soundings in fathoms for the first two miles as marked on Admiral Bullock's Chart are, 7, 9, 11, 13, 13; in the next two miles 14, 15, 16, 15; in the fifth and sixth miles, 15, 17, 18; in tho seventh and eighth miles, 18, 18, 21; in the ninth and tenth miles, 20, 23, 30; in the eleventh, twelfth, and thirteenth miles, 31, the deepest sounding, and 25; in the fourteenth and fifteenth miles, 23, 23, 21; in the remainder $2\frac{3}{4}$ miles, 19, 15, 17, 12, 9, 7 fathoms; hence the deepest soundings, 31 fathoms, or 186 ft., are in the channel of the Pas de Calais; and to give an example of this depth, easily understood, it is about 24 ft. lower than the towers of Westminster Abbey.

The gradients of the bed of the Channel, as taken from the soundings on the Admiralty Chart, are as follows:—

Descending Gradients from Dover.

Yards.	
1.—2,350	1 in 176
2.—1,413	1 „ 212
3.—1,000	1 „ 256
4.—1,167	1 „ 590
5.—1,400	1 „ 691
6.—2,550	1 „ 1,300
7.—7,833	1 „ 650
8.—5,333	1 „ 1,470

Ascending Gradients to Cape Gris-nez.

Yards.	
9.—2,733	1 in 228
10.—2,533	Level
11.—1,333	1 in 212
12.—1,234	Level
13.—1,133	1 in 85
14.—6,367	1 „ 182

This statement shows that, without regulation, the general gradients are very favourable.

We will conclude, then, that the eight shafts are sunk in the exact positions, in calm weather and still water, for these conditions are essential to the economy and rapid execution of the design. We have now to form the submarine communication between the shafts, having thus reduced the operation to a distance of two miles.

The shafts being in place, the bed of the sea would be brought to a fair surface by the operation of divers, who would be enabled to work without pressure on their lungs or their bodies; but into the particulars of this system I do not wish to enter, as it is a special arrangement for such purposes of operating in deep water.

The next operation is that of sinking and bedding on the bed of the Channel, the tubes or construction for the railway; these may be for a single line or a double line. The single line would be sufficient for the traffic, except for special trains; the double line would fulfil all purposes. I will refer to the double line at present, and then describe a tube, the joint of which is patented by Mr. Williams, of Liverpool, by means of which the tube, moving on circular joints, can take an elastic position, and all the junctions can be made above the surface of the water, while the remainder of the tube is bedded in the sea.

The space between the shafts being divided into lengths, say, of $\frac{1}{4}$ of a mile each, and heavy iron frames fixed in the bed of the Channel by the divers, the lengths of tubular sections which I would propose to submerge at one time are $\frac{1}{4}$ mile, 1,320 feet, a little more than the length of Waterloo-bridge. Eight of these lengths being sunk and covered, complete the distance of two miles, and if a sufficient power and a sufficient number of operators were provided to commence from each shaft, the whole between two shafts would be done in half the time; and it is equally certain also that nine times the power and operators would complete the whole distance between Dover and Cape Gris-nez in the same time as would be required for joining two shafts.

The gigantic nature of the work and the magnitude of its details require corresponding means of execution, both in the steam-ships and other vessels, for placing the shafts in position, and for embedding the lengths of tube in their proper places in the bed of the Channel, as well as for all tho operations for filling the spaces between

the outer and inner rings of the shafts with concrete, in forming the banks of concrete round the shafts, and in covering with concrete the submerged tubes immediately they are placed in position. It is by an excess of power and means, in steam-ships and other vessels, in operators, and in materials for forming concrete, that the progress and completion of the work can be accomplished with rapidity and economy. Thus to cover a length of tubular section a quarter of a mile long, in two hours of the tide, would require 1,500 men; to fill the space between the rings of each conical shaft would require 500 men for two hours' work; and to form the bank of concrete round each shaft would require 350 men for the same time.

On the projects for crossing the Channel, whether by large steam-ships carrying railway trains, or by a tunnel excavated in the chalk, or by a bridge, or by a continuous tube, I intend to offer to your notice but few observations, but these I trust will be consistent with the good sense and judgment of the meeting.

Everyone will concur that, for comfort in a gale of wind, the largest and steadiest steam-ship will afford the least annoyance and greatest convenience to passengers; but there are few people who can imagine that a railway-carriage is the most suitable place for undergoing the wretchedness of sea-sickness; and it may be anticipated that, in fine weather, the passengers would prefer the deck of the steam-ships, and in bad weather and a tempestuous sea, they would seek the saloons and cabins, in preference to keeping their seats in the railway-carriages. Hence all the benefit of the proposed arrangement for transporting railway-trains across the Channel by large steam-ships would be confined to the non-disturbance of portmanteaus, bags, &c., in the carriages themselves. The passengers would certainly never remain in them; and the disadvantage of loading the steam-ship with the railway-train would soon bring the system to an end, and very deservedly. The superaddition of this useless weight to the arrangements proposed, in 1862, by Mr. A. S. Ayrton, in connection with the new port of Cape Gris-nez, for which I had made the studies, design, and estimate, would be the great drawback to the project, and it is evident to every reflecting mind that the completion of the Channel subway, with direct railway communication between England and France, would be the ruin of the combination for this system.

On the proposal of a continuous and uninterrupted tube across the Channel, through which railway trains would pass, it appears to me, while not exaggerating the difficulties in completing tubes of such a length, that the public would be averse to travelling such a distance without intermediate shafts, which would not only be necessary for ventilation, but would give additional security, both in idea and reality. I do not say that the number of shafts which are in my design are absolutely requisite, because the more perfect the means of junction of the lengths of the tubular subway are, the fewer shafts would be required, but I take two geographical miles between the shafts as a length which would not only give confidence to the public in the certainty of the work being executed—which conviction is almost a necessary element of success—but would also avoid the disagreeable reflection that they must travel so great a distance with the certainty of not seeing the light of day.

Regarding the design for a bridge over the Channel by M. Boutet, I give no decided opinion at present, but I fully concur in the idea of His Imperial Majesty, that the span of each division in the original design should be considerably diminished. The principle of the design is that of supporting this span in tension, but the amount of this tension must depend, in the first instance, on the radius of curvature of the arches, which in the original design is very considerable. I was asked to be consulting engineer to the English party connected with this project, but declined on account of having preferred this very plan which I now describe. That a permanent bridge can be constructed I am fully convinced of, but that a bridge is the best mode I do not agree to. Nevertheless, there is no difficulty in forming the foundation of the piers up to low water, and above that line the works would be open to the eye, and the progress would depend upon the means to be used in the construction.

I am informed, by a gentleman who visited Paris, that a model of M. Boutet's bridge, 66 feet in length, stood the usual tests to which it was publicly submitted in Paris, with success, and, in pursuance of encouragement afforded by the French Government, a further test of the system is being made by a span of 330 ft., which he understands is as successful as the lesser span. These results depend upon a system which consists in the elimination of all possible superfluous weight, by developing the powers of each particle of the metal employed; and the plans which he has had an opportunity of seeing seem calculated, to a great extent, to produce this result.

The tunnel scheme, in which Messrs. Hawkshaw, Brunlees, and Lowe, civil engineers, have been engaged, and which they have had the honour to submit to his Imperial Majesty, may be justly regarded as a work involving much time in its construction, and liability to danger during that time. In the work of the Thames-tunnel, instances of progress occurred in the years 1826 and 1827, of from 12 ft. to 14 ft. per week; and taking the length of tunnel effected from 27th of October, 1826, to the 27th of April, 1827 (the months when the most rapid progress was made, and before any difficulties presented themselves), there was completed an aggregate length of 252½ feet during a period of 26 weeks, giving an average of nearly 10 feet per week.

The precautionary measures of the engineer-in-chief, Sir I. Brunel, so well exemplified in the construction of the celebrated shield, were as perfect as could be well-devised for a structure which depended for its progress upon manual labour, and though, by the introduction of machinery, a progress considerably above the rate obtained at the Thames-tunnel might be effected, it must be borne in mind that the pressure to which the operations might be subject—from a head of more than twelve atmospheres combined with the great distance of the working operations from the entrances, would try every fissure in the chalk or other strata in which the Channel tunnel would be constructed; and if once the full effect of pressure took place in the tunnel, a scene of ruin and destruction would ensue which would completely terminate the undertaking. If a rate of progress twice that of the most rapid advance of the shield in the Thames-tunnel were assured, a complete exemption from accidents and delay of every character, and the works proceeded with from each end simultaneously, it would require fifty years to complete the distance of 17¾ geographical miles between Dover and Cape Gris-nez. When the Thames-tunnel was commenced, it was calculated it would be completed in two years. It was commenced on 16th of February, 1825; stopped by an irruption, 12th May, 1827; was resumed in September in the same year, and on the 12th of January, 1828, was stopped by the second irruption for seven years; resumed in 1835; finally opened on the 18th March, 1843. The Thames-tunnel was, therefore, in course of construction ten years instead of two; but it is not likely that Mr. Hawkshaw's tunnel would be subject to the like delay; one single irruption would be its ruin. If Capt. Penrice's machine were used for the tunnel, then the progress would be totally different; but one condition of safety must necessarily be the unbroken continuance of the chalk and its freedom from fissures.

In conclusion, I would draw your attention, ladies and gentlemen, to this fact, that if we sink a shaft, such as I have described, in the deepest part of the Channel, and maintain it in its position by the weight of the structure itself, the surrounding bank of concrete, and the network of chain cables to prevent ships driving against it, we can submerge and maintain seven more shafts in a decreasing depth of water.

If we can submerge tubular sections of one quarter of a mile in length, longer than Waterloo-bridge, bed them properly, join them firmly to each other and to their massive frames, embedded in the bed of the Channel, and, during the same tide in which these tubular sections are submerged, cover them with cement concrete six feet in thickness, sloped away on each side to prevent abrupt resistance to the tide; if we can complete, under these conditions, eight sections between two shafts, we can complete the remaining eight divisions spanning the width between Dover and Cape Gris-nez, and the object is then accomplished. A single summer of quiet weather would be more than a sufficiency of time, and eight millions of money, together with the assistance of the large steamships from the navies of France and England, would be more than a sufficiency of money.

It is due to Count Gleichen (Prince Victor Hohenlohe), R.N., to state that his Serene Highness has taken great interest in my project, and I trust that that interest may assume a more active state, should the design become a reality. I have some reason to conclude that our late gallant Commander-in-Chief in the China seas, Admiral the Hon. Sir Henry Keppel (G.C.B.—instead of K.C.B., which, however, he soon must be), might be induced to take command of the maritime department of this great undertaking.

Somewhat in connection with the Channel subway, I have submitted to a committee of noblemen of France a design for a grand harbour at Boulogne, which, while facilitating the communication between France and England, would form an addition to the ports of France worthy of the reign of the Emperor Napoleon III. The area of the harbour would be 1,126 acres, with a depth of 42 feet, at low-water, at its entrance, and a rise in spring-tides of 25 feet, the breakwater being 7,110 metres in length, which is 3,339 metres longer than the celebrated harbour of Cherbourg, and fortified with 100 of Sir J. Whitworth's heavy ordnance, carrying shot a range of six miles. The advantages of a harbour in this locality are partly set forth in this paper, both in the rapid reference to the nature of the obstructions to the ports on the French side of the Channel, and to the advantageous position of Boulogne over that of Marseilles for trade with all the coast of America north of the 18th parallel of latitude.

It is well known that our eminent president of this evening, Captain Tyler, has, in addition to his many important missions, taken great interest in the port of Boulogne, and made suggestions for its improvement.

Of the Distance from Boulogne and Marseilles to Ports across the Atlantic.

The importance of Boulogne as a commercial port of France may be judged by a brief comparison of distances from it to the west compared with Marseilles.

It is evident that every vessel bound to the west from Marseilles must run from Lat. 43·17 to Lat. 36·07, and from E. long. 5·22 to W. long. 5·21, to clear the Straits of Gibraltar, and, taking the nearest course, this run would equal 800 miles. Passing the meridian of Cape St. Vincent 200 miles further west, vessels would be fairly in the Atlantic Ocean.

Meanwhile, a ship starting from Boulogne would, in 312 miles, have cleared the Scilly Islands, ready to run for any western port; and comparing the distance of the two ports of Marseilles and Boulogne from St. Thomas's (which is the island usually made by the Royal mail steamers), it will be found that, even to a point so far south as Lat. 18·30, while the distance from Marseilles would be 3,971 miles, the distance from Boulogne would be not more than 3,673 miles, making a difference in favour of Boulogne of 298 miles.

When it is considered also that a radius of half the distance from Boulogne to Marseilles includes Paris and all the towns on the Rivers Seine, Marne, and Loire, the provinces of Loraine, Champagne, Artois, Picardy, L'Isle de France, Normandy, Bretagne, Maine, Anjou, Touraine, Chartrain, Dunois, Orleanois, Blaisois, with parts of Poitou, Berry, Nivernois, and Burgundy, it may be concluded that the establishment of a port accessible at low-water for large ships must be regarded as one of the most important commercial enterprises for France of the present century.

Of course it may be said that for several of the provinces enumerated there are local ports, as Havre, St. Malo, Nantes, &c. True, but there are none accessible at low water, as Boulogne would be.

Looking to the other ports of France in the Pas de Calais, they are all subject more or less to the dangers of shoals in front of them; and to give an idea of the causes which deteriorate the ports on the French coast of the Channel between the Isle of Ushant (Ouessant) on the west, and Calais on the east, I have subjoined the following list, which shows the nature of the foreshore along the above-named line of coast:—

Classification of Sand and Shingle along the French Coast, from the Isle of Ushant as far as Calais.

Ouessant	
Lanpaul	Sand.
Aberviach	Sand and soft mud.
All the coast between Isle de Bas and Ouessant	Grey sand, mixed with small pebbles of various colours, and resembling nuts.
Ile de Bas (Channel between it and coast)	Sand, gravel, and broken shells.
Morlaix	Sand and rocks.
Port Blanc	White sand.
Heaux Light	Sand and mud.
River Pontueux	Sand and mud.
Ile de Bréhat	Sandbanks.
Paimpol	Sand, bottom soft mud
Binic	Sand.
Point du Roselier	Muddy sand.
Yffiniac	Sand.
Port Dahouet	Sand.
Eiqui	
Cape Fichel	
St. Cast	Sand.
Bay of Frenay	Muddy sand.
St. Briac	Bottom of sand and mud.
La Rance	Sand.
Banc de Solidor	Fine white sand mixed with broken shells.
St. Malo	Sand (very rocky).
Corbières Bank	Blue tenacious clay.
Cancale	Clayey muddy bottom.
Bay of Mont St. Michel	Sand.
The coast between Champeau & Granville	Low and sandy.
Granville	Sand.
Regneville	Sand and shells.
Havre de Blainville	A kind of lagoon, almost entirely filled with sand.
St. Germain Bay	Sandy clay.
Surville	Sand.
Port Bail	Sand, pebbles, and small stones.
Shore, from Port Bail to C. Carteret	Low and sandy.
Shore, from C. Carteret to C. Flamanville	Is a white, sandy beach.
Le Banco Velco (opposite Port Bail)	Coarse sand shingle.
Vanville Bay	Sandy beach.
Cape La Hogue	Rocks and sand.
Goury	Pebbles and gravel.
Querqueville	Sand, gravel, and rocks.
Cherbourg Bay	Bordered by a low, sandy beach, the bottom uneven
Cape Levi	Muddy bottom.
Coast between Capes Levi and Barfleur	Low and sandy.

Honfleur	Mud mixed with sand.
Harfleur	Sand.
Point du Hoc	Sand and shingle, mostly all rolled shingle.
Havre	Shingle, seemingly cemented with mud.

The approaches to Le Hâvre are obstructed by banks of stones and shingle.

Cape La Hève	Sand and shingle.
Cape Antifer	Sand.
Etretat	Shingle.
Yport	Shingle.
Fecamp	Shingle, cemented by mud.
St. Valérie en Caux	Shingle.
Raz de St. Michael	Shingle.
Point Ailly	Shingle.
Dieppe	Shingle.
Ridens de Dieppe	Sand and broken shells.
Belville	Shingle and sand.
Ridens de Neuvilleté	Sand.
Tréport	Shingle.
The bar of entrance to Tréport	A mixture of sand, gravel, and shingle cemented together.
Cayeux	Sand.
St. Valerie sur Somme	Sand.
Left bank of the Somme	Shingle.
Embouchure de la Somme	Sand.
St. Quentin	Sand.
River Athie	Sand.
Touquet Point	Sand.
Etaples	Sand and broken shells.
Cape Barfleur	Sand and broken shells.
Cape La Hogue	Mixture of muddy sand and gravel.
Petite Rade	Sand and broken shells.
Marcouf	Sand and broken shells.
R. Douve	Sand.
Isigny	Mud.
Coast from Carentan to Point Mercie	Sand and gravel.
Coast from Point Perce to Cape Manvieux	Sand and shingle.
Port en Bessin	Sand and gravel.
Courseulles	Sand.
Embouchure de L'Orne	Sand.
Oystrelram	Sand.
St. Aubyn	Sand.
Embouchure de la Dives	Sand.
Embouchure de la Seine	Sand and mud (shifting sands).
Banc du Ratier	Large quantities of stones, rolled shingle, and some sand.
Banc d'Amfard	This bank uncovers about 6 feet at low water springs, but its surface is subject to great changes, for, in 1855, it was found that the stones or pebbles which constituted its inferior part in 1834 were then buried under shingle 6 feet thick, proving that the shingle on it is not stationary as on Banc du Ratier.
Embouchure de la Tongues	Sand.
All the Coast from Etaples to Cape Alprech	Sand.
Cape Alprech to Boulogne	Sand.
Boulogne to Gris-nez	Sand and broken shells, with the exception of $\frac{1}{4}$ mile from Audrescelles towards Gris-nez, shingle.
Gris-nez to Wissant	Sand and broken shells.
Wissant to Calais	Sand.

Of the Tides in the English Channel.

The tide of flood impelled from the Atlantic Ocean into the English Channel, presses upon the coasts of Brittany and Normandy, to an elevation considerably greater than it attains on the English coast. Thus, while at the Scilly Islands the rise of spring-tides is not more than 16 ft., the rise at Ushant is 19 ft., and increases in height along the coast of Brittany to 22 ft., and at Aberviach $25\frac{1}{2}$ ft. At Ploncessat and at L'Ile de Bréhat it attains an elevation of 31 ft. Entering into the gulf of St. Malo, bounded by L'Ile de Bréhat and Cape de la Hogue, the flow of the tide is impeded by the abrupt projection of the coast of Normandy, which protrudes into the Channel from St. Malo to Cape de la Hogue, an extent of sixty miles, and the waters forced against this abrupt line of coast attain a rise varying from 31 to 35 ft. at St. Malo, and 39 at Cancale and Granville. If nature had formed, at this point of the coast, an estuary like the Bristol Channel, the tide would have attained, in the higher part of such an estuary, the greatest rise in the world; for i f with a rise of 16 ft. at the Scilly Islands and 27 ft. at Lundy Island, a height of 44 ft. is attained at King's-road, and 60 ft. at Chepstow, the rise in such an estuary opening from Granville, with a rise of 39 ft. at the entrance, would have been 80 ft., which is a higher rise than in the Bay of Fundy.

While the waters thus embayed and driven up against the coast attain these great elevations, the main stream of flood passes on through the more confined channel formed by St. Alban's Head and Cape de la Hogue, but does not rise on the Norman coast more than from 15 to 17 feet between Cape de la Hogue and Cape Barfleur; and the waters from the Gulf of St. Malo, rushing out by the Race of Alderney, also tend to set the stream of flood upon the English coast towards Hastings. Passing Cape Barfleur, the flood stream fills the bay between that headland and Cape de Caux; and being impressed against the coast of Normandy, north of the Seine, passes onwards along the coasts of Normandy and Picardy, and increases to 27 feet at Dieppe, Tréport, Cayeux, and St. Valery, 25 feet at Boulogne, and 27 feet at Cape Gris-nez. Leaving the English Channel, having passed Cape Gris-nez, it expands into the North Sea, where, at the port of Dunkerque, the elevation of spring-tides does not exceed 18 feet.

On the Rise of Tide on the English Shore of the Channel.

While on the coast of France the flood tide attains an elevation of 25 to 37 feet, as above described, its rise and progress on the coasts of England are very different. Entering upon the Scilly Islands with a rise of 16 feet, it continues along the coast with an elevation varying from 16 to $13\frac{1}{2}$ ft., dipping at $5\frac{1}{4}$ ft. at Weir Head; then, from Bigbury Bay, it attains various elevations of 15, 14, 12, and $11\frac{1}{2}$ ft. to Lyme Regis, and descends to 5 ft. at Christchurch, makes $7\frac{1}{2}$ ft. at the Needles Point and Hurst Castle, 7 ft. at Yarmouth and in the Isle of Wight, $12\frac{1}{2}$ ft. at Cowes, 11 ft. at Calshot Castle, $13\frac{1}{2}$ ft. at Portsmouth and Porchester, and increases to 18 ft. at Shoreham. From Shoreham eastward, the rise continues to increase to 20 ft. at Beachy-head, 24 ft. at Hastings, and descends again to $18\frac{1}{2}$ ft. at Dover, which is the last point on the English coast where high-water is produced by the Channel tides.

A comparison of the rise of tide at points on the two coasts opposite to each other gives the following interesting results:—

On the French Coast.	Rise of tide.	*On the English Coast.*	Rise of tide.
L'Isle Ouessant	$19\frac{1}{2}$ feet.	Land's-end	16 feet.
Aberviach	22 ,,	Lizard	$14\frac{1}{2}$,,
L'Isle de Bas	23 ,,	Plymouth	$15\frac{1}{2}$,,
St. Malo	35 ,,	Torbay	$13\frac{1}{2}$,,

On the French Coast.	Rise of tide.	*On the English Coast.*	Rise of tide.
Cherbourg	17 feet.	Portland	$6\frac{3}{4}$ feet.
Le Hâvre	22 „	Portsmouth	$12\frac{1}{2}$ „
St. Valery......	27 „	Brighton	$19\frac{3}{4}$ „
Dieppe	27 „	Beachey-head ..	20 „
Le Somme	27 „	Rye	22 „
Boulogne	25 „	Dungeness	$21\frac{3}{4}$ „
Gris-nez	27 „	Dover	$18\frac{3}{4}$ „

Of the Meeting of the Channel and North Sea Tides.

The meeting of the tides from the English Channel and North Sea takes place at various points between Beachey-head and Dover, according to the rise of the tide; thus, five hours before high-water at Dover, the line of junction is between Beachy-head and Point Ailly. An hour later, the point of meeting has shifted to a line joining Bexhill and Cayeux; another hour later, and the meeting takes place in a line between Rye and the mouth of the river Somme; in the next hour, the tides meet in a line joining Dungeness and Torque Point; and, finally, one hour before high-water at Dover, the line of meeting of the tides is on a line between Dover and Dunkerque.

The greater rise of the Channel tide, $18\frac{1}{2}$ ft. at Dover, and 27 at Cape Gris-nez, over those of the North Sea, affects the east coast of England, west of the great estuary of the "Wash," and has its due influence in driving the line of meeting of the tides further and further to the eastward.

Of the Lines of Separation of the Tides.

As the Channel and North Sea tides meet in certain lines, so have they also lines of separation, and these lines travel from west to east, as the lines of meeting do.

One hour after high water at Dover the tides separate in a line joining Beachey-head and St. Valery; an hour later, they separate in a line joining Hastings and Treport; in the next hour, in a line from Hastings to Cayeux; another hour, viz., four hours after high water at Dover, the separation takes place in a line from Folkestone to Calais. At the fifth hour after high water at Dover, the line of separation runs from the South Foreland to Gravelines; and at six hours after high water it is on a line between Ramsgate and Nieuport.

On the various Levels of the High and Low Water-lines.

It is interesting to show how the change of level of the waters of the Channel, by the tidal action, may affect the rise of tide.

Forty minutes before it is high water at Dover, the waters at the mouth of the Channel, by the tidal (viz., at the Scilly Islands) have ebbed out, and an hour after high water at Dover, the Gulf of St. Malo, where the waters, which were at high-water, were from 16 ft. to $18\frac{1}{2}$ ft., where the mean level of the sea is now 16 ft. to 18 ft. below it. Consequently, the level of the waters in the east part of the Channel is from 25 ft. to 28 ft. above the water in the Gulf of St. Malo, and the pressure due to this head must operate on the velocity of the western ebb stream. Taking 150 miles from Dover to the Gulf of St. Malo, and the same distance along the east coast of England, it will be found that, when the low water in the Gulf of St. Malo is 18 ft. below the level of the mean sea-level, the low-water on the east coast of England is only $3\frac{1}{2}$ ft. below that level.

I have been enabled more readily to give the remarks on the tidal action in the English Channel by the valuable information contained in "The Channel Pilot," by J. W. King, Master R.N., printed for the Hydrographic office of the Admiralty, and by the annual "Tide Tables for the British and Irish Ports, computed by Staff-commander J. Burdwood, R.N.," to whom I have more than once been indebted for tidal information. The remarks on the tides in the River Thames, by my old and valued friend, W. R. Maughan, Esq., possess great interest to anyone studying the subject, as his tidal observations on this river for many years are the most complete on record.

Returning again for a moment to the subject of the tubular railway, I can state positively that the difficulties of completing this mode of communication would be very considerably less than the difficulties which were overcome by Sir Isambard Brunel in the construction of the Thames-tunnel. I am fully persuaded that there can be no doubt of the success of this scheme, if adequate measures be taken, and I trust that it may be completed in the reign of the Emperor Napoleon and of our own Sovereign Queen Victoria, and within the lifetime of every one present.

DISCUSSION.

The Chairman, in opening the discussion, said that engineers were, in one sense, the happiest people in the world, for nature had provided for them in every way. If the Valley of the Weald had not, as Mr. Page said, been denuded, engineers would have come forward to cut a canal through it, but as it happened to have been denuded by nature, it was their business that evening to consider the best means of establishing communication with France, under, across, or through the Channel. There were no doubt many present who had schemes of their own for the purpose, many who had not, but who would be none the less disposed to criticise that of Mr. Page, and possibly some who, like his friend M. Petiet, who told him that after thirty years' experience in conducting the traffic across the Channel, he had come to the conclusion that it was as perfect as possible, and that no improvement was necessary. He did not think, however, that the last class would be very numerous.

Mr. Bateman said he did not hear the whole of the paper distinctly; but though it appeared to contain a good deal of information, and some speculation, as to what the tides in the Channel were, and what they would have been if the formation of the channel had not been what it was, there was very little detail of the *modus operandi* of the tubular railway. He had not been able to gather any one particular operation which must be performed in constructing the tube. He understood that some eight shafts or pinnacles were to be formed in the Channel, as to which he ventured to say that if they had existed there naturally, it would have been the object of both nations to have removed them, as serious impediments to the navigation of the Channel. Some of the chief operations depended upon the power of divers to work in depths approaching 200 feet; and, as far as his own knowledge went, he did not think that they could work under a pressure of more than from 40 to 60 feet of water; and if the junctions of these tubes were to be effected by divers at such a depth, he should like to hear how it was to be done.

Mr. Thomas Brassey confessed that so far as he had been able to understand the project, it was one of such a gigantic and exceptional character as he had never before heard propounded. No engineer had ever attempted any thing of the kind, and he very much doubted whether it would succeed; his impression was that it would not. He did not think it was possible to sink the tube, as was proposed, to the depth of some 200 feet by any means yet known, and to attempt to do a thing so gigantic without greater experience would be a very hazardous experiment, to say the least of it. He agreed with Mr. Bateman that it was impossible for miners to work at a depth of 200 feet. Therefore, with no experience to guide them, he thought it was a bold matter to attempt to execute such a project, and no wise man would attempt it.

Mr. Weigall said he had had an opportunity of seeing

the model of the bridge constructed by M. Boutel, 60 ft. in length, which was tested by the pressure of as many people as could stand upon it, and the result was so satisfactory that the inventor immediately set about the construction of a model on a still larger scale, which he believed had been equally successful.

Mr. Hawes said that, whatever differences of opinion there might be on other points, all were agreed that some better mode of crossing the Channel than that now in existence was required, both in the interests of commeree and of travellers. The question simply was, what was the best means of accomplishing the desired end. Two or three schemes had been devised, but that plan alone, which had already been tested by experience, had not yet been referred to. No experience had yet been gained as to the making a bridge upwards of twenty miles in length over one of the stormiest channels in Europe, or as to the laying of a tube at the bottom of such a channel, working under such a depth of water, as Mr. Page proposed. Nor, again, had they had any experience as to the results of such a plan as was very clearly explained a few nights ago by Mr. Bateman, at the Royal Institution. With regard to the making of subaqueous tunnels, experience did shed some light, for tunnels had been made under rivers of considerable depth of water, and where the depth fluctuated considerably at different states of the tide, and tunnels had been made in loose and shifting soil. Again, it was now a matter of experience that tunnels could be made through the hardest rock as well as through the softest soil, and if the strata were known with tolerable certainty, engineers could state, with tolerable certainty, the cost per yard or per mile, and the length of time which would be required for the work. Tunnelling, therefore, had, in his opinion, an undoubted advantage over any other plan for Channel communication, and this advantage of experience was very important in a matter involving an outlay of eight or ten millions sterling, for it was enrious that each of the schemes now put forward would cost, according to the calculations of its promoters, pretty nearly the same sum. With regard to the tunnel, however, the estimate was vouched for by engineers of experience, both English and French, who were also unanimous as to the time which would be required, but, in any other plan, involving new and untried conditions, it would be impossible to have the same unity of opinion, particularly as it was proverbial that in any great engineering work unforeseen difficulties were sure to arise which could not be allowed for even by the most talented men. He thought, therefore, that before embarking in a work of such magnitude, the comparative advantages and disadvantages of a tunnel and of a tube, either on Mr. Page's or Mr. Bateman's plan, should be very carefully weighed, bearing in mind that in the former case comparative certainty, both as to time and expense, might be arrived at. It should also be remembered that the works of a tunnel would go on uninterruptedly, uninfluenced by the weather or by storms, whereas Mr. Page began by saying that he should require an uninterruptedly fine summer, and the assistance of the combined fleets of England and France, and three or four thousand men all ready to go to work at a minute's notice. With all this and some £8,000,000 of money to boot, then he could do the work successfully. The French engineers did not say how long it would take to complete their bridge, nor what would be the cost, and the history of the Menai-bridge showed that these matters were not very easily calculated to a nicety beforehand. Mr. Bateman had no doubt entered so minutely into details, that he had no doubt come to as near an estimate as was possible; but there was this difficulty about his plan, that great engineering skill would be required in carrying it out, and this must add an element of uncertainty to the estimate, and the weather also would materially affect it. With regard to the tunnel, it was not only his own opinion, but that of Mr. Brunlees, Mr. Lowe, and the three French engineers, who had been for some time connected with the project, that it would run through the chalk from one side to the other of the Channel. A well had been sunk on the Calais side 1,000 feet deep without getting out of the chalk, and borings had been made on the English side, which also showed the chalk to great depth. Mr. Hawkshaw also, with the assistance of mechanical appliances, made by Mr. Brassey, had made soundings all across the Channel at very short intervals, and the result was there was every reason to believe that, with the exception of a very short distance of the French coast, the chalk was uninterrupted. Again, in the case of a tunnel, by driving a driftway at each end in the manner familiar to every miner in the north, and to many in the south of England, it would be pretty easy to ascertain, almost to a certainty, whether the work could be successfully accomplished or not; and, if the latter were the case, which he did not believe, an immense expense would be saved. Assuming the tunnel to be made, there could be no doubt that every passenger from England would prefer going direct from London to Paris by rail, rather than submit to the inconvenience of the present mode of transit, which it was admitted ought to be superseded. He could not but believe, therefore, looking to the immense importance to England, in a commercial point of view, of having direct communication with France, and through France with the whole of the Continent—for passengers from all parts of Europe would doubtless avail themselves of this method of crossing—that there would be such an amount of traffic as would yield a fair dividend on the necessary capital, even if it did not return a very handsome profit. It was, however, at the present time impossible so to bring this matter before the public as to secure the necessary amount of subscription, and, therefore, he believed they must look to the united action of France and England, and perhaps of Belgium, to accomplish the work. It was a work worthy of two great nations, and he hoped the two governments would institute such preliminary inquiries as would prevent any fatal error being made at the beginning, and then, when the right method was ascertained, which, in his opinion, was a tunnel, he trusted that the public on both sides would support their respective governments in advancing the money required to carry out the enterprise. He hoped, therefore, the matter would not be considered from a narrow and isolated point of view, but as a question involving the welfare, prosperity, and convenience of two great nations; and that France and England would come forward and do what was required to cement the bond of union which had now for some time existed between them.

Mr. Bridges Adams said:—Easy communication from every part of the world to all other parts is an essential condition of large civilisation. Easy communication between England and the Continent constitutes a very important part of this civilisation, as well as between England and Ireland. The one great drawback is seasickness, annoying even to Dane-descended men, webfooted and with salt in their veins, but fatal for the time being to the Celtic race—the dark-haired tribes, precious to us for their music, poetry, and artistry, though not so highly gifted with the homelier qualities, inducing law and order. Practically, taking into account the numbers of travellers, sea-sickness in the short sea transit—the "narrow seas"—is more annoying than the long voyage. Ages back, had there been a peninsular neck from Scotland to Ireland, we should have become one people, a very desirable thing, but not so desirable in the case of the Continent. Our strength, and power, and industry has grown by the protection of our salt-water moat, which kept war from our doors, and left us leisure to pursue the arts of peace. How to avoid sea-siekness in this narrow transit is a subject on which many men's thoughts are set. There have been some six methods proposed. Two over the water, by balloon and bridge, the former uncertain as the wind, which bloweth wheresoever it listeth; the latter possible, but risky and of

very doubtful utility. We would rather leave it to our Gallic neighbours. Two under the water, the tube and the tunnel; and two at the water level, the artificial peninsular neck, and the iron ship, moved by steam or other power. All these are within possibility. With our engineering power, we can accomplish anything we choose that is not contrary to the laws of nature; and probably the solid dyke connecting England to France would be easier than the tube, and certainly less risky in after consequences. There is no part of the narrow Channel that would sink St. Paul's Cathedral above the dome, and if piles were driven in the bottom, the wash of the sea would collect sand and shingle round them as it does along the coasts, till the piles were levelled over, and if then a succession of piles were driven, the mound would gradually surmount the surface, like the breakwater in Plymouth Sound, or like the wattles and straw ropes that gather up the sand from the salt-water margin on the coast of the North Sea. But I should give my vote for the endurance of sea-sickness, rather than this thing should come to pass. When Britain first "rose from out the azure main" she was an enclosure of nature, and she has profited by the enclosure just as farms do by agricultural enclosures, her watery highway being also her castled moat. Tubes or tunnels we do not object to, for we can always throw cold water on any quarrel by drowning them out, but a narrow causeway wall or embattled harbour, and all concomitant evils, we can in no wise contemplate with pleasure. Without wishing to impede any number of tunnels under the Channel, I have long come to the conclusion that the ancient system of going down the sea and on the sea in ships, is the true one, only instead of steam-boats, tossed like corks on every wave, we must have veritable shapely ships, of a size and proportion to rule the waves like floating breakwaters, with broken water to weather, and smooth water to leeward. Sea-sickness is a result of the diaphragm heaving vertically with the tossing of the vessel, and the vessel tosses because its size is very limited compared with the size of the waves. Reverse the condition, and make the waves limited compared with the size of the vessel, and the sea-sickness will cease, provided the vessel neither pitches nor rolls. The *Great Eastern*, some 750 feet long, does not pitch, but she does roll, and makes people sea-sick athwart-ships. Her floor is diamond-shaped, tapering stem and stern. With greater width, and a flat floor throughout, she would probably have been free from sea-sickness. We have scarcely yet taken into our thoughts the great results that would spring from transit made as free from nuisance by sea as by land—the enormous increase of travelling and commerce. Other things being equal, the sea is wholesomer than the land, there is no bad drainage, and abundant ventilation; and eating and sleeping may be quite as easy as in houses ashore. With abundant size and area, and cheap transit, cheaper than anything we can obtain by land, by reason of the large numbers, numberless small traders would grow up, bringing their own goods to market, and growing educated in the process. Vessels would come up the Thames and the Mersey, from the Seine, and the Rhine, and the Elbe, and the coasts of the North Sea, bringing all kinds of fruit and produce, and unlimited cattle, and carrying back our manufactured goods. Railway travelling as yet is a question of much discomfort; sea travelling should be all comfort were its conditions rightly understood and provided for, from port to port direct. By sea, such as our transit should be, a traveller journeys as it were in his own house. By rail, he is as it were only part of a machine. Even the speed of the railway does not compensate for journeys broken into parts; and twenty miles per hour by sea might be far more comfortable than thirty by land, and not much slower if the breaks be taken out, while during the sea journey, free from sickness, any occupation might be pursued. What, then, are our needs? First, ample size. A parallel hull of 1,000 feet in length by 200 feet in breadth, giving a deck area of some 4½ acres, with an immersion of 20 feet, giving a displacement of about 148,000 square yards, equal to a carrying power of over 100,000 tons burden, the top sides rising above the water-level some 25 feet, and divided horizontally into two decks—one for passengers, one for goods. The weight of the goods and passengers would be but a very small proportion of the weight of the vessel, and the immersion would thus always be at the same level, and not subject to variation. The next consideration is safety from fire, and from collision with other vessels or with the shore. The vessel should be wholly of iron, and therefore incombustible, and it should be constructed, not in what are called water-tight compartments, but cellular, like a beehive, up to the level of immersion, in cubes of 4 feet, the outer tier of cubes filled with Seyssel asphalte, filled in hot, and consequently forming a water-tight caulking 4 feet thick, the other cells being simply air-tight. A perfect life-boat is thus formed—a flat-bottomed cellular raft of 4½ acres area, the external sectional form being a parallel beam 20 feet deep and 200 ft. wide, sloping upwards from the bottom at each end to a sharp edge at the water-level, the cut-water being, so to speak, horizontal. The entrance to the two decks is from each end, by doors made to close water-tight from the outside when at sea, and opening at the shore to platforms or dummy barges rising and falling with the tides, and there are no cargo hatches whatever, so that cattle and goods pass in as on an ordinary road. The next question is of propulsion, and that should be by paddle-wheels, applied on a very different mode from any that has yet obtained. The difficulty with paddles hitherto has been, first, the varying immersion by the varying weight of cargo, and next, by the lateral rolling keeping one wheel out of the water, and the other too deep, and also by the varying heights of the waves, and their blows, so frequently carrying away the paddle-floats, and breaking the shafts. Another objection is the projection of the wheel beyond the side of the vessel. To get over these difficulties, a mill-race is cut longitudinally through the vessel, from end to end, in one straight line, like the race of an undershot water-mill on shore, the bottom of the race being so much below the external water level as is desirable for the paddle immersion. The entrance and exit for the water is adjustible, as in a water-mill. In this mode, variation of wave-level externally will not affect the internal level. The race is divided amidships by a partition into two channels, and in each channel are placed two paddles, one near each end of the vessel. Each paddle is worked by a separate engine, to revolve in either direction. The paddles are considerably narrower than the channels in which they work, in order to leave dead water in contact with the surfaces, and to avoid friction. The distance between the paddles in each channel will be quite sufficient for them to act advantageously on the race independently of each other. The process is simply reversing the water-mill, where the water moves the wheel by making the wheel move the water, or use it as a haulage-rope. The height of the channels is amply sufficient to prevent any choking of the water, and they are enlarged into a circular box at the wheels, as usual. In what are called twin boats, with an open channel below and a central paddle, there is no governance of the water-level and there is choking at the wheel, the more especially if the frontage opening is larger than the width of the wheel. The theory of the structure should be two flat internal sides, instead of convex, but even this would not adjust the water entrance, and the structure must necessarily be held together by cross beams at top, without lower ties, and thus there is a great loss of displacement or floating power. The results obtained from the *Water Witch* have been remarkable, and they have been a consequence of being enabled to regulate the water entrance, but this has been neutralised in a great measure, because the water has been forced through narrow and crooked passages in making

its exit, with an enormous loss of power. If a mill-race were constructed like the *Water Witch*, the mill would be useless. Of course a mill race through a vessel takes away a large stowage space; that is, in other words, saying, that, in addition to the usual stowing space there must be space for the mill race. But, to set against this, we get rid of the external projection of the paddle-wheels, and we get better floating and stability against pitching and rolling. And, by working each two paddle-wheels in opposite directions, the vessel may be turned round on her centre. The next question is, of the power to move the paddle-wheels. In our present state of knowledge, this must be steam, and to make steam we need fuel. The best is petroleum, which can be discharged into or pumped out of the lower cells without trouble or nuisance, and converted into gas to feed the fires without needing stokers or roasting men alive, raising or lowering the steam at pleasure, by merely moving a handle; and the same apparatus will serve for the lighting of the vessel internally and externally. No chimney would be needed, and all ventilation would be very effectually provided for in the mill-race. On a central mast might be carried a practical lighthouse, gas lit, to prevent collison. Such a vessel would not be fitted for a long voyage, for long voyages are for few passengers and small quantities of goods. The shorter the voyage, the larger the amount of traffic; and, therefore, we may console ourselves that she would not pass through the Suez Canal. We have heard much of late of overloading ships. In a paddle steamer, the first consideration is always to keep the immersion at the same level. Of the utility of such large vessels for short voyages, and probably as floating sanitaria, there can be little doubt; nor does it follow that they must necessarily run at great speeds. With the nuisance of sea-sickness removed, travellers would cease to be so anxious about getting out of them. If such a vessel was to start from Blackwall on a fine summer's day, with arrangements for carrying in comfort 20,000 passengers, with all their shore conveniences, round the coasts of England and Europe, plenty would be found to prefer such a trip on the open sea to sea-side lodgings on the land, even at a speed of seven miles an hour, say a ten-days' trip. But, of course, with adequate power and sufficient reason, the larger the vessel the greater might be the amount of speed.

Mr. P. Rapsey Hodge thought there was no difficulty in building steamboats to cross the Channel, but there was great difficulty in preventing sea-sickness. With regard to the tunnel, he did not think all the difficulties had been taken into account. It was all very well to talk about the Valley of the Weald which existed in prehistoric times, the surface of which had been denuded by water, but he did not believe in that theory, and his views had been formed after careful study of the subject for very many years. He believed that England had been severed violently from France, and Ireland from England, and if this were so there must be a chasm somewhere, breaking the continuity of the chalk, and filled with silt and *debris* from all the surrounding cliffs, and when the enormous distance to which the portions had been separated was considered, it was impossible to doubt that the chasm was of great depth. Hence arose a great difficulty in the way of a tunnel. He agreed with Mr. Brassey that there would also be great difficulties in the tubular system, but, at the same time there was little doubt that either Mr. Bateman's or Mr. Page's scheme would succeed. If railway communication were to be established between England and France he was convinced that it must be by a tubular railway, and he saw no difficulties except those of detail. He quite agreed, however, that it should be carried out by the governments of England and France, and perhaps other continental powers.

Mr. Galloway said that, admitting the possibility of driving a tunnel under the Channel, there still remained the question whether some other mode of communication would not be preferable. But with regard to the plan suggested by Mr. Page, he did not think that in practice his ventilating shafts would be admissible. If the tunnel method were adopted, he should suggest that one be driven from each side, so as to allow of trains running each way, and at a sufficient depth to allow of driving underneath the sea with safety. But then came the question whether the public would approve of a tunnel at such a depth beneath the sea. The plan he should suggest would be that of large steamers, constructed on the cellular principle, flat-bottomed, but with three keels, so that the columns of water between would keep them from rolling, and with the paddle-wheel on each side, worked by a direct-action engine, with a long stroke. The railway trains could then be brought in at one end, suspended in the centre during the passage, and disembarked at the other, without difficulty.

Mr. Austin said he had been engaged for the last 32 years in some of the largest tunnelling works in the world, under Mr. Brassey, and, therefore, spoke with experience, and for the last 16 years he had devoted all his spare time to the perfecting of a scheme for a submarine tunnel between England and France. His scheme had been favourably noticed in the *Mining Journal* and also in the *Times*, and although it took time for any new idea to make way, he believed it would eventually succeed. He proposed three tunnel ways, in order to separate the goods from the passenger traffic, and at such a depth as to avoid any danger from the superincumbent pressure. He had seen a great deal of excavation, through all sorts of strata, including quicksands, and apprehended there were no difficulties which could not be overcomec. His estimate was only £21,000,000, a mere bagatelle compared to what was spent in the Abyssinian war and in other matters, and considering the cordiality which had now for a long time existed between England and France, and the importance of having regular and easy communication, not only with the continent, but with India and the East, he hoped this matter would receive the serious attention of government, as he was sure it deserved.

Admiral Ommanney quite agreed in the importance of improving the means of communication between France and England, but it appeared to him that while tunnels and tubes were being discussed, a good deal might be done by improving and enlarging the present harbours of Dover, Calais, and Boulogne, so as to allow of the entry and exit, at all states of the tide, of a superior class of steamers, such as now plied between Holyhead and Dublin at a speed of eighteen miles an hour. He was quite sure that engineers who could devise such schemes as they had heard of that evening could vastly improve these harbours, and render them available for such steamers as he had referred to. With regard to Mr. Page's scheme, he must, in the interests of mariners, protest against the ventilating towers as impediments to navigation.

Mr. Page, in replying to the various remarks which had been made, said there were two observations made by Mr. Bateman and Mr. Brassey quite worthy of those gentlemen, and of great importance to the question, the first of which was how divers could work 200 feet below the sea without undue pressure upon their lungs and bodies. It was, however, very easily answered. Supposing the room in which they then were was at the bottom of the sea, and the walls were carried up above high water, would anyone dispute that they could send out a diver from that room into the sea, passing through a sort of valve-cupboard into the sea, and give him only the atmospheric pressure, with perhaps a pound or so more. He had devised a dress for this purpose by which all pressure was removed from the body. That being explained, all the difficulty about divers operating in deep water was removed. Then, again, Mr. Brassey

said that they had had no experience in such a structure as he proposed.' But all great engineering works had been carried out without previous experience; it was the genius of the engineer that created the work, and left it to commoner minds to copy. Had Edwards experience when he built the Pontypridd? Had they any experience of a bridge like the Menai bridge, or of a tunnel like that under the Thames? The genius of the engineer created both those works. It was the fault of their profession at the present time that there were so few originators and so numerous a body of copyists. If he put before Mr. Brassey a design for sinking a shaft in the deepest part of the Channel, say 31 fathoms, showed him all the details, and gave him the weight of everything, he was certain Mr. Brassey would give an estimate, and, more than that, he would carry it out. Then, as to the question whether it was within their power to sink, in the deepest part of the Pas de Calais, a shaft which should reach the bottom and rise 30 feet above high-water. He denied that there was any difficulty in the matter. He would undertake that it could be floated off and sunk, and filled in with concrete in a single tide. There were only two questions to be answered—Could they sink a shaft and give it permanence in that depth of water; and, could they submerge a floating wrought-iron structure, somewhat like the Menai-bridge, just over a quarter of a mile in length? If they could not do this they were not fit to be called engineers and ship-builders. He had no doubt that Admiral Ommanney, or any other naval officer of like eminence, would undertake the management of the work if the engineering details were provided for. He did not think anything could be said against his plan if it were practicable. He thought Mr. Bateman was rather too hard upon his shafts, because he had likened them to rocks; for if there had been eight rocks in the Channel between Dover and Cape Gris-nez, they would have been utilised in a different way long ago. The convenience of the public must be taken into account, and the number of those travelling between England and France, as compared with the number of ships which would be inconvenienced when there were two geographical miles between each obstruction, these always being also well lighted at night, and giving fog signals when necessary. It was not to be supposed that when an engineer brought forward a scheme so bold and novel in its conception as the present one, that it should at once meet with general approbation; but he believed that in a year's time Mr. Brassey himself would say that on further consideration the plan was feasible. He should like to ask what was the proposed depth of Mr. Hawkshaw's tunnel below low-water line.

Mr. Hawes said the depth below low-water line was from 400 ft. to 450 ft., the depth of water being 180 ft.

Mr. Page thought people would prefer not to go quite so low. It was quite true, as Mr. Hawes had said, that there had been plenty of experience in the making of tunnels, but that was no reason why they should continue the same system, when by another mode they could attain the same end in one-fiftieth part of the time, and much more easily and agreeably. He did not know how the ventilation would be provided in the tunnel, which was a serious consideration. He had not had the opportunity of hearing Mr. Bateman's lecture at the Royal Institution, but his opinion was, that although the public was easily led sometimes, they would not be very ready to go into a tube something like 24 miles in length, without an opening from end to end. A system of this sort had been suggested some years ago for taking passengers from London to Brighton, and the same plan, he believed, had been adopted by the Post-office for the carriage of mails, but he did not think the general public would like to be treated as parcels in that way, nor did he think they would approve that mode of travelling.

The Chairman, in moving a vote of thanks to Mr. Page for his interesting paper, said, he was rather surprised that no gentleman had taken exception to the length of time stated as necessary for the completion of a tunnel. Mr. Page had put it at 50 years, which he thought was rather over the mark. They had had some experience in tunnel work, particularly the Mont Cenis tunnel, which had to be driven through the hardest rock, every atom having to be blown away by gunpowder, and yet that was going on at a very considerable rate at the present moment. Therefore, if it were possible to bore through the chalk below the sea, there was no doubt that the labour would bear no comparison whatever to that he had just referred to; it would be in comparison like cutting through a cheese, and he could not help thinking that Mr. Page's estimate of the time necessary was much too high.—[Mr. Page—Yes.]—There were, no doubt, difficulties in the way of laying a tube, but he did not say they were insurmountable. In the meantime, however, there were 300,000 or 400,000 persons crossing the Channel every year under very unfavourable circumstances, and that number would probably very soon be increased to a million if the mode of crossing were made more comfortable. Looking to the severity of weather in the Channel, the variety of constitutions and temperament in the *genus homo*, there could be no doubt that about four-fifths of those who crossed suffered very considerably on the passage, and they must not forget that the great majority of those who crossed were English, because, unfortunately, we could not travel anywhere except within the narrow limits of our own island without crossing the Channel, whereas continentals could go from one country to another by means of railways only. This was a point which was not sufficiently considered, he believed; for bearing in mind that there was always something to be learnt by travel, it was evident that the continental nations had a great advantage over the English in this respect. The subject, therefore, was one of great national importance, and should not be considered too much as a question of mere £ s. d. He quite agreed in the view which had been expressed, that such an enterprise was not suited to the operations of a public company, but that it should be done by the governments of both countries, and if it could not be done in this way, it ought not to be attempted.

The vote of thanks was unanimously passed, and the meeting separated.

CANTOR LECTURES.

The second of a course of lectures on "The Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," was delivered by Dr. Benjamin Paul, F.C.S., on Monday, the 14th March, of which the following is an abstract:—

The use of fuel as a source of motive power is based on the principle that heat, being a condition of energy, is convertible into mechanical force. It is through the medium of water, and by means of its transformation into vapour, that the result is chiefly produced, the heat generated in combustion being expended in vaporising the water. Here, as in all other phenomena of combustion, there is a definite relation between the quantity of heat thus expended and the quantity of water vaporised. Under ordinary conditions of atmospheric pressure, every unit of weight of water vaporised requires 537 heat-units, or 5·37 times as much as is requisite for heating the same weight of water from the freezing to the boiling point. The heat thus expended presents itself in the water vapour, or steam, as elastic force, causing an increase of volume and augmented pressure which are available for producing motion. A cubic inch of water thus becomes a cubic foot of steam.

There are other ways in which heat may be converted

into mechanical force, such as the vaporisation of ether' the expansion of air, &c., but they are not in any essential particular different from the use of water for this purpose.

The connection between heat and mechanical energy has long been in some degree recognised, and it has been practically applied in the production of heat by friction, as practised by savages, who light their fires by rubbing two pieces of wood together. The use of the old flint and steel is another instance. But the first to point out the existence of a definite relation between heat and motion was Count Rumford, who, in 1798, showed that, in boring metal, part of the mechanical force expended is converted into heat, and that a large quantity of heat might be produced merely by the strength of a horse. In fact, though more heat might be obtained by using as fuel, the fodder of the horse, the animal organism may be regarded as a heat-engine. As the general result of his observations, Count Rumford says.—"It appears to me to be extremely difficult, if not quite impossible, to form any distinct idea of anything capable of being excited and communicated in the manner tbe heat was communicated and excited in these experiments, except it be motion."

But though Rumford's experiments proved the intimate relation betwoen heat and mechanical energy, they were not of such a nature as to indicate it quantitatively. For nearly half a century this subject remained much in the same position as he left it, until, in 1842, Mayer introduced the term "mechanical equivalent of heat," and, in 1843, Joule made known the result of his experiments, undertaken with the object of determining the numerical value of the ratio between heat and mechanical energy. This important numerical constant is commonly called Joule's equivalent. Its absolute magnitude varies according to the unit of weight and the thermometric scale to which it refers, and the corresponding difference in the unit of heat. The quantity of heat requisite to raise the temperature of 1 lb. of water 1° F. is equivalent to the mechanical force represented by the fall of 772 lbs. through 1 foot. The quantity of heat requisite to raise the temperature of 1 kilogramme of water 1° C. is equivalent to the mechanical force represented by the fall of 423·55 kilogrammes through 1 metre.

Mr. Joule has also proved, what was previously a mere speculation, that not only are heat and motive power convertible and equivalent, but that all other kinds of physical energy are likewise convertible and equivalent.

The ascertained equivalence of heat and mechanical energy affords another mode of expressing quantities of heat. Instead of heat-units, quantities of heat may be expressed in terms of work, the unit of work being either the work done in lifting a weight of 1 lb. through a height of 1 foot, or the work done in lifting a weight of 1 kilogramme through a height of 1 metre. Expressed in this form, the heat generated by combustion of 1 lb. of carbon is 11,194,000 foot lbs.

Quantities of heat may also be expressed in terms of water converted into steam; and this mode of expression represents what is termed the theoretical evaporative power of any kind of fuel, or, in other words, the effect which would be produced if all the heat generated by combustion of a given weight of the particular fuel were applied in producing steam. In practice this is never the case, and therefore the theoretical evaporative power of fuel is to be understood as merely expressing a maximum value which can never be exceeded, nor ever fully attained in the use of fuel.

The total heat generated in any case of combustion may be regarded as distributed through the product of combustion at the moment when that change takes place; and according to the mode in which fuel is burnt for producing steam, the product is gaseous, consisting either of carbonic acid gas mixed with nitrogen and excess of air, or of those gases together with some water vapour. In the ordinary use of fuel for generating steam the quantity of air-supply requisite for supporting combustion amounts to about 24 lbs. for each pound of fuel burnt. By combustion, this becomes, therefore, 25 lbs., and the volume of air entering the furnace is about 300 cubic feet for each pound of fuel burnt. By the heat generated in combustion, the temperature of the gaseous product is increased to upwards of 2,000° F., and its volume is increased to nearly 2,000 cubic feet, as it leaves the surface and passes into the flues, where it comes in contact with the boiler to which heat has to be transmitted.

The conditions prevailing in the furnace and flues of a steam boiler consist in a constant flow of hot gas from the furnace towards the chimney, and of a progressive reduction of the temperature as well as the volume of that gas, by the transfer of heat from it to the water in the boiler, as it passes along the surface of the metal plates which are exposed in the flues, &c. The efficiency of the furnace and boiler will therefore correspond to that portion of the total heat of eombustion which is communicated to the water, so as to produce steam. That will depend on a variety of circumstances affecting the transfer of heat, either by radiation, conduction, or convection. The greater the difference of temperature between the source of heat and the body to be heated, the more rapid will be the rate of transfer. The greater the extent of surface they present to each, the more rapidly will the heat be transmitted from the hotter to the colder body. The nature, thickness, and state of the surface of any body intervening, like the plates of a boiler, between the source of heat and the body to be heated will also have an influence on the rate of transfer. So far as this influence is exercised by the kind of materials which boiler plates are made of and surrounded by, they stand in the following order as regards conductivity for heat:—(1) Copper, (2) iron, (3) brick.

The rate of transfer of heat, by conduction from a fluid to a solid, is nearly proportionate to the square of the difference in temperature, whenever that is considerable; and the distribution of heat by convection throughout the mass of a liquid is also proportionate in rate to the difference in temperature between the liquid and the source of heat.

In any case where fuel is burnt for producing steam, it is evident that the gaseous product of combustion cannot be cooled down below the temperature at which steam is to be produced, so long as it is in contact with the boiler. It must, indeed, always have a temperature somewhat higher, because it has not only to keep up the degree of heat, but also to serve as a source of heat sufficient for converting water into steam at the rate required, according to circumstances. Therefore, the temperature of the furnace gas, when it is discharged into the chimney, will be, for this reason, at least 300°F., and in this way there is a considerable waste of heat, proportionate to the temperature at which the gas is discharged. This waste of heat is, in many instances, augmented by the necessity of producing steam at a certain rate, and of burning fuel with that object at a proportionate rate. In Cornish boilers, where the conditions are favourable for economie use of fuel, the rate of combustion is sometimes very slow, but, as will be seen from the following table, it is often exceeded considerably in other kinds of boilers, and most of all in those where the conditions are unfavourable for the full utilisation of the heat generated, as, for instance, in marine boilers.

		Quantity of fuel burnt per square foot of grate surface per hour.
Cornish boilers	slowest rate....	4 pounds.
	ordinary „	10 „
Factory „	slowest rate....	12 „
	ordinary „	16 „
Marine „	slowest rate....	16 „
	ordinary „	24 „
Locomotive do.	slowest rate....	40 „
	ordinary „	120 „

To maintain this rate of combustion, it is requisite to have a strong draught in the chimney, for supplying air to the furnace and removing the products of combustion. For this purpose, the gas discharged into the chimney should have a temperature of about 600°F., and the quantity of heat corresponding to this temperature amounts to about one-fourth of the total heat generated by the combustion of the fuel.

In this way, therefore, the practical effect of fuel in generating steam is always reduced, under ordinary circumstances, considerably below the effect which might theoretically be produced.

The amount of heat wasted by the discharge of hot gas into the chimney also depends on the efficiency of the heating surface of the boiler, or that portion of it which is exposed to direct radiation of heat from the fire, and to contact with the heated product of combustion.

There is also another source of loss, by the waste of fuel in the unburnt state as dust and cinders. This varies—according to the texture and other characters of the fuel, partly also according to the degree of care with which the firing is conducted—from nothing up to about 2 or 3 per cent.

The waste of heat by radiation and conduction from the surface of a boiler is in all well arranged furnaces and boilers very small.

Production of smoke and soot also reduces the effect of fuel, inasmuch as they result from imperfect combustion, and the deposition of soot on the heating surface of a boiler renders it less capable of absorbing heat from the hot furnace-gas.

These varying circumstances together contribute, in varying degrees, according to the construction of a boiler and furnace, to reduce the efficacy of fuel in producing steam, and though it might be expected that three-fourths, or at least two-thirds, of the total heat of combustion should be utilised, it is more frequently the case that the effect is very much less than this.

In the steam-engine itself there is a further waste of heat in several ways, and it is rarely that an engine and boiler work with a consumption of less than two pounds of coal per indicated horse-power per hour. This corresponds to an effective result in work done of 1,980,000 foot-pounds, while the quantity of heat generated by the combustion of two pounds of coal is equivalent to 23,160,000 foot-pounds, or more than ten times as much.

Passing now to the use of fuel for the production of cold, it must be remembered that, in the conversion of a solid into the liquid state, or of a liquid into vapour, there is always an expenditure of heat which is disposed of in effecting these changes so as not to be appreciable by the thermometer. It is by means of such a change that cold is produced. This operation is simply a transfer of heat from one material to another. Water has the greatest capacity of absorbing heat in its conversion into vapour, but water does not vaporize readily enough at ordinary temperatures to answer for cooling. Ordinary ether, however, vaporizes much more readily, and that is the material which has hitherto been used most effectually for artificial refrigeration. But even ether vaporizes too slowly under ordinary conditions, and it is necessary to assist the formation of vapour by removing the atmospheric pressure. It is for this reason that fuel is used in artificial refrigeration, the vessel containing the ether being connected with a double acting air-pump worked by a steam engine, so that each stroke of the pump produces a vacuum into which the ether vaporises. The heat absorbed in vaporising is supplied by cold water or brine surrounding the ether vessel, and in this way the temperature of the liquid is reduced.

Liquified ammonia has also been used for refrigeration, and this material possesses characters very suitable for the purpose. Its capability of absorbing heat is nearly as great as that of water, and it vaporises readily, even at temperatures much below the freezing point of water. There are two ways in which it may be used—either by liquifying gaseous ammonia by pressure alone, or by heating a solution of ammonia, under pressure, so as to separate the ammonia from its solution in water.

Artificial refrigeration is now extensively practised, chiefly with ether. In breweries it is especially serviceable, and there are refrigerating machines now in use capable of producing a cooling effect equal to the melting of ten tons of ice an hour.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Colonel Scott, R.E., secretary.

The Earl de Grey and Ripon presided on Wednesday, at a meeting of the committee appointed by her Majesty's Commissioners for the Exhibition of 1851, to carry out the series of Annual International Exhibitions, the first of which will be held in 1871. The other members present were—His Royal Highness the Prince Christian, Sir Francis Sandford, Mr. Bowring, Mr. Cole, Mr. Gibson, and Lieut.-Colonel Scott (secretary).

His Royal Highness the Prince of Wales will preside on Monday next at the Society of Arts, at the committee appointed by the Society at the request of her Majesty's Commissioners, to organise the Educational Division of the Annual International Exhibitions commencing in 1871.

EDUCATIONAL NOTES.

The League held a very important meeting at St. James's-hall, on the 25th ult. Sir Charles Dilke, M.P., chairman of the London Branch of the League, took the chair, supported by Mr. J. Stuart Mill, Mr. Dixon, M.P., Mr. Fawcett, M.P., the Hon. Auberon Herbert, M.P., Mr. Anthony Trollope, Miss Emily Faithfull, Mrs. Fawcett, Miss Garrett, Mr. Edmond Beales, and others. The Chairman said their position had been materially changed since the last great meeting which the League had held in that hall, for they were now in a position, after due consideration of the Bill, to offer certain definite amendments, the nature of which he explained. The Rev. J. G. Rogers moved a resolution, condemning "the power given to school boards to found denominational schools at the public expense; and receiving with pleasure the assurances of Mr. Gladstone that this portion of the Bill shall be redrawn." This was seconded by the Hon. Auberon Herbert. Mr. J. S. Mill, in supporting the resolution, said, in the course of his speech—"The difference between what the Bill gives and what we desire is the difference between good and better. But in the present case (the religious question) it is the difference between good and bad. The Bill does not simply halt and hang back in the path of good; it does positive evil—it introduces a new religious inequality. Even the alterations that are promised leave untouched a great part of the evil, for they leave the whole of its principle. Teachers are still to be employed and paid by the entire community to teach the religion of a part. True, this is now to be done out of school hours, and I would by no means depreciate the value of this concession. . . . . . But the principle remains of teaching the religion of a part with funds raised by taxation from the whole; and a measure infected by this bad principle cannot be satisfactory to any but persons of the dominant creed, nor to impartial persons of any creed." Mr. Mill enlarged upon this part of the question, and, in conclusion, he said, "Let all parties have what religious teaching their conscience approves and they are willing to pay for. But when a man tells me

his conscience requires that other people shall have religious teaching, whether they like it or not, and shall have it in schools though they would prefer having it elsewhere, and shall not be helped like other people with their secular teaching unless they consent to accept religious teaching along with it, I tell him that he is not asserting his own freedom of conscience, but trampling on that of other people. If this is a right of conscience, it was bigotry and prejudice to complain of the persecutions of the Vaudois and of the Protestants. The case is less flagrant, but the principle is the same." Mr. Anthony Trollope and Mr. Dixon, M.P., also spoke in favour of the resolution, which was carried unanimously. Dr. E. Lankester then moved,—"That this meeting strongly objects to the principle of permissive compulsion, and generally to the permissive character of the Bill; and is of opinion that no measure of national education ought to be accepted by Parliament which does not guarantee education to every child." This was seconded by Mr. Robert Applegarth, and supported by Mr. Fawcett, M.P., who said he supported the resolution because it seemed to authorise him to say in their name that, if certain vital amendments could not be introduced into the Bill, it should be rejected. It would be better to wait one, or even two years, than to see permissive sectarianism handed over to every country town and village. After some remarks from Mr. Illingworth, M.P., in favour of the resolution, it was carried unanimously. Mr. Leone Levi proposed, and Mr. Edmond Beales seconded a resolution in favour of establishing in every district school boards elected by the ratepayers, with jurisdiction over much larger areas than those proposed by the Bill.

The agitation in the provinces on the education question is, for the moment at least, subsiding. A few meetings have, however, been held during the last ten days. The Nonconformists of Birmingham, at a large meeting, passed resolutions protesting (1) against the power given to local boards to levy a rate for the support of schools in which they may determine that the religious teaching shall be denominational; (2) against the conscience clause, which requires a Noncomformist British citizen to claim religious toleration in schools supported by national money; (3) against the permissive arrangement for religious inspection by Her Majesty's official Inspector. A large meeting at Hanley passed similar resolutions.

At a special meeting of the executive of the Union, held in London, the following resolution was adopted:—"That this committee, fearing that serious practical difficulties will arise from the amendments shadowed forth by Mr. Gladstone with reference to the conscience clause, trusts that the government will take time for consideration before finally determining on any such amendments." Meetings of the League have been held in Marylebone and Chelsea.

Two letters have been addressed by Earl Russell to Mr. Forster, expressing his views as to the Bill. He justifies the objections made by the Dissenters, and says, "It is clear that in all country districts churchmen will have a majority, and will use their advantange to introduce into the schools what the Bishop of Winchester calls distinctive teaching." This he regards as a real and very considerable grievance, and he thinks there are two ways in which the difficulty may be overcome; the one, that suggested by Mr. Auberon Herbert, namely, that the school boards should have power to direct the reading of the Bible in the school, but without any formulary or catechism; the other, which Lord Russell greatly prefers, is "that Parliament should direct that a portion of the Bible should be read, and a hymn sung every morning before the secular teaching begins; that no formulary or catechism should be used in the school, and that the conscience clause should apply to the time at which the Bible is read. For Roman Catholics would object to our authorised version, and Jews would object to hearing lessons from the New Testament."

In his second letter, Lord Russell says:—"I omitted to mention that in my 'Introduction to Speeches,' &c., recently published, I had myself suggested a provision similar to that which is contained in the Government Bill. In speaking of an education rate, I had said that, 'if supported by rates, the ratepayers should decide on the religious instruction to be given, or, if they preferred it, give a secular character to the school.' I have, however, added, with a view to give effect to the conscience clause, that, 'when any religious instruction is given, it should be either in the first or last hour of school attendance.' But in the full light of the recent discussion in the House of Commons, I perceive the evils that would probably arise from giving so large a discretion on religious instruction to the ratepayers. I also omitted to notice the danger—a very real one—that, by insisting on their objections, the Protestant Dissenters may defeat the government plan for the present year. But the prospect of obtaining a national unsectarian education, founded on the exclusion of all catechisms or formularies, is, in the present temper of the nation, so fair a one, that I think the country may well wait a year for the accomplishment of so great a blessing."

The publication of these letters has provoked some correspondence. Mr. Vernon-Harcourt, M.P., thinks the plan which Earl Russell proposes in respect to the matter of religious teaching goes as nearly as in practice is probably attainable, to reconcile the demands of political justice with the dictates of religious sentiment —two things which, in legislative action on this subject, can never be safely divided. In addition to the concessions made by the government, there is still a very difficult question which, is yet unsolved—viz., what is to be the character of the religious instruction to be given in the time set apart for that purpose? There are three possible schemes—first, the original plan of the Bill; secondly, that to which Mr. Gladstone's remarks appeared to point — viz., that religious instruction should be separately given, the school for that purpose being equally accessible at different times to the teachers of all denominations; thirdly, that to which Lord Russell's letter points. "Let us take," says Mr. Harcourt, "the Bible as the basis of our common Christianity, and make the reading of the Scriptures the sole religious instruction to be given in rate-supported schools. Let us leave to those who reject the pure and simple teaching of the Scriptures as insufficient for the young the responsibility of repudiating this common ground of dissident opinion."

The view that there is a "general religious belief" in the English nation, apart from the articles or confessions of faith of the various denominations, has received a remarkable confirmation from a passage in Dr. Newman's recently published work on the "Grammar of Assent," where, after describing various peculiar sections as assenting to certain peculiar doctrines or objects of faith, he writes thus:—"But these are only denominations, parties, schools, compared with the national religion of England in its length and breadth. Bible religion is both the recognised title and the best description of English religion. It consists not in Creeds and Articles, but mainly in having the Bible read in church, in the family, and in private." Further on, he says:—"Our national form professes to be little more than thus reading the Bible and a correct life;" and, "I am not speaking of particular schools and parties in England, whether of the High Church or the Low, but of the mass of piously-minded and well-living people in all ranks of the community."

The Rev. A. J. D. D'Orsey, in a letter which he heads "Instruction not Education," thinks that "much of this wordy warfare might have been avoided, had the disputants at the outset defined their terms, for both sides talk of education when they mean instruction. The League, for example, pleads for the education of every child in the kingdom, while it is abundantly plain that it actually means the instruction of these children in 'the three R's,' and nothing else. The Union, no doubt,

adds 'instruction' in religion, but makes no adequate provision for physical instruction, and therefore, leaves a large portion of 'education' neglected." He points out that, while the League accuses the Unionists of being "obstructives" because they contend for liberty to teach what they rightly believe to be a part of "education," the Union unfairly charges the Leaguers with being "godless," as if by separating religious from secular "instruction" they omitted religion altogether from "education," and he asks whether there is not a "possibility of coming to some agreement, founded on a simple definition of what we really want, i.e., a sound elementary education for the proper training of the children of our people as religious, intellectual, and physical beings, to which great end various kinds of instruction must of course contribute. Let a proper teacher, time, and place, be assigned to each department, so as to have three separate (but not therefore antagonistic) agencies, producing one harmonious whole."

CORRESPONDENCE.

POSTAGE ON PRINTED MATTER.

Sir,—After carefully perusing the petition on the above subject, which appears in the last number of the *Journal of the Society of Arts*, I reluctantly feel it my duty to guard the Society and the public against an impression which, though certainly not intended, its wording will, I fear, produce. This I shall best do by saying that, while I have always been desirous of seeing a parcels post established, on such terms and conditions as would lead neither to positive loss nor to its fraudulent use, I cannot but regard the measure described in the petition as open to grave objection.

I cordially recognise the importance of giving to newspapers and other periodical literature every facility for circulation that can be allowed, without undue sacrifice of more general interests; and several months ago I drew up, and placed in the hands of government, a plan for attaining this object—a plan, I presume, still under consideration.

May I request that you will do me the favour to insert this letter in the next number of the *Journal* of our Society.—I am, &c., Rowland Hill.

March 28, 1870.

THE OXIDATION OF IRON.

Sir,—My attention has been called to a short notice in the *Journal* (present vol., p. 400), which, I believe, may mislead some of your members, and act prejudicially to my reputation as a chemist. The paragraph has reference to a paper which has appeared in the *Comptes Rendus de l'Academie des Sciences*, "On the Oxidation of Iron." The first question referred to was that iron rust is not an hydrate of peroxide of iron, as stated, but a mixture of magnetic oxide, carbonate of protoxide, and of hydrato of peroxide of iron, with a trace of ammonia.

As to the oxidation of iron, is it tho oxygen of the atmosphere or its watery vapour, or the carbonic acid it contains, which determines the chemical action. Tho results of my experiments prove beyond doubt the fact, that carbonic acid is tho active agent. Thus, iron can remain free from oxidation for several months in dry or moist oxygen, but if carbonic acid be present, in a few hours it is attacked.

My venerable and illustrious master, M. Chevreul, in presenting my paper, containing many experiments, to the Academy, made some remarks on the importance of the presence of ammonia in rust, and that this fact had been long known. [This is what the paragraph in the *Journal* refers to.] This I was aware of, and therefore merely included it in my analysis, without further allusion to it.

In conclusion, allow me to add that I am proud that my master was kind enough to notice the paper, and that the Academy has inserted it in its *Comptes Rendus*.—I am, &c., F. Crace Calvert.

ANGLO-INDIAN ROUTES.

Sir,—In your *Journal* of the 11th inst., containing Sir Frederick Arrow's paper on the "Suez Canal," and the discussion thereon, Sir Bartle Frere, chairman of the conference, suggested the expediency of "a still more direct and rapid route from the Mediterranean to the Persian Gulf." Our cousins in America have spanned a continent, connecting by railway the Atlantic and Pacific oceans. France has severed Asia from Africa by the Suez Canal, affording the shortest ship route between European and Asiatic waters, thereby economising time and freightage for sea-borne cargoes; and it now remains for England to assert her rightful place in the friendly rivalry of progress, by constructing a railway between the Mediterranean and the Persian Gulf, with the long-desired objects of shortening and facilitating the transit of passengers and mails, and carriage of specie, merchandise of small bulk, and, under certain circumstances (happily not imminent at the present time), troops and war material, to protect our dominion and commerce in the East. Now, a geographical line from (say) the British port of Malta to the Gulf would touch Acre and Mohamrah as the respective termini; whereas, measuring from the same point to the northern corner of the Levant, and thence to and by the valley of the Euphrates, the most tortuous river in the world, would exceed this line in length by some 400 to 500 miles; and we have no right to assume that there are fewer engineering difficulties on the Eupbratean route, until at least a cursive survey is taken of the shorter line. Such a survey might be easily accomplished within a month. The line suggested would be alike apart from Russia on the north, and Egypt on the south, in case of occurrence of political complications; and, however costly the construction of a pier or harbour at Acre, modern experience proves that the shortest route is ultimately the cheapest. We might fairly estimate the saving of six hours between England and India as equivalent to a million pounds sterling within a period of twenty years; and, taking into calculation the high speed safely attainable on the level tracts of the central desert, Mohamrah might be reached within the twenty-four hours.

An abstract of an essay on this subject by Mr. John Locke, of Dublin, read at the British Association, Cheltenham meeting, in 1856, appears in the report of for that year (p. 114); and a more detailed description, containing maps and some interesting and curious information, was communicated by the same gentleman, in the following year, to the Historic Society of Lancashire and Cheshire, Liverpool, and is printed at length in their transactions, under the title of "Commerce of the Medial East." However, this title involves a secondary and subordinate question. As surely as the waters of both oceans flowed into the canal prepared for them by the enterprising genius of Lesseps, so surely will traffic flow from the intermediate countries to the iron road that links tho Mediterranean to the Persian Gulf.—I am, &c., Indicator.

March 17th, 1870.

NOTICES OF BOOKS.

The Architectural Review; and American Builders' Journal. Edited by Samuel Sloan, architect, Philadelphia. (London: Samson Low and Son.)—This review, which, as an exchange, will be found on the

library-table of the Society, contains a very large variety of articles, not only on architecture and building in the United States, but on general subjects, suited to readers on this side of the water. It contains a large number of illustrations.

The Midnight Sky. By Edwin Dunkin, of the Royal Observatory, Greenwich, and F.R.A.S. (London: Religious Tract Society.)—This is a reprint of the articles and star maps which were published originally in the *Leisure Hour*, with the addition of some new astronomical papers. A complete revision has also been made. The author says, in his preface, that he has received many communications from correspondents in all parts of the country, which prove that, with a little practice, by the aid of his star and index maps, the principal stars and constellations are easily learnt. The year is divided into months, and each month is treated by itself. There are also chapters on eclipses, meteors, and other phenomena, as well as on the planets and fixed stars.

GENERAL NOTES.

Free Schools of Industrial Art.—A plan is now before the Massachussets State Legislature, U.S., by which every town of a certain size will be compelled to maintain, in connection with its town school system, an evening school for education in "the industrial arts." These evening schools will be open two hours on five evenings in the week, with a competent master or mistress for every twenty-five pupils. Travelling loan collections of models and casts of works of art and design are to be formed, the expense of which will be borne by the commonwealth. A monthly system of examinations is also proposed, with the exhibition of meritorious works.

New Method of Extracting Gelatine, &c.—It is announced that a mode of obtaining gelatine from all animal substances capable of yielding glue has been discovered. The oils and grease are separated from the gelatine by means of benzine, coal-oil, or other hydrocarbons. In some cases it is found advantageous to treat the material with lime, before the hydrocarbons are employed; but these are only exceptional. After the substances treated have lain for a considerable time in benzine, or other agent employed, the fatty matters are dissolved, and the pure gelatine is found at the bottom of the vessel; they are, therefore, easily separated in order to be treated in the usual manner. The hydrocarbons are recovered by evaporation, by means of steam and condensation, and both the gelatine and the fatty matters are afterwards purified by the ordinary processes.

A Convenient Anemometer.—This instrument, introduced by Mr. Casella, for measuring ventilation, was first used in the Royal Victoria Hospital, Netley, and has since then been adopted in our Houses of Parliament, the United States Senate, several of our northern mines, and many of the leading prisons and hospitals throughout the country. Actual experiment has fixed the graduations. There is a large dial divided in its circumference into 100 parts, which represents the number of feet up to 100 traversed by the current of air. There are also five smaller dials marked on the larger one, with their circumferences divided into 10 parts only, one revolution of each being equal to ten of the preceding dial, and representing 1,000, 10,000, 100,000, 1,000,000, and 10,000,000 respectively; this latter measures the low velocity of 50 feet per minute, whilst the others extend the registration continuously up to 10,000,000 feet, or 1,893 miles. Jewelling in the most sensitive parts insures the utmost delicacy of action. The instrument is put in the current to be measured, and after a given time removed; the hands on the dials being marked in their first and subsequent position, and the figures noted somewhat after the fashion of a gas indicator.

Exhibition of Design at Berlin.—The Committee of Professors of Drawing in Germany have determined to form an exhibition, to be held at Berlin between the 10th and 24th of the coming month of April, with the special object of generalising and elevating the study of drawing, in giving teachers and the public the opportunity of judging of results obtained, and of the efforts that are being made towards their improvement. The exhibition is to be divided into three groups; the first to consist of models and examples; the second of works of all kinds produced by pupils; the third, of instruments and materials of all kinds connected with drawing. In the case of the drawings, the name of the pupil, his age, the time which he took to execute the work, will be given, with a statement whether it was taken from nature, or from what kind of model or example. In the case of instruments, materials, models, &c., a notice will set forth all necessary particulars, including the subject, the name of the author, and the price. The exhibition promises to be large and useful.

Diamond Mining in Australia.—About the middle of December, another very fine lot of 121 diamonds from the ground of the Mudgee Gold and Diamond Company, were received by the manager, Mr. W. H. Tuckett, through the Bank of Victoria. One beautiful stone weighed $2\frac{1}{8}$ carats. In order to extend their operations, the company have purchased a steam-engine. Since the departure of last mail, the Australian Diamond Mines Company have been steadily pushing on their works, and have obtained, with one machine, 171 diamonds and 38 oz. of gold. The yield of gold has more than paid the working expenses during the month. The 171 diamonds will be sent to the company's agent in London by the outgoing mail. This parcel will make the total quantity sent to England 759 stones. Two of the company's machines have been idle, owing to the breakage of copper sieves, but they will be at work again in about a week's time. The six-carat diamond found in the Australian Diamond Company's ground, and sent to Europe to be cut, was returned to Europe by the last mail. It has been cut down to a diamond of 3 3-16 carats, and is an exquisite specimen of brilliancy and purity. It possesses an exceptional value, as the first large-sized Australian gem discovered, and is highly prized by the lapidaries through whose hands it has passed. A sale of Australian diamonds found by the Mudgee Company took place on the 6th December, at the Shipping Exchange, Collins-street West. There was a good attendance, and some of the stones (of which there were 81 offered) realised very satisfactory prices, the sums received ranging from £2 2s. to £10 10s. per stone. This is the first sale of the kind that has taken place here; but, as the supply of gems bids fair to be pretty constant, it is probable that the sales will now be periodical.—*Melbourne Argus.*

Pacific Telegraphs.—The Pacific Cable Bill, recently reported to the legislature, provides that the starting point for the cable shall be south of Cape San Juan, in Washington Territory. The line which the American and Asiatic Telegraph Company originally estimated, and to which substantially, we presume, they still adhere, was about 5,000 miles long. But the islands of the Pacific offer a great advantage in breaking this long line; and in this respect the enterprise is less hazardous, so far as the establishment of the line is concerned, than its Atlantic predecessors. The distance from San Francisco to Cape San Juan, in Washington Territory, is 700 miles, and this part of the line is already built. There begins the ocean cable proper, which, proceeding north-westerly, finds its first station at Sitka, a distance of 630 miles. Thence, proceeding due west 500 miles, it touches Kodiak, where there is, or lately was, a military post. Thence, stretching south-westerly along the Alaska peninsula and the Aleutian group of islands 450 miles, it touches Oonalaska. From that point it leaves American islands behind, and, 660 miles to the

west, reaches the island of Attou, and with 650 miles more, Urup, the latter on the Asiatic shore. Another stretch of 300 miles carries it to Hakodadi, in Japan, where its mission proper as an ocean cable may be said to end. But with a northerly move of 200 miles, it reaches Poseyat, where, on the mainland of Asia, it will connect with a branch, already built, of that great Russian overland route which continues to the mouth of the Amoor River. From Poseyat a southerly bend of 650 miles (also submarine) carries the cable to Nagasaki, when an easterly branch may continue 600 miles to Yokohama, and a westerly one of 450 to Shanghai, the latter to connect with the East India Telegraph Company's line, so encircling the globe. These were the stations, and also the distances that were estimated a year or more ago, and if they have been or shall be slightly changed, it can only be in the way of improvement. Even as they are, it is clear that no distance between adjacent points in the long line is greater than 700 miles, which is a trifle in ocean telegraphy. And, again, it is clear that the strict trans-Pacific course—say from San Juan to Hakodadi, is only 3,190 miles in length, while that from Sitka to Japan is only 2,490. It is evident that the project is perfectly practicable, and that it need not be long before daily news may be had in New York from Japan and China, as early as it is now communicated from England and California.

Adulteration of Aniline Colours.—The *Bulletin du Musée de l'Industrie de Belgique* contains an account, signed P. Gouillon, of the manner in which, in spite of apparent difficulties, this adulteration is carried on so as to escape notice, except when tested very minutely, although of course the colours of aniline suffer in point of freshness through it. The chief result is, that its dyeing powers are diminished, for it is clear that a colour capable of dyeing, in its pure state, a hundred parts, will only dye eighty parts when twenty per cent. of foreign matters has been added to it. As it is necessary to detect and separate the strange matter, which may not even be known to exist in the adulterated colours, a chemical test is required. Neutral soluble salts, such as sulphate of soda, sea-salt, &c., and principally sugar, are used in these adulterations, and although they are insoluble in alcohol, this does not prevent the deceitful practice in question; but the fact that all the colours of aniline can be dissolved in alcohol furnishes a means of separation. A definite weight of the suspected colour is first pulverised, then gently heated in a bath for one hour, and frequently stirred, and prevented from melting. This is done to get rid of the water of crystallisation which the salts above-named contain, the loss in weight, if there be any, is noted, the residue is dissolved in alcohol at forty degrees, and the whole poured into a vessel to be precipitated. It is left to stand for an hour, then carefully poured into a bottle, to which a fresh quantity of alcohol is added, and then poured off again after standing a sufficient time, and so on until the residue, if there be any, is rendered entirely colourless. Three levigations, however, ought to be enough. This residue is the foreign matter, the nature of which can be determined by the ordinary tests; its weight, added to that of the water lost in drying, indicates the proportion in which this matter was mixed with the aniline product. The aniline colours, when thus adulterated, present in the powder a dull and greyish appearance, and when moistened and slowly dried often effloresce, although this effect is not produced when sugar has been used to adulterate the material; and since this last can be introduced without destroying the crystalline character of the aniline colours, it is most frequently used. To detect the presence of sugar, a few grammes of the suspected colour are diluted in half a glass of water, and, after the addition of beer yeast or leaven, exposed to the air in a warm place, at the temperature of the month of July. If sugar be present, numerous bubbles of gas will be found upon the liquid like froth. This carbonic acid gas is a characteristic in the tests of saccharine compounds. It is pretended that the salts above mentioned, as used in these adulterations, are accidently and naturally present, but experience and examples prove that this is an invention, for in the manufacture of common colours, in spite of their being prepared with great care, just enough only of the salts necessary for precipitation are contained in them, and observation shows that these colours carry away little or nothing of the salts in their separation from the dissolving liquid; and however discoverable by re-agents, such as nitrate of silver, chloride of barium, &c., these salts are not appreciable by weight when they are separated in the treatment of colours in alcohol, so that this pretence is simply groundless. The article concludes with the mention of some of the more palpable adulterations, as chalk, sand, alum, starch, and the like, which even an unexperienced person can detect, and a promise is thrown out that, as other species of fraud become known, the means of detecting them shall be published.

The Report of Mr. T. P. Allen on the existing state of Education in Richmond, Twickenham, Mortlake, and neighbourhood, which was to have been a supplement to this week's *Journal*, will be issued next week.

MEETINGS FOR THE ENSUING WEEK.

Mon......Social Science Assoc., 8. Adjourned discussion on "The Government Education Bill."
Society for Encouragement of Fine Arts, 8. Mr. H. Tidey, "Beauty and the Beautiful."
Farmers' Club, 5½. Mr. J. B. Lawes, "Exhaustion of Soil in relation to Landlord Covenants, and the Valuation of Unexhausted Improvements."
Society of Engineers, 7½. 1. Discussion on Mr. Peter Jensen's paper on "The Friction in the Steam Cylinder;" and (time permitting) 2. Mr. W. Lloyd Wise, "The Patent Laws."
R. United Service Inst., 8½. Capt. A. Moncrieff, "The Progress that has been made in the Application of the Moncrieff System to Garrison, Siege, and Naval Ordnance, and to Coast Works."
Entomological, 7.
Medical, 8.
Asiatic, 3.
Victoria Inst., 8. Mr. E. J. Morshead, "On Comparative Psychology."
London Inst., 4.
Institution of Surveyors, 8. Discussion on Mr. Mathew's paper, "A Plea for Culture in the Profession of a Surveyor."
Royal Inst, 2. General Monthly Meeting.

Tues ...Civil Engineers, 8. 1. Discussion on "The St. Pancras Station and Roof." 2. Mr. Thomas Sopwith, jun., "On the Dressing of Lead Ores."
Pathological, 8.
Anthropological, 8.
Syro Egyptian, 7. Annual Meeting.
Social Science Assoc., 8. (At the Society of Arts' House.) Prof. Stanley Jevons, "On Industrial Partnerships."
Royal Inst, 3.

Wed ...Society of Arts, 8. Adjourned discussion on Mr. Bridges Adams' paper "On Tramways."
Pharmaceutical, 8.
R. Society of Literature, 4½.
Obstetrical, 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Royal Society Club, 6.
Artists and Amateurs, 8.
London Inst., 7½.
Royal Inst., 3.
Chemical, 8. 1. Dr. John Hunter, "On the Analysis of Deep-sea Water." 2. Dr. J. H. Gladstone, "On the Refractive Equivalents of the Aromatic Hydrocarbons, and their Derivatives." 3. Prof. How, "On an Acid Feedwater from the Coal Fields of Stellarton, U.S., and the results of its use."
Linnæan, 8. 1. Dr Baird, "On New Species of Annelids." 2. Dr Dickie, "On *Algæ* from the North Atlantic Ocean."
Social Science Assoc., 4. (At St. James's Hall.) "On the Education of the Blind Sons of Gentlemen, in connection with the Worcester Proprietary College."

Fri ......Philological, 8½.
Royal Inst., 8.
Quekett Club, 8.

Sat ......R. Botanic, 3¾.
Royal Inst., 3.

Journal of the Society of Arts.

FRIDAY, APRIL 8, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

April 13.—*Passion Week.*—No Meeting.

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum, on Wednesday evening, the 4th of May.

NETHERLANDS INTERNATIONAL EXHIBITION.

The Diplomas and Certificates awarded to British exhibitors at this Exhibition have been received by the Society of Arts, and can be had on application, by the parties entitled, or their duly authorised agents.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

With this week's *Journal* is issued, as a supplement, Mr. Allen's report on the Existing State of Education in Richmond, Twickenham, Mortlake, and neighbourhood.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

On Monday afternoon, the 4th inst., at three o'clock, the Committee appointed by the Society, at the request of the Royal Commissioners, to organise the educational division of the International Exhibitions commencing in 1871, met for the first time. **His Royal Highness the Prince of Wales, K.G.,** President of the Society, in the chair. The following is a list of the members of the Committee present:—T. W. Allies (Secretary to Catholic Poor Schools Committee); Samuel Andrews; Rev. E. A. Abbott (Head Master of the City of London School); B. B. Aguirre (King's College); Rev. Dr. Angus (Principal of Regent's-park College); F. A. Abel, F.R.S.; Professor D. T. Ansted, F.R.S.; W. B. Baskcomb (Science and Art Department); Hon. and Rev. F. Byng; Rev. F. S. Barry, M.A. (Head Master of the Mercer's School); G. C. T. Bartley; W. F. Barrett, F.C.S.; John Bell; Charles Brooke, M.A., F.R.S.; John Ball; Rev. G. C. Bell (Head Master of Christ's Hospital); H. A. Bowler (Science and Art Department); Rev. J. S. Brewer, M.A. (King's College); Rev. W. Haig Brown (Head Master of Charterhouse School); Rev. Canon Cromwell (Principal of St. Mark's College); Hyde Clarke; D. N. Chambers; Right Hon. W. Cowper-Temple, M.P.; F. S. Cary; Sir Michael Costa; Eyre Crowe (Science and Art Department); Henry Cole, C.B.; Rev. B. M. Cowie; G. H. Davis, LL.D. (Religious Tract Society); Lord De L'Isle and Dudley; Captain Donnelly, R.E.; Rev. E. Daniel (Principal of Battersea Training College); Major-Gen. F. Eardley-Wilmot, R.A., F.R.S.; Francis E. Fox (representing British and Foreign Bible Society); C. W. Franks (Endowed Schools Commission); Rev. J. G. C. Fussell; Professor G. Fuller, C.E.; Professor Guthrie, Ph.D.; Colonel Hamley, C.B., R.A.; C. Wren Hoskyns, M.P.; William Hawes; J. F. Iselin, M.A. (Science and Art Department); A. K. Isbister, M.A., LL.B. (Head Master of Stationers' School); Rev. James Johnson, B.A. (representing Home and Colonial School Society); Henry Jeffery; Lord Henry G. Lennox, M.P. (Chairman of the Council); Walter McLeod (Royal Military Asylum, Chelsea); Professor A. Mariette (King's College); Rev. M. Mitchell; Right Hon. Sir J. S. Pakington, Bart., M.P.; Frederick Pitman; V. Pistrucci; Rev. G. Ridding (Head Master of Winchester School); Rev. C. F. Routledge; Rev. H. R. Reynolds; Rev. W. Rogers; Rev. Arthur Rigg, M.A.; Samuel Redgrave (Vice-Chairman of the Council); C. W. Roberts; Venerable Archdeacon Sinclair (representing the National Society); John Sykes, M.A. (Privy Council Office); Rev. C. B. Scott (Head Master of Westminster School); Arthur S. Sullivan; L. Schmitz, LL.D. (London International College); L. C. Sayles; Col. H. Y. D. Scott; Sir Walter Stirling, Bart.; Thomas Twining; The Chief Rabbi; Seymour Teulon (Vice-Chairman of the Council); Rev. J. F. Twisden, M.A. (Science and Art Department); Henry Vaughan; James T. Ware; Professor Willis (Royal School of Mines); Rev. Dr. Woolley (Royal School of Naval Architecture); T. A. Wright.

His Royal Highness, in opening the proceedings, said—My Lords and Gentlemen—We are assembled here for the purpose of organising the Educational Section of the International Exhibition of 1871, and I appear before you on this occasion in a double capacity; not only as President of your Society, but also as President of the Royal Commission of 1851, in which office I succeed the late lamented Lord Derby, who, much as he was missed and always will be missed as a great statesman, will also be missed as President of the Commission, whose interests he had so much at heart. The long-standing connection of this Society with exhibitions is well-known. In these very rooms the Exhibitions of 1851 and 1862 were first planned; and, with regard to the subject of education, I think I may say that this Society has always been prominent in using its best efforts for its promotion. It is almost needless to remind you that the Society held, in 1854, an Exhibition which was inaugurated and opened by my late lamented father. This Society, therefore, having as one of its most important objects the promotion and improvement of education, I think we are well qualified, in our associated capacity, to deal with the subject which is before us; and I can assure you, gentlemen, that it is a great gratification to me to preside here upon this occasion, and to show to you, by all the means in my power, that I am fully alive to the importance of this great question of education. It may perhaps be agreeable to the meeting that I should read a very short address which I have before me, which will explain precisely the objects with which we are here met. The meeting to-day is of members of a large committee of persons, eminent in their various stations for the interest they have displayed in education, appointed without reference to political party, denomination, or social position, for the purpose of causing the best possible representation, in 1871, of the various materials and apparatus used in teaching, and for exhibiting, as far as practicable, the results of the many systems of instruction which are practised in this country and the other nations of the world. Under the first class, we find such objects as affect the sanitary conditions of schools, the desks and stools used, maps and globes, books, pictures, scientific diagrams, objects of natural history, and the like. Under the second class will be shown illustrations of modes of teaching, drawing, reading, writing, music, and gymnastics; and the interesting work of educating those whom

nature has deprived of sight, speech, and hearing, with the successful results of such modes. In this Exhibition of education, foreigners as well as British subjects will take their share; and I am happy to say that Sweden has already applied for permission to exhibit a full-sized model of one of its parish schools. The duty of this committee is to see that such work as I have sketched out shall be completely accomplished; that exhibitors shall come forward and offer their productions, that the best only shall be selected for exhibition, and the discussions on systems of instruction shall be properly organised. I indulge a sanguine hope that the labours of this committee will teach many lessons, which will lead to improvement of the quality of primary education, and to the extension of the secondary instruction in science and art so much needed for the industrial progress of this country—a necessity proved at the Exhibition of 1851, originated and conducted by my illustrious father, and confirmed again in 1862, and at Paris in 1867, where our own artizans showed, by their remarkable reports, how strong were their convictions on this point. Difficulties there are, as there always must be, in the completion of a great work; and here I am reminded how fully the difficulties connected with this work of education were appreciated by my late father, as long ago as 1851; and you will, I, hope allow me, whilst on this point, to quote the Prince Consort's own words in a speech delivered on June 22, 1857. He said:—"You will probably trace the cause of our social condition to a state of ignorance and lethargic indifference on the subject among parents generally; but the root of the evil will, I suspect, be found to extend into that field on which the political economist exercises his activity—I mean the labour market, demand and supply. To dissipate that ignorance and rouse from that lethargy may be difficult, but with the united and earnest effort of all who are friends of the working classes it ought, after all, to be only a question of time. What measures can be brought to bear upon the other root of the evil is a more delicate question, and will require the nicest care in handling, for there you cut into the very quick of the working man's condition. His children are not only his offspring, to be reared for a future independent position, but they constitute part of his productive power, and work with him for the staff of life; the daughters especially are the handmaids of the house, the assistants of the mother, the nurses of the younger children, the aged, and the sick. To deprive the labouring family of their help would be almost to paralyse its domestic existence. My visit with the Princess of Wales to the Middle-class Schools in the City of London, on Wednesday last, and the reports on Faversham School and the district union schools of the metropolis which have been published by our Society, make me hope that even these difficulties may admit of solution. By improved organisation of schools and of teaching power, I think it is shown that instruction may be so given as to enable *earning* and *learning* to go hand in hand. I close these few remarks by bidding "God speed" to this committee in the great work that is before them. Two resolutions will be offered for your acceptance, and any explanation will be afforded which may seem necessary.

His Royal Highness then called upon the Secretary to read the following correspondence between the Royal Commission for the Exhibition of 1851 and the Society of Arts:—

Office of Her Majesty's Commissioners for the Exhibition of 1851, 5, Upper Kensington-gore, W.
19th November, 1869.

Sir,—I am directed by Her Majesty's Commissioners for the Exhibition of 1851, to request you to call the attention of the Council of the Society of Arts to the accompanying announcement of a series of annual international exhibitions, the first to be held in 1871.

Her Majesty's Commissioners are fully sensible of the many and great services rendered by the Society of Arts to the various exhibitions, both national and international, since their first proposal in the year 1845, and especially to the great International Exhibitions of 1851 and 1862. Her Majesty's Commissioners are also mindful of the fact that the first educational exhibition held in this country was organised by the Society of Arts, and that the Educational Museum, at South Kensington, owes its origin to that Society, which placed at the disposal of the Committee of Council on Education the objects which had been exhibited at St. Martin's-hall, and which, at the close of the exhibition, were presented to the Society of Arts. They, therefore, particularly desire to obtain the valuable co-operation of the Society of Arts in producing a complete and effectual exhibition, especially in the educational class.

Her Majesty's Commissioners desire to call attention to the fact that the distinguishing principles of the proposed exhibitions are those particularly recommended by the Society of Arts itself, in their letter of the 15th December, 1858, addressed to her Majesty's Commissioners for the Exhibition of 1851, in which they express an opinion "that the exhibition should consist of works selected for excellence, illustrating especially the progress of industry and art, and arranged according to classes, and not according to countries."

I am further to say that Her Majesty's Commissioners hope the Council of the Society of Arts will think fit to appoint a committee to co-operate with them in promoting the proposed series of annual international exhibitions, and especially in producing a complete exhibition of all matters relating to the important subject of education.

I have the honour to be, Sir,
Your most obedient servant,
Henry Y. D. Scott, Lt.-Colonel, R.E.,
Secretary.

To the Secretary of the Society of Arts.

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-street, Adelphi, November 30th, 1869.

Sir,—I have brought under the consideration of the Council of this Society your letter of the 19th instant, in which Her Majesty's Commissioners for the Exhibition of 1851 draw the attention of the Council to a series of annual international exhibitions intended to be held by them, the first of which will be held in 1871, and expressing the hope of Her Majesty's Commissioners that the Council of the Society will think fit to appoint a committee to co-operate with them in promoting the proposed series of annual international exhibitions, and especially in producing a complete exhibition of all matters relating to the important subject of education.

I am directed by the Council to express their cordial desire to co-operate with Her Majesty's Commissioners in the important work they have undertaken, and they will at once take steps for the formation of a large and comprehensive Committee, representing the various interests connected with education, similar to that which conducted the Educational Exhibition of 1854; and they have every confidence that, under the care of such a Committee, they will be able to get to gether such a display of articles connected with education as will creditably represent that class in the exhibition.

I have the honour to be, Sir,
Your obedient servant,
P. Le Neve Foster, Secretary.

Lieut.-Colonel Henry Scott, R.E.

His Royal Highness then called upon the Secretary to read the following report of the proceedings of the International Educational Exhibition of 1854:—

In 1854, the Society of Arts, with the aid of a large and influential Committee, similar in character and number to that which has come forward on the present occasion, held, in St. Martin's Hall, an International Educational Exhibition. It was divided into six sections, as follows:—

I. Buildings.
II. Fittings and furniture.
III. Apparatus and materials.
IV. Books, maps, prints, and diagrams.
V. Results.
VI. Objects or models and drawings of projects for supplying desiderata.

The total number of exhibitors was 539, of whom 425 were British and 114 foreign. Large and valuable contributions were received from abroad, the foreign countries represented being France, various States of Germany, Belgium, Holland, Spain, Sweden, Denmark, Switzerland, and the United States; India, Malta, and Canada also sent contributions, and it may be mentioned that our present Royal President, the Prince of Wales, was an exhibitor of some of the specimens used in his studies.

The Exhibition was opened in July, by His Royal Highness the Prince Consort, who was for so many years President of this Society, and took a particularly warm interest in all its efforts for the advancement of education. Most of the foreign countries above mentioned were, on this occasion, represented by Commissioners accredited by their respective Governments. During the nine weeks that the Exhibition was open, a series of lectures in connection with it, sixty-one in number, were given by eminent educational authorities, and these were afterwards published in a volume. Reports on some of the departments of the Exhibition were also made, and reviews of many of the books exhibited were given in the Society's *Journal*.

The Exhibition was closed in September, but the Council of the Society, feeling how valuable a permanent national collection of this kind would be, urged its formation upon the government, and, with the consent of the exhibitors, a large number of the objects shown were transferred to the Department of Science and Art, and formed the foundation of the present valuable educational collection at the South Kensington Museum.

By order,
P. Le Neve Foster, Secretary.

His Royal Highness then called on Col. Scott to give an explanation of the objects contemplated by the Royal Commission.

Lieut.-Col. Scott, in explaining the objects contemplated by the Royal Commission, said the chief points of difference between the intended Exhibition of 1871 and those of former years were briefly as follows:—On former occasions the endeavour had been to exhibit as many classes of objects as could possibly be brought together; but in 1871, on the contrary, the idea would be to collect only a certain number of objects of manufacture—such a number as could be well examined and reported upon in a reasonable period of time—together with objects of art and scientific inventions. It was intended that manufacturers should be divided into classes, of which a certain number should be brought forward year by year; but with regard to the fine arts and scientific inventions, articles coming under these designations would be eligible for exhibition annually. Again, in the forthcoming Exhibition, instead of allowing things to be sent in wholesale, without distinction, everything would be submitted to a careful examination by competent tribunals before admission, and only those objects which were thought worthy, either from their novelty or excellence, would be admitted. These objects, when sent in, would be in a great measure arranged by the officers of the Commissioners, who would also take upon themselves the chief part of the expense connected with such an arrangement, which had hitherto fallen somewhat heavily upon exhibitors. On this occasion, the glass-cases, stands, and a great part of the requisite machinery would be provided at the expense of the Commissioners. Another point of difference would be this, that no prizes would be given, the certificate of admission to the Exhibition being considered a prize in itself. On former occasions, it had been found that the jurors, who were supposed to be judges, turned out in practice to be little better than advocates, and that the stronger nations, which were represented by the greatest number of jurors, almost always came off victorious. In the forthcoming Exhibition, on the other hand, a report would be made, as soon as possible after the Exhibition was opened, by competent persons appointed by every country exhibiting; all the jurors would agree in the report to be made, and then it would be left very much to the public themselves to judge as to the comparative merits of the various articles exhibited. Whilst stating that no prizes would be given, he referred entirely to prizes offered by her Majesty's Commissioners; for he thought it very likely that societies, and perhaps private individuals, would be willing to offer prizes for particular objects, but the manner in which these would be given could not as yet be determined upon. The Exhibition would take place in buildings which were now being rapidly erected on each side of the Horticultural-gardens (as shown in a model at the side of the room), which would be in communication with the large central hall at South Kensington, and this also would in part be made use of. The Exhibition would be connected with the conservatories of the Horticultural Society, and arrangements had been made with the officers of that body to enable visitors to the Exhibition to visit the gardens, there being a promenade from the upper galleries of the Exhibition to the present arcade. An English catalogue would be printed, and every foreign country would be at liberty to publish a catalogue in its own language if it thought fit. In the first year, the objects chosen for exhibition would be these:—Fine arts, applied or not applied to works of utility; scientific inventions of all kinds—and these would be brought forward annually. Then, of manufactures—pottery of all kinds; woollen and worsted fabrics; and educational works and appliances. Horticulture would also form part of the Exhibition every year, and would, no doubt, prove a very interesting feature. With regard to the educational portion of the Exhibition, as had already been stated, it had been put into the hands of the Society of Arts, for Her Majesty's Commissioners felt they were quite safe in so acting, and that they could not do better than submit this department to a Society which had already done so much in the cause of education.

The Right Hon. Sir John Pakington, M.P., moved the first resolution, as follows:—"Resolved, that this having Committee, heard the observations of his Royal Highness the President, the correspondence which has taken place between the Commissioners for the Exhibition of 1851 and the Council of the Society of Arts, together with the report of the proproceedings of the Educational Exhibition of 1854, and the explanations offered by Lieut.-Col. Scott, hereby expresses its approval of the purpose, and pledges itself to give its hearty co-operation." He said that, after the clear explanation which they had just heard from Colonel Scott, of the object of these interesting annual exhibitions, it would be almost presumption on his part to detain the meeting for many moments, but he felt certain that he only uttered the common sentiments of all present, when he could not refrain from expressing the great delight which it gave him to see that this interesting portion of the approaching series of Exhibitions not only received the sanction of H.R.H. the Prince of Wales, but also his personal assistance and co-operation. He felt that he should also be speaking the sentiments of the whole meeting if he ventured to say that, one and all, in their respective capacities, and with their respective powers, would be desirous of rendering to his Royal Highness the utmost assistance possible. The great question of national education had been appropriately touched upon in the opening address, to which they all had the pleasure of listening; and he could not

refrain from expressing briefly, but emphatically, his earnest and anxious hope, and, he might perhaps add, his confident belief, that the time was at last at hand when, by the vigorous determination of her Majesty's government, supported, as he believed they would be, by the great majority of the members of the Legislature of all parties, this great and important subject would receive its final solution and settlement. However that might be, and even supposing that the most sanguine hopes entertained upon this subject were realised, there would still be much of great importance, and probably of some difficulty, yet to be done; and he was disposed to believe that nothing could more tend to smooth away those difficulties, and to compass that which was seriously and anxiously desired, than the information which would probably be derived from such an Exhibition of educational appliances as they were now looking forward to.

Professor Willis, in seconding the resolution, said he had taken great interest in former exhibitions, and having held office therein, he was enabled to judge in some measure of their organisation. With respect to the changes which had been explained by Lieut.-Colonel Scott as about to be introduced into the forthcoming series, he begged to congratulate the Committee on these improvements, and he had no doubt that, in preparing the programme, many other little points might arise which might be beneficially attended to. He therefore had much pleasure in seconding the resolution.

The resolution was then put and carried unanimously.

The Right Hon. W. Cowper-Temple, M.P., moved the second resolution, as follows:—"That this Committee be divided as follows into five Sub-Committees, one for each of the five sections into which Class X. is divided, viz.:—

Section 1.—School Buildings, Fittings, Furniture, &c.

Allies, T. W. (Secretary to Catholic Poor Schools Committee)
Andrews, Samuel
Bangor, Bishop of
Canterbury, Archbishop of
Chadwick, Edwin, C.B.
Clark, Rev. Samuel, M.A.
Cromwell, Rev. Canon (Principal of St. Mark's College)
Daniel, Rev. Evan (Principal of Battersea Training College)
Fox, Francis E. (representing British and Foreign Bible Society)
Hamley, Colonel, C.B., R.A.
Harness, Colonel, C.B., R.E.
Her Majesty's Inspectors of Schools:—
- Arnold, Matthew
- Bellairs, Rev. H. W.
- Bowstead, J.
- Cowie, Rev. B. M.
- Fearon, D. R.
- Fraser, Rev. S. J. G
- Gream, Rev. N.
- Hughes, Rev. H.
- Kerr, John
- Moncrieff, Rev. G. R.
- Norris, Rev. J. P.
- Robinson, Rev. C. J.
- Smith, Rev. H.
- Tinling, Rev. Canon
- Watts, Rev. E. T.

Johnson, Rev. James, B.A. (representing Home and Colonial School Society)
Jowitt, Rev. W. (Head Master of the City Middle Class School)
Lyttelton, Lord
McLeod, Walter (Royal Military Asylum, Chelsea)
Murray, John (Treasurer)
Norwich, Bishop of
Ridding, Rev. G. (Head Master of Winchester School)
Rigg, Rev. Dr. (representing the Wesleyan Training Institution)
Russell, Earl, K.G.
Salisbury, Bishop of
Sandham, Henry (South Kensington Museum)
Shaw, Benjamin
Shuttleworth, Sir J. Kay, Bart.
Sinclair, Venerable Archdeacon (representing the National Society)
Sykes, John, M.A. (Privy Council Office)
The Lord Chancellor
The Lord Mayor
Trevelyan, Sir Charles, K.C.B.
Tufnell, E. C.
Twining, Thomas
Unwin, Rev. Dr. (Principal of Homerton College)

Section 2.—Books, Maps, Globes, Instruments, &c.

Abbott, Rev. E. A. (Head Master of the City of London School)
Aguirre, B. B. (King's College)
Angus, Rev. Dr. (Principal of Regent's Park College)
Baskcomb, W. B. (Science and Art Department)
Bates, Rev. Jonathan, M.A.
Brown, Rev. W. Haig, LL.D. (Charterhouse School)
Butler, Rev. Dr. (Harrow)
Byng, Hon. and Rev. F.
Carlisle, Bishop of
Chambers, Robert
Chapman and Hall, Messrs.
Clarke, Hyde
Davies, Rev. T., D.D. (Principal of Haverford West College)
Davis, G. H., LL.D. (Religious Tract Society)
De L'Isle and Dudley, Lord
Galpin, T. Dixon
Grote, George, LL.D., F.R.S. (President of University College)
Hornby, Rev. J. J. (Head Master of Eton)
Hudson, Rev. T. P., M.A.
Hughes, Professor W., F.R.G.S. (King's College)
Her Majesty's Inspectors of Schools:—
- Barry, Rev. H. B.
- Binns, Rev. B. J.
- Brodie, E. H.
- Crabtree, Rev. E. W.
- French, Rev. G.
- Hernaman, Rev. J. W. D.
- Johnstone, Rev. C. F.
- Lomax, Rev. J.
- Oakeley, H. E.
- Routledge, Rev. C. F.
- Stokes, S. N.
- Tregarthen, Rev. W. F.

Jex-Blake, Rev. J. W. (Principal of Cheltenham College)
Key, T. Hewitt (Head Master of University College School)
Lincoln, Bishop of
Llandaff, Bishop of
Longman, William
Mackenzie, Rev. C. (City of London College)
Macmillan, Alexander
Manchester, Bishop of
Murby, Thomas
Murray, John
Petter, G. William
Pistrucci, Professor (King's College)
Ripon, Bishop of
Routledge and Co.
St. David's, Bishop of
Scott, Rev. C. B. (Head Master of Westminster School)
The Chief Rabbi
Williams, Rev. J. D., M.A. (Principal of Brecon College)
Wilson, Rev. Alexander, M.A. (National Society)
Worcester, Bishop of

Section 3.—Appliances for Physical Training, including Toys and Games.

Barry, Rev. F. S., M.A. (Head Master of the Mercer's School)
Bartley, G. C. T.
Bodkin, Sir W. H.
Bradby, Rev. E. H. (Principal of Haileybury College)
Bradley, Rev. G. G. (Head Master of Marlborough School)
Bruce, Right Hon. H. A., M.P.
Chambers, D. N.
Cooper, Sir Daniel, Bart.
Cowper-Temple, Right Hon. W., M.P.
Davidson, Ellis A.
Dilke, Sir Charles W., Bart., M.P.
Edgar, Rev. J. H., M.A.
Franklin, Jacob A.
Franks, G. W. (Endowed Schools Commission)
Gerstenberg, J.
Gloucester and Bristol, Bishop of
Hawes, William, F.G.S.
Huxley, Professor, F.R.S. (Royal School of Mines)
Her Majesty's Inspectors of Schools:—
Arnold, Rev. E. P.
Fussell, Rev. J. G. C.
Lynch, H. J.
Mitchell, Rev. M.
Parez, Rev. C. H.
Sandford, Rev. H. R. P.
Synge, Rev. F., M.A.
Warburton, Rev. W. P.
Williams, W.
Isbister, A. K., M.A., LL.B. (Head Master of Stationers' School)
Jeffrey, Henry
Lennox, Lord Henry G., M.P.
Lichfield, Bishop of
Neate, Charles
Reynolds, Rev. H. R.
Rogers, Rev. W.
Teulon, Seymour
Vaughan, Henry
Ware, James T.
Wylde, R. G. (Science and Art Department)
York, The Archbishop of

Section 4.—Specimens and Illustrations of Modes of Teaching Fine Art, Natural History, and Physical Science.

Abel, F. A., F.R.S.
Anderson, John, C.E.
Ansted, Professor D. T., F.R.S.
Armitage, Thos., M.D.
Barrett, W. F., F.C.S.
Bell, John
Brooke, Charles, M.A., F.R.S.
Cary, F. S.
Clarke, Hyde
Costa, Sir Michael
Curwen, Rev. John (Tonic Sol-Fa Association)
De La Rue, Warren, F.R.S.
Donnelly, Captain, R.E.
Eardley-Wilmot, Major-General F., R.A., F.R.S.
Flower, Professor W. H. (Royal College of Surgeons)
Frankland, Professor, F.R.S. (Royal College of Chemistry)
Fuller, Professor G., C.E.
Goldschmidt, Otto
Goodeve, Professor T. M. (Royal School of Mines)
Guthrie, Professor, Ph.D.
Harrowby, Earl of
Hart, Solomon, R.A.
Hogg, Robert, LL.D.
Hawes, William, F.G.S.
Hoskyns, C. Wren, M.P.
Hullah, John
Huxley, Professor, F.R.S. (Royal School of Mines)
Her Majesty's Inspectors of Schools:—
Capel, Rev. H. M.
Wilkinson, Rev. F.
Iselin, J. F., M.A. (Science and Art Department)
Johnson, Edmond Charles, M.D.
Leighton, F., R.A.
Lindsay, Sir Coutts, Bart.
Lubbock, Sir John, Bart. M.P.
Macfarren, G. A.
Matchwick, W. (South Kensington Museum)
Merrifield, C. W., F.R.S. (Royal School of Naval Architecture
Millais, J. E., R.A.
Moseley, Rev. Canon
Mundella, A. J., M.P.
Pakington, Right Hon. Sir J. S., Bart., M.P.
Percy, Professor John, M.D., F.R.S. (Royal School of Mines)
Phillips, J. A.
Playfair, Dr. Lyon, C.B., M.P.
Price, Rev. Bartholomew, M.A., F.R.S.
Ramsay, Professor A. C., F.R.S.
Redgrave, R., R.A.
Reed, E. J., C.B.
Rigg, Arthur, M.A.
Samuelson, B., M.P.
Smyth, W. W., F.R.S. (Royal School of Mines)
Sopwith, Thomas, F.R.S.
Strange, Col., F.R.S.
Sullivan, Arthur
Sydney, F. J., LL.D. (Royal College of Science, Dublin)
The President of the Royal Academy
The President of the Royal Academy of Music (Earl of Dudley)
Thomson, T., M.D., F.R.S. (Science and Art Department)
Twisden, Rev. J. F., M.A. (Science and Art Department)
Whitworth, Sir Joseph, Bart., LL.D., F.R.S.
Williamson, Professor A. W., F.R.S. (University College)
Willis, Professor (Royal School of Mines)
Woolley, Rev. Dr. (Royal School of Naval Architecture)
Wyatt, Sir M. Digby
Wylde, Professor, Mus.D.

Section 5.—Specimens of School Work, serving as Examples of the Results of Teaching.

Barry, Rev. Dr. (Principal of King's College)
Bell, John
Bell, Rev. G. C. (Head Master of Christ's Hospital)
Bourne, Alfred (Secretary of the British and Foreign School Society)
Bowler, H. A. (Science and Art Department)
Brewer, Rev. J. S., M.A. (King's College)
Brown, Rev. W. Haig (Head Master of Charter-house School)
Buchheim, Dr. (King's College)
Crowe, Eyre (Science and Art Department)
Dixon, George, M.P.
Exeter, Bishop of
Fawcett, Professor Henry, M.P.
Granville, Earl, K.G.
Hall, Rev. T. G., M.A. (King's College)
Hamilton, R. G. C. (Privy Council Office)
Her Majesty's Inspectors of Schools:—
Blakiston, Rev. J. R.
Cornish, Rev. F. F.
Du Port, Rev. C. D., M.A.
Fitch, J. G.
Gordon, J.
Howard, Rev. W. W.
Kennedy, Rev. W. J.
Middleton, D.
Pickard, Rev. H. A.
Sewell, Rev. Capel
Temple, Rev. R.
Watkins, Rev. F.

King, A. C., F.S.A. (South Kensington Museum)
London, Bishop of
Mariette, A. (King's College)
Oxford, Bishop of
Peterborough, Bishop of
Pitman, Frederick
Redgrave, Richard, R.A.
Redgrave, Samuel
Rochester, Bishop of
Schmitz, L., LL.D. (London International College)
Wyatt, Sir M. D.

And that it be an instruction to every Sub-Committee each to appoint a reporter, and that such reporters meet together to promote concerted action." It was very satisfactory to know that so many persons had expressed their willingness to serve on these Committees, and he was quite sure their labour would not be spent in vain; for although, up to the present moment, interest in the subject of education had been confined to a comparatively small number of persons—and perhaps those most zealous in it had often been looked upon by others as amiable enthusiasts—yet at the present moment the importance of education had been generally recognised in a most remarkable manner, and there had been a great increase in the interest taken in it by the public at large. It was now found that efforts made to disseminate more widely a knowledge of what was really required in education, and of the best methods of bringing it to bear, would meet with a large response, and prove of great utility, for not only primary but technical education was now generally acknowledged to be of absolute importance to the maintenance of England's position amongst the civilised nations of the world. He was sure, therefore, that the gentlemen who formed these sub-committees would not find that their labour was spent in vain. No doubt that labour would be considerable, for they would have to select, out of a large number of objects which would be placed before them, those best adopted for useful exhibition and most worthy of public examination. But this labour, whatever it might be, would, he was sure, be cheerfully and usefully undertaken, and it was very pleasing to all that there was such a cordial response to the appeal which had been made by His Royal Highness to engage in this great undertaking, and to support him in the work which he had so patriotically undertaken.

Professor Guthrie, in seconding the resolution, said he must approve of the main features of the forthcoming Exhibition, for, as he understood, they differed from those of preceding ones chiefly in the greater subdivision in the *personelle* of those who would have to examine and report upon the subjects brought before them, corresponding necessarily and properly to the greater sub-division which must from time to time be introduced into the articles themselves, as these exhibitions became more and more accurate as tests and illustrations of the progress of invention and manufacture. He trusted that they would have to examine and judge of a far greater number of educational appliances than such exhibitions had hitherto brought together, for the exact and experimental sciences were now so much more fully developed, that it was impossible to remain any longer contented with attempting to teach an experimental class by means of a black board and a piece of chalk; it was now necessary to have an efficient apparatus for teaching these subjects, and to prepare it with as much care as was now taken in the organisation of a library, and other appliances for teaching classical and literary knowledge.

The resolution was carried unanimously.

Lord De L'Isle then said his Royal Highness had evinced, by his kindness in taking the chair on that occasion, and by the opening address with which he had favoured the meeting, the deep interest he took in the cause of education, which was one of the most important subjects of the day, and one in which his late illustrious father had always taken a lively interest. He felt sure that, not only on that occasion, but on any other, his Royal Highness would lend the weight of his authority, and give his support to anything that would be for the benefit and welfare of his country. He had therefore great pleasure in proposing, "That the best thanks of the Committee be given to his Royal Highness for presiding on this occasion."

The Rev. W. Rogers, as a member of the Council, begged most cordially to second the motion, which he hoped would have been proposed by the Chairman of the Council, but his lordship was suffering from a severe cold.

Lord Henry G. Lennox, M.P., then put the resolution to the meeting, which was carried unanimously.

His Royal Highness the Prince of Wales, said he begged leave to thank his noble friend for the kind way in which he had proposed the vote of thanks in the name of the meeting, but he really required no thanks at all, for it had given him the greatest pleasure to be present and to open the interesting proceedings of the day. He also begged to thank all the gentlemen present for so kindly and cordially supporting him, and to assure them that he he did take a very great interest in the important subject of education, and should be ready at all times to give his most hearty assistance to help it forward.

His Royal Highness Prince Christian presided, on Wednesday morning, at a conference, held in the Great Room of the Society. The subject of the conference was the representation of the fine arts in the forthcoming series of Annual International Exhibitions. Amongst those present were the Lord Chancellor, Sir Daniel Cooper, Col. F. Eardley-Wilmott, Henry Cole, C.B., Col. Henry Y. D. Scott, R.E., Richard Redgrave, R.A., Joseph Durham, R.A., J. E. Millais, R.A., R. Westmacott, R.A., G. G. Street, A.R.A., George Godwin, F.R.S., S. C. Hall, F.S.A., T. Hayter Lewis, F.S.A., Samuel Redgrave, C. F. Hancock, James Fahey, E. B. Stephens, J. H. Donaldson, G. Lucas, R. P. Spiers, P. H. Simpson, J. T. Tayler, E. J. Girardot, J. D. Crace, Harrison Weir, James Gumple, G. Trollope, F. P. Banaud, Walter Field, E. W. Wyon, E. A. Englefield, Henry Ashley, T. Roger Smith, and C. T. Hayward.

Prince Christian said it was a great pleasure to him to take the chair that day, as he hoped by so doing he was helping, in some slight degree, to promote the growing taste for fine arts. That taste for fine arts could not have a better means of cultivation than would be offered through these Annual Exhibitions, and they would show how closely artistic pursuits could be associated with the works of industry. There used to be an intimate alliance of art with industry, but this had been lost sight of in modern days, though characteristic of mediæval times and with the art producers of those times. What was aimed at in these Exhibitions was a revival of this wholesome alliance, and it was hoped by their means to encourage the cultivation of artistic talent in useful productions of every description. The history of art gave numerous instances showing that the greatest artists and the most illustrious men in the art ranks had not disdained to combine the useful with the beautiful. Michael Angelo was a sculptor, painter, and architect; so was Raphael. Leonardo da Vinci was an engineer, an architect, and an engraver, as well as a painter. Francia, also a painter, was besides a goldsmith and engraver on metals. Cellini was a goldsmith and sculptor; Holbein was an architect, painter, and designer; and Albert Durer was both a painter and engraver. These were a few out of many great examples, and these should stimulate people of our time to a cultivation of art.

Lieut.-Col. Scott, R.E., the secretary of her Majesty's Commissioners of 1851, then proceeded to make a state-

ment on a variety of details connected with the Exhibitions. He pointed out, by means of a model, the position of the Exhibition buildings now in course of erection on each side of the Horticultural Gardens, and with galleries abutting on the Exhibition-road and the Albert-road. The Exhibitions would differ in many respects from all other Exhibitions which had gone before, for whereas other Exhibitions had endeavoured to obtain as many objects as possible to exhibit, and had so increased that it had become a toil and confusion to visit them, these Exhibitions would only contain selected works—that was to say, works which had been adjudged by competent jurors, at home and abroad, to be worthy of exhibition. There would be a division of space for exhibited objects; British produce would have two-thirds of the space, in conjunction with such foreign objects as should be sent to be approved by judges appointed, while one-third the space would be set apart for those exhibitors who should obtain certificates for the admission of their objects from their respective governments. The exhibitors would not be at expense for show cases, and agents were to be appointed to take care of the goods. There were to be no prizes—the entrance being considered as a prize in itself, and as a proof of merit; and as regarded works of art, a fund would be provided for purchasing works, those works thereafter being so employed as to aid in art education. The jurors would not be required to make distinction as to their estimate of one work with another, but would only point out excellence in works, so that the invidiousness of comparison would be avoided. The catalogues would be printed in English, and any foreign country might produce a catalogue of its own. The objects exhibited would not be arranged by countries, but by classes. Colonel Scott proceeded to explain that there would be four divisions in the first Exhibition—that of May, 1871—the divisions being one of art in all its ramifications, one of manufactures, one of scientific inventions, and the last of horticulture.

Mr. Godwin said it might be desirable to hear something about the financial arrangements. By whom was the money to be found for the erections?

Lieut.-Col. Scott stated that the Commissioners of 1851 intended to take upon themselves the entire expense and responsibility. He presumed that it was within the limits of his duty to explain in what manner the Commissioners have become possessed of the means which would enable them to do this. They all knew that the Exhibition of 1851 left a considerable surplus in the hands of the Commissioners. That surplus they devoted to the purchase of the Kensington-gore estate; and the Museum now stood on a portion of the estate. They had leased the centre to the Horticultural Society, which had done good work, and was now entering upon a new phase. It was for a time beaten by its own success, but it was now collecting around it a great many men of great eminence, and in a few years' time that society would return again to its former position. If the society met with success it would pay a rental to the Commissioners, but, if not, it had no rental to pay. The Commissioners next gave a sufficient portion of their estate for the purposes of the 1862 Exhibition; and they had sub-let it to the government on the clear understanding that they intended to place upon it the natural history objects of the British Museum. That undertaking was still in abeyance. Whether they intended to put the museum there or not he could not say. The Commissioners sold it for one-half of its worth, to enable the Natural History Museum to be placed there. They gave the site of the Albert Hall and guaranteed £50,000 towards its expenses. The seats to be sold in the hall were of the value in all of £200,000, and seats to the value of £112,000 had been sold. They went on selling the seats very well until the panic arose two or three years ago; then there was a cessation in the application, and no demand had arisen since. But, in connection with the proposed Exhibitions, such facilities would be afforded to possessors of seats in the hall that as soon as they pointed out the advantages which would arise the sale would recommence, and that, he hoped, would put in the hands of the Commissioners £50,000 to be applied to science and art, but it would not be wanted for the purposes of the Exhibition. Lastly, finding themselves possessed of land of immense value—the property which was purchased twenty years ago had immensely increased in value—the outlying portions had been sold and returned money; relying upon the value of this property they thought they could not make a better use of the amounts at their disposal than by applying the money to the establishment of Annual International Exhibitions.

Mr. S. C. Hall, F.S.A., took it for granted that a fee of one shilling would be paid by the public, and that would go towards the expenses.

Colonel Scott said that whatever they got would be devoted to science and art. Their Charter of Incorporation provided that their means should be spent in that way.

Mr. H. Cole, C.B., ventured to hope that some gentleman would pick a hole or two in the proposed rules, in order that an opportunity might be afforded to members connected with the Exhibition to remove any misapprehension that might arise.

Mr. S. C. Hall expressed regret that there was not a more enlarged sphere for art manufactures. The limitation to carpets and pottery was somewhat of a mistake; and for one or two other useful branches he would like to have seen classes. There were only two strictly considered as manufactures, and he thought that there ought at least to have been three or four. He would not have made that objection had not Mr. Cole invited them to do so.

Mr. Richard Redgrave, R.A., said that an Exhibition of Fine Arts covered a great many industries. Whatever industry contributed a work which could be considered a specimen of high art would be represented. They by no means wished to limit the Exhibition to articles representing those two industries only.

Mr. Cole said he would recommend Mr. Hall to read a little red book, in which he would find, by way of example, a list of the different kinds of things that could be exhibited every year as objects of fine art. He saw a furniture maker in the room, and also several decorators who were accustomed to add fine art to objects of utility. Now if any gentleman thought fit to make art the chief feature, he could fairly expect to have his production exhibited. For instance, they might take a chair, and if they could make it an object of art, and not merely one of utility, then every year it might get admitted. Mr. Hall had referred to only two classes as being able to get acceptance. But there was nothing whatever to prevent the Munich or the Bavarian people, or indeed their own people, such as the manufacturers at Stourbridge, to present an object on glass, not merely as an object on glass, but as the finest engraving on glass; and supposing the quality was such as the judges appreciated, then that class might come in every year. The distinction he wiseed to lay down was just this, that articles of manufacture belonging to a particular class, would only come in once in seven years.

Professor Hayter Lewis, F.S.A., asked who the judges were who would have to determine on the admission of the articles sent. The names or the authority of the judges would be most important.

Mr. Cole apprehended that he might be permitted to answer that question, which he was sure he would not be asked ten days hence, by which time Professor Lewi would know how it was proposed, in a general way, to get at the judges. At the last meeting of the General Purposes Committee for the Exhibition, it was determined to form three committees, to consider the rules

by which the admission of objects should be governed. They hoped to get the two ex-presidents and the present President of the Architectural Society to consider how they would recommend the objects of art to be admitted. Then they would try to obtain the services of some painters with laymen, and some sculptors in connection with laymen to devise general rules. The desire of the Commissioners was to adopt the very newest mode of admitting things with the most infallible judgment if possible. In speaking of the officers of the Architectural Society, he referred to the head institution.

Mr. Hyde Clarke said there was one thing to which he might refer, and which had already been taken into consideration by the Society of Arts, that with regard to the conferring of prizes upon exhibitors in the ensuing Exhibition. This it was proposed to do in three ways, by a distinct offer of the gold medal of the Society in each of the several classes. That would embrace 16 classes; but beyond that a special fund would be formed for the purpose of purchasing works exhibited in the Exhibition, and afterwards using them for purposes of general education. The Council hoped to raise £5,000 as their contribution towards that purpose, and very likely more. With that example from the oldest society in connection with Exhibitions, it might be the means of stimulating other people to such a course of action as might very largely contribute to the funds at the disposal of Her Majesty's Commissioners.

The Lord Chancellor would be glad if some of those who were distinguished in art could give them any intimation of how far they might expect, on the part of those who were so distinguished, assistance in the great work they had in hand, whether by their sending themselves works of high art to form part of the Exhibition, or encouraging them either as a body like the Royal Academy, or as individuals encouraging the work in hand by disseminating the knowledge of what had been undertaken, and exercising an interest in the undertaking by sending works of art to the Exhibition.

Mr. Cole remarked that Mr. Millais was present, and he would like to know whether there was a possibility that next year he would send one of his pictures to the Exhibition.

Mr. J. S. Millais, R.A., in reply, said he was quite ready to promise that. There was a question in regard to the light of the gallery. He saw no difficulty with regard to the western side of the gallery, but the eastern side, which Colonel Scott said would be devoted to works of art, he could not see, without an explanation, how it could be satisfactorily lighted; because there was a blank wall upon the side abutting upon the Exhibition-road; and on the other side it must be lighted from the west, which would throw rays of sunlight upon the wall, which would not be advantageous to the paintings on exhibition. Would Colonel Scott explain how the light was to be arranged, and whether models would be submitted before the arrangements were completed. He thought that was an important thing with regard to sending works of art.

Lieut.-Col. Scott said he would be very glad indeed —the work was entrusted to his charge—of Mr. Millais's assistance in regard to the arrangement of the galleries. But Mr. Millais had rather been judging from what he had seen on the ground at present, than from what he had explained would really be the case. The galleries would all be top-lighted. He stated that the galleries would be lighted in the same way as the galleries were lighted in 1862, and it was generally allowed that they were the most successful that had ever been built.

Mr. Millais—Certainly. There was no doubt of it.

Mr. R. Redgrave, in the absence of their President, thought he might be allowed to say a word. Although no member of the Academy could pledge the Academy, yet he felt sure they would do all they could to help the Exhibition. It was to be remembered that the Exhibition looked forward to a different development of art to that which was commonly expected at the Academy. He was quite aware there was to be a pictorial Exhibition, quite apart from the specimens of manufactured art, but there would be an endeavour to link the art to purposes of real utility. The Exhibition would be very valuable, he thought, in stimulating some artists to prepare works of a character not purchasable by individuals at present, which would show that England really was prepared to work on a different scale and in a different manner to what had hitherto taken place; and many members of the Academy would be anxious to co-operate in that view, and show works of a different character to those exhibited at the Academy. At the same time, it must be remembered that the Academy had rooms of its own and large space to fill; and while there was a desire on the part of all of them to assist the Exhibition, yet outsiders must be looked to, who should make a strong push to support the Exhibition. Knowing the value of works of art being placed in juxtaposition with their own, they might be stimulated to range themselves side by side with artists of other nations. There was to be no absolute division, and therefore there would be an opportunity of seeing their own work placed side by side with the works of another country, and the result might be to get them out of the habit of working in any particular mode because it was English, and perhaps reject the better mode of working belonging to a foreign country. The Academy would be most anxious to co-operate and advance the arts by placing them in such juxtaposition. He thought he might say, in the absence of their President, that there would be an endeavour to aid the great Exhibition in the purposes it had at heart. He hoped that some sculptors present would express their views.

Mr. G. Godwin, F.R.S., asked as to the construction of the juries. He was quite sure the works to be submitted would depend very materially upon the nature of the juries. Colonel Scott had said in his address that manufacturers and artists sending works would no longer be subject to the expression of opinion by small bodies, but would be rewarded by the estimation of the whole country; but Colonel Scott forgot for the moment that an opinion would have to be passed, and the new jury would have a much greater power than the jurors of previous exhibitions. As he understood it, the reward to artists and manufacturers would be the admittance to the Exhibition, and that would depend upon the proper exercise of knowledge on the part of the jurors; therefore he thought it would be well to state the means which were to be adopted in apointing the jurors.

Mr. R. Westmacott, R.A., said, not being a practising sculptor, he had hesitated to rise, but as an old member of the Academy, he had risen to express his belief that no institution which had at heart the advancement of the taste of the country, would ever find the Royal Academy, collectively or individually, indisposed to assist so desirable an object. There were sculptors present, and he had hoped they would speak on the occasion. They were young enough and active enough to contribute; and as an old hand, he had taken the liberty of answering for others, that their object was to advance what had been set before them, and to co-operate in every way with societies that had so desirable an object in view.

Mr. James Fahey, Secretary of the Institute of Painters in Water-colours, felt great pleasure at having the opportunity of expressing the opinion that he had been able to form of the working of the meeting. He had received a communication on the subject, which stated that any observation the Society he represented might deem it proper to make, would be welcome. In reply he did make a suggestion, and he

had great pleasure in seeing that the recommendation had been carried out. The part he drew particular attention to was Clause 6, that no work previously exhibited could be admitted. There could be no objection to that, and the only observation he made was that it would withdraw from the undertaking the support of all the artists and members of any society now established. It had been said by a member of the Academy that they must provide for their own walls, and it was in that sense that he wished to draw the attention of the committee to that resolution. He begged to express the very great satisfaction he had in seeing that clause had been altered so as to meet every requirement that could be wished. It was now Clause 2, and read thus:—"No artist can be allowed to exhibit more than two works of each kind, one of which, at least, must not, except under special conditions, have been previously exhibited in London, but he may send works of as many different kinds as he pleases, thus the same artist may send for admission two oil paintings, two water-colour paintings, two paintings on enamel, porcelain, &c., also two sculptures in marble, two in wood, &c." There was only one other matter to which he desired to call attention, and that was in Clause 4, "the works of deceased artists are not admissible, except as copies or reproductions." He would suggest whether the committee might think necessary to alter that clause a little, to give a year after the artist's death, or in the exhibition following his death.

Mr. R. Redgrave observed that that was the rule in the Royal Academy. That the year following an artist's death one of his works might be exhibited.

Mr. Harrison Weir asked whether engravings would be exhibited by the engraver or the artist drawing upon the wood, or whether it would be exhibited by the artist or the engraver alone, or did the exhibition comprehend wood engraving.

Mr. S. C. Hall took the liberty of suggesting that it would be better to enlarge the rule, rather than confine it to pictures not exhibited before. There were so many private dealers, so many exhibitions, and so great a necessity for artists keeping up their reputation by exhibiting, that if the rule was stringent they would have a very limited exhibition of pictures. There would in a fortnight or three weeks be eighteen exhibitions opened in London—he included the private dealers who had annual exhibitions—and, therefore, he hoped Col. Scott and the committee would not be too strict in the demands of pictures never exhibited before. They might have a good many third or fourth class pictures, but of works by the better masters they would have very few. In the month of May they would all be preparing for the annual exhibitions, and would put forth their strength there, and societies would be very jealous of such a regulation as that proposed by the promoters of the Exhibition. He would put the question to Mr. Fahey, whether he would like to see two or three painters of the Artists' Institute sending their best pictures to South Kensington—would it not weaken very materially their own institute? Why not go back to some three, four, or five years, and admit pictures that had not been exhibited within that period. He understood that one picture exhibited before would be admitted with one not exhibited previously, and that would perhaps meet the difficulty.

Lieut.-Col. Scott said that was the case.

Mr. S. C. Hall then proceeded to comment upon the rule respecting the works of deceased artists, and observed that in the past two years they had lost some distinguished painters, and by the rule laid down, their works would be excluded from exhibition. There were many foreign artists whose works would be excluded for the same cause, and the effect would be a very limited exhibition.

Sir F. Sandford called attention to rule 5—"All works of art, except reproductions of ancient and mediæval works, must have been executed since 1862." The words "all works of art," were very elastic, and would allow of the directors making them more elastic if they found a strict interpretation would make the Exhibition unattractive.

Mr. J. S. Millais asked whether the commission intended insuring works of great value lent to the Exhibition. There were many gentlemen who possessed works of great value, and who would not lend them unless they were insured. In the case of the Exhibition in Scotland, they obtained works with difficulty, and then only under certain conditions as to insuring them against fire. No doubt the new building would be most safe, still there was the objection on the part of collectors, and it was only right that they should be protected when out of their possession.

Mr. Cole said the great purpose of the Exhibition was that the producer should be the exhibitor rather than proprietor. An artist might desire to exhibit a work which he had sold, which he was accustomed to do at the Royal Academy. He had no doubt that Mr. Millais could not let him have any one of his six beautiful works which he was good enough to allow him (Mr. Cole) to see, as they were already the property of someone else. Mr. Millais was allowed to exhibit them, doubtless, but he did not know whether the Royal Academy paid the insurance. At any rate, what happened at the Royal Academy might happen also at Kensington. Speaking of the institution he was connected with—South Kensington—they left the full responsibility upon the proprietors, and they had very little if any difficulty, as he was happy to say they had never had any accidents; the question was never put to them, "Will you insure?" In fact, they must say to exhibitors, "You must have confidence; we do not insure." He expected that in most cases the two pictures an artist would send would be under pretty much the same conditions as those sent to the Royal Academy; most of the pictures, he hoped, would be sold before they came to them.

Mr. Stephens observed that Mr. Hall had hit the point which raised a difficulty. If they wished well to the Exhibition, they must hope for some change in the rule. In the first place, it would be limiting the works in stating that one work must be one never before exhibited. If artists were to come into competition, they must send the best work of the current year or the past year. The Academy, or some other institution, would therefore be deprived of their best work. But if an artist was content to send works of an inferior character, he would not do justice to himself. Some few years ago, he was connected with a committee at South Kensington, of which Mr. Redgrave was also a member, and he then asked for an exhibition of sculpture, all the works having been previously exhibited; and the argument used was that, if they started an exhibition to come into competition with the Royal Academy or the British Institution, they must fail, because a sculptor would send to that exhibition to which he had been accustomed. That was a point which was serious, and ought to be carefully considered in the new Exhibition. He was afraid his friends would be better disposed to the proposed Exhibition provided it were stated that no works should be sent there but what had been previously exhibited. By adopting such a rule as that, they would do away with a jury to decide upon a work, except as to applications for space, and it would still enable the existing institutions to receive the best works for the current year. If it had been an Exhibition of decorative art specially, it would have been much more generally useful to the country. He thought the whole strength or weakness of the Exhibition would depend upon the second clause.

Sir F. Sandford said if they were limited to works which had been already exhibited in London, there was a large class of works brought out every year, which

had not been admitted into exhibitions, and had no means of getting there, all of which would be shut out. He trusted they might do something in the course of next year, if not to do away with some injustice, at least to give persons who desired to send works not exhibited in London the opportunity of doing so.

Mr. J. Bell remarked that there was one class of works to which he wished to allude, and which he hoped might gain admission to the Exhibitions. It was a rule of the Royal Academy that sculpture was not to be protected by glass. Perhaps that regulation was founded upon good reasons, but those reasons would not attach to the International Exhibitions. Therefore, he hoped that the Commissioners would let in a special class of sculpture which had not yet found place in any of the exhibitions or public exhibitions in London. There were very many things that people would be inclined to send in sculpture, very fine, delicate works, if they were glazed. If such a rule was put forth, they would get a class of sculpture never exhibited before, certainly not in the Royal Academy.

Mr. R. Westmacott hoped that the observations which had been made would lead to beneficial results. It struck him that a little too much stress perhaps had been laid upon the Exhibition part of the scheme. Mr. Hall had told them that, in a fortnight or less, they would have eighteen exhibitions of modern works. The announcement was perfectly astounding. He did not think there was one-half that number. It was a very curious and important fact, and it only showed that nobody could justly say there was no encouragement of art, because art would not be reproduced unless encouraged in some way. It was a matter of demand and supply. The great object of the Committee was the same as the Royal Academy—to get the best works they could. So far the Exhibition of works was private, but the great object of their meeting there was one of paramount importance, as they must not refuse to look the fact in the face that England was very deficient in taste, and what they wanted to produce was that sort of excitement which would lead to a great amelioration in taste generally. During the last 100 years—for their Academy was modern compared to others—the country need not be ashamed of the work done, but be proud that they had made, in matters of taste, so great an advance. But there was a time when it was considered absolutely impossible to employ an English artist, and they went abroad and employed Rubiliac and others. With Flaxman taste began to revive, and from that time, in sculpture, architecture, and engraving, they had made great advances, and they were holding their own against all others. When Englishmen were put upon their mettle they stuck to their colours, and although slow in coming to a conclusion they did themselves and their country honour, and why they should fail in art he did not know. But they must remember, as a celebrated French writer had said, "all trade is art." He was sorry to say, a great deal of that art was trade in this country, but as it was so, and must be so, they must endeavour to throw art into trade, and that they might do by making those efforts which it was the object of that Society to push forward. As an exhibition, the forthcoming Exhibition would not shine very pre-eminently. Artists had to meet their obligations to other societies, and they also had to consider the views of their employers, who might not be indisposed to let pictures be exhibited at the Royal Academy, but who would not care to have them carried into every institution that happened to be established; and he believed that that would very materially influence not only the numbers but the quality of the works sent to the new Exhibition. What he hoped would be impressed upon the public was, that these Exhibitions would carry out what the Society of Arts and the institution of South Kensington had been long desirous to do, and which his Royal Highness the Prince Consort was anxious should be done. Indeed, he had a great deal of conversation with him upon the point; and he held that the great object of the present day should be to carry out an Exhibition of art as applied to useful objects, which would improve and induce improvement throughout the country. This would be a desideratum. It was not possible to walk from there into the city of London, and see one of the finest outlines, that of St. Paul's Cathedral, hidden by that detestable bridge at the foot of Ludgate-hill without a feeling of shame. But it was not the only instance they had in London; wherever there was a public building erected, the same want of taste was to be seen in the neighbourhood. There was the utmost difficulty in London to get an outline not offensive to good taste. They had a committee sitting there, whose object was to put something like better taste into the people for the future, but for the present all they could do was to look at the spoiled outlines, and groan under them until they fell down. He did not want to make a joke of it, but there was an opening in the proposed Exhibitions for improving the taste of the country. He hoped that that would be the ruling idea in the minds of all who had anything to do with the Exhibitions; and they must also remember that the object of the meeting was not to do what the Royal Academy was doing, but to assist in improving the taste of the people. This could be done by letting them see good works instead of bad works; and there was an enjoyment in beauty not a mere fancy, not because people had fancies or tastes, but there was an enjoyment in beauty because of itself. As Plato had said in his terse way, the beautiful and the good went together; and they must always impress that upon people. It was the conjunction that was absolute, that was that the good was impressed by the beautiful, and the beautiful was the good, and they should enjoy whatever they saw tenfold by seeing it put into a form beautiful to their senses. He believed such an Exhibition as that they were then met to promote would do what was required if they only put their shoulders to the wheel. He would not do more than refer to the question of judges, which Mr. Goodwin referred to, and he simply said the solution of the difficulty was a serious thing. There were many artists who would not send contributions unless they were satisfied as to the tribunal. Even the best artists now did not like the work—it was a difficult thing in the Academy; few knew what a painful, responsible, delicate thing it was to judge other men's works. As to insuring works, that would be impossible; it was not done anywhere. The other day he heard of a large insurance, for five or six days only, being effected upon a picture simply to cover the risk of sending it to an auction room, and keeping it safe until it was sold. So that proprietors themselves should be the persons upon whom the tax should fall. The tax would be a very slight one, a few shillings in the £100—not a great tax upon anyone. He had been asked to propose the following resolution:—"That this meeting, after having had explained to them the intended International Exhibition, so far as it relates to the section of fine arts, desires to cordially co-operate in carrying out the plans proposed to them."

Mr. S. C. Hall seconded the resolution. He very cordially agreed with what Mr. Westmacott had said. He hoped he should live long enough to give a very cordial support to the Exhibition when it opened. Of course he should, as he had done for many years, produce an illustrated catalogue of the best articles in the Exhibition. He hoped to see all the suggestions carried out to improve the public taste.

The motion was passed.

The Lord Chancellor said he had the honour to be present on the occasion simply as a member of the Society of Arts, a society, on the Council of which he had been placed for some years; and he only regretted that of late his duties elsewhere had so seldom permitted him to attend its meetings. He particularly

regretted that he could not be present on Monday, but he was glad to be able to be there that day. While the Society could never forget having deeply interested itself in the promotion of art, it remembered most gratefully that its efforts would have been of no avail, if the impulse and direction of those great undertakings which had now recommended themselves to all parts of Europe, had not been given in the first instance by the illustrious Prince whose memory they all revered, whom they were not likely to forget at any time, but whom they were more likely to remember when they found those connected with him by the closer ties of affection actively engaged in following in that career to which he directed them. When they remembered that he who was nearest to the Throne, together witn their chairman upon that occasion, so closely connected with the Royal family, were taking a part in aiding their discussions and assisting them in their judgment, they could not but feel a thrill of pleasure. Prince Christian had pointed out to-day the union which subsisted of old between art of the highest character and its application to the comforts of life; and he might be permitted to mention that it was stated to him, at the Exhibition of 1862, by a well-known Frenchman, a large employer of labour, and celebrated for his promotion of art and his kindness to those in his employ, and who had known England well in 1851, that he was struck with wonder at the great development which had taken place in their taste in the period of eleven years. He asked the Frenchman whether he attributed the improvement to the prevalence of foreign artists amongst them, and he replied, "No; but to the stimulus given by the Exhibition of 1851, and to the schools of design which had been established throughout the country." And in saying that he showed how closely connected was the art of design and the higher branches of art in the cultivation of taste, and its applications to the comforts of life. He trusted that the meeting would inaugurate a new and glorious career for England in this respect. It was a great satisfaction to them that their President upon that occasion was able and willing to preside and take part in the meeting. They desired to tender to him their cordial thanks for having so courteously and kindly come forward to urge them on in the career set before them, and he hoped the Prince and other members of his illustrious house would continue to assist in the promotion of the objects they had met to advance.

The motion was carried with acclamation.

Prince Christian said: Lord Hatherley, I beg to thank you most sincerely for the kind terms in which you have expressed yourself regarding myself. I can only say, as I said before, that it has given me great pleasure to preside over this meeting, which I wish I could have done more efficiently. However, what particularly gives me great pleasure to do so has been the hope that, in a very modest way, I am carrying out, in some degree at least, the wish of the illustrious Prince Consort, as the Lord Chancellor has just mentioned; and I think we cannot carry out his wish in any better way than by applying all our energies in promoting those exhibitions which we have now in hand.

The Conference then terminated.

The Commissioners request the publication of the following, which has been sent to the *Times* and other journals:—

Upper Kensington-gore, W., 6th April, 1870.

Sir,—I notice in your paper of this date a telegram to the following effect:—

"Brussels, April 5th, evening.

"The *Independance Belge* of this evening announces that the Commission appointed to organise the display of specimens of Belgian handicraft at the London Exhibition of 1871, have abandoned the idea of having Belgium represented."

I have only this morning received a letter of yesterday's date from M. T'Kint de Nacyer, informing me that a Commission has been formed for Belgium, of which His Royal Highness the Count of Flanders has been named honorary president. It is, therefore, evident that the telegram is incorrect. I beg to enclose a copy of the letter, and shall feel much obliged if you will have the kindness to insert it in your paper.

I am, Sir, your obedient servant,
Henry Y. D. Scott, Lieut.-Col., R.E.,
Secretary to Her Majesty's
Commissioners.

(Copy.)

Bruxelles, le 5 Avril, 1871 (1 Rue Latérale).

Messieurs,—Nous avons l'honneur de vous informer qu'un arrêté royal, en date du 16 mars dernier, dont vous trouverez ci-joint un exemplaire, nous a confié la mission d'organiser et de diriger la participation des artistes, des industriels, des horticulteurs, etc., à l'Exposition Internationale qui aura lieu à Londres en 1871, et qui est placée sous votre haute direction.

Installée par M. le Ministre de l'Intérieur, le 28 mars dernier, la Commission belge a composé son bureau de la manière suivante:—

Président—M. T'Kint de Naeyer, sénateur.

Vice-présidents—MM. de Cannart d'Hamale, sénateur; Sainctelette, membre de la Chambre des Représentants; et De Keyser, directeur de l'Académie Royale des Beaux-Arts d'Anvers.

Secrétaire—M. J. Clerfeyt, secrétaire du Conseil Supérieur de l'Industrie et du Commerce.

Son Altesse Royale Monseigneur le Comte de Flandre, frère de Notre Souverain, a bien voulu accepter la présidence d'honneur de la Commission belge, et donner ainsi une marque du haut et vif intérêt qu'il porte à la réussite de l'œuvre internationale á laquelle nous avons été associés.

Nous nous félicitons pour notre part, Messieurs, de l'occasion qui nous est offerte d'entrer avec vous dans des rapports qui nous permettront, espérons-nous, de seconder vos intentions et vos vues, dont le succès nous paraît d'ailleurs assuré, en raison même de la large part que vous avez prise à l'initiative et à la réussite des grands concours internationaux de 1851 et 1862.

Veuillez agréer, Messieurs, l'assurance de notre considération la plus distinguée.

Le Président, T'Kint de Naeyer,
Le membre Secrétaire, J. Clerfeyt.

A Messieurs les Commissaires Britanniques
de l'Exposition Internationale de Londres en 1871.

PROCEEDINGS OF THE SOCIETY.

INDIA COMMITTEE.

A Conference on the subject of "The Through Route to India," was held on Friday evening, April 1st. The chair was taken by W. Maitland, Esq., late President of the Calcutta Chamber of Commerce, and the Conference was opened by Mr. Hyde Clarke.

METROPOLITAN PUBLIC WORKS AND BUILDINGS COMMITTEE.

This Committee met on Friday, April 1. Present:—Lord Elcho, M.P., in the chair; Lord de L'Isle, Sir W. Bodkin (Assistant-Judge), Messrs. Hyde Clarke, H. Cole, C.B., the Hon. Dudley Fortescue, M.P., Colonel Du Cane, R.E., W. H. Gregory, M.P., C. F. Hayward, R. Westmacott, R.A., &c.

Having read the minute appointing this Com-

mittee, viz., "to confer with the Chief Commissioner of Works, the Lord Mayor of London, and the Chairman of the Metropolitan Board of Works, with a view of establishing such harmonious action between the several authorities they represent as may prevent the creation of public or quasi-buildings which may disfigure the metropolis :"—

It was resolved that the Right Hon. W. Cowper-Temple, M.P., be requested to take the chairmanship of this Committee.

It was further resolved, that letters be written to the Lord Mayor and to the Chairman of the Metropolitan Board of Works, requesting the appointment of an early day in May next, for receiving a deputation from this Committee.

Lord Elcho laid before the Committee the following notice of motion, given by him in the House of Commons, and the same was ordered to be entered in the minutes :—

"That no general control over works and buildings in the metropolis, constructed under Parliamentary sanction, being at present invested in any government or public officer or department, other than that now exercised by departments of government over the buildings that are under their superintendence, and the design and execution of unsightly works, such as the Charing-cross Railway-station and the railway bridges across the streets and roadways of the metropolis, as well as the juxta-position of the London, Chatham, and Dover Railway-bridge and the new Blackfriars-bridge across the Thames, being reasonably attributable to the fact that railway, gas, water, and other public companies or chartered bodies have not been hitherto required to deposit any designs, elevations, or models of projected works or buildings when applying for Parliamentary powers; it is the opinion of this House that, having regard to the improvement of the metropolis, and as a security against its further disfigurement, it is desirable that whenever any public company or corporate body applies for Parliamentary powers to enable it to execute any works, or erect any buildings in the metropolis, or to raise money for the execution or erection of such works or buildings, it should, as recommended by the Thames Embankment Committee of last session, before coming to Parliament, deposit at the Office of the Commissioners of her Majesty's Works and Public Buildings, plans and elevations, designs or models, in like manner as railway companies are now obliged to deposit plans and sections at the Board of Trade, and that the Standing Orders be amended so as to effect this object. And it is further the opinion of this House that the First Commissioner of Works should, as also recommended by the same committee, report to Parliament on such plans and elevations, designs, or models, and that such reports should be referred to the Committees on Private Bills, in the same manner as the reports from the Board of Trade and Admiralty are now referred, and that they be also laid before both Houses of Parliament along with the plans and elevations, designs, or models on which they are based."

CONFERENCE.

On Thursday, March 31st, a Conference was held, on "The Relation of the State to Science." Lord Henry Lennox, M.P., Chairman of Council, presided.

Lieut.-Col. A. Strange, F.R.S., said before reading his paper, he wished to state shortly the circumstances under which he had been led to take a somewhat prominent part in this question. The greater part of his life had been spent in India, and during the last 13 years of his residence there he was a member of the great Trigonometrical Survey. He had always been interested in scientific investigation, and he had often to lament the total absence in India of means and appliances for carrying on such investigations. He had looked forward, however, confidently to his return to England, as a time when he would be able, with superior means at his disposal, to carry out many ideas which had long been uppermost in his mind. He returned to England about ten years ago, and shortly afterwards, as a juror in class Scientific Instruments of the International Exhibition of 1862, made the acquaintance of a great many scientific men, both Englishmen and foreigners, but to his great disappointment, he found that those scientific appliances which he had expected to find so abundant were to a great extent wanting. He found that, in many branches of science, investigators laboured under very great difficulties, and that in many foreign countries the facilities afforded were much greater. From that time the subject had constantly occupied his mind, and he had frequently endeavoured to prevail upon men of science to undertake the agitation of the question, but without success, as there has always been a disinclination which could not be overcome. Shortly before the meeting of the British Association, in 1868, in talking this matter over with a friend, Dr. Mann, who had had considerable experience in connection with that Association, he was strongly urged by him to read a paper before that body, in the hope of provoking discussion upon the matter. He took his advice, and that formed the origin of the movement which they were now assembled to discuss. He wished to acknowledge the great assistance which he had always received from Dr. Mann.

The Paper read was—

ON THE PROPOSED INQUIRY, BY A ROYAL COMMISSION, INTO THE RELATIONS OF THE STATE TO SCIENCE.

By Lieut.-Colonel A. Strange, F.R.S.

The remarks which I am about to offer have been prepared in compliance with the desire of the Council of the Society of Arts, that I would write a paper, for the purpose of opening the discussion for which this Conference is convened. I felt bound to undertake the honourable task thus imposed upon me, whilst regretting it had not fallen into abler hands.

I believe I shall best carry out the wishes of the Council, first, by describing the present position of the question; and, secondly, by suggesting the points connected with it on which discussion, at this moment, seems most desirable.

The movement for an inquiry into the state of science in England originated in a paper read by me at the meeting of the British Association at Norwich, in 1868. This led to the appointment of a Committee to inquire into and report to the Association on the two following questions :—

"1. Does there exist in the United Kingdom of Great Britain and Ireland sufficient provision for the vigorous prosecution of physical research?

"2. If not, what further provision is needed? and what measures should be taken to secure it?"

I had the honour of being chairman of this Committee, which contained the names of some of our most distinguished men in every branch of science. At that period, I hoped it might be possible to arrive at some definite conception of what was wanted to place science on a satisfactory footing. But the discussions of the Committee, and the character of the correspondence which came before it from the various persons whom we consulted, convinced me that the attempt to do this must fail. I felt it, however, my duty

to submit to the Committee an outline of the arrangements which I myself thought desirable; but I did not urge the adoption of my views. On the contrary, I was the first to advise that, instead of laying before the Association a definite scheme, we should recommend that body to ask the government for a Royal Commission to investigate the whole subject. My proposal was at once adopted by the Committee, in the form of the following report:—

"Your Committee, having sought the counsel of many of the most eminent men of science of the United Kingdom upon these questions, so far as it was found practicable to do so, and having carefully deliberated thereon, have arrived at the following conclusions:—

"1. That the provision now existing in the United Kingdom of Great Britain and Ireland is far from sufficient for the vigorous prosecution of physical research.

"2. It is universally admitted that scientific investigation is productive of enormous advantages to the community at large; but these advantages cannot be duly reaped without largely extending and systematising physical research. Though of opinion that greatly increased facilities are undoubtedly required, your Committee do not consider it expedient that they should attempt to define categorically how these facilities should be provided, for the following reason:—

"Any scheme of scientific extension should be based on a full and accurate knowledge of the amount of aid now given to science, of the sources from which that aid is derived, and of the functions performed by individuals and institutions receiving such aid. Your Committee have found it impossible, with the means and powers at their command, to acquire this knowledge. A formal inquiry, including the inspection of records to which your Committee have not access, and the examination of witnesses whom they are not empowered to summon, alone can elicit the information that is required; and, as the whole question of the relation of the State to science, at present in a very unsettled and unsatisfactory position, is involved, they urge that a Royal Commission alone is competent to deal with the subject.

"Your Committee hold that this inquiry is of a character sufficiently important to the nation, and sufficiently wide in its scope, to demand the use of the most ample and most powerful machinery that can be brought to bear upon it.

"Your Committee, therefore, submit, as the substance of their report, the recommendation that the full influence of the British Association for the Advancement of Science should at once be exerted to obtain the appointment of a Royal Commission, to consider—

"1. The character and value of existing institutions and facilities for scientific investigation, and the amount of time and money devoted to such purposes.

"2. What modifications or augmentations of the means and facilities that are at present available for the maintenance and extension of science are requisite; and,

"3. In what manner these can be best supplied."

This report was presented to the British Association, at its last year's meeting at Exeter, and after receiving the approval of the various Committees to which such matters are always submitted, it was referred to the Council "for consideration and action if it seem desirable."

The Council appointed a Sub-committee of its own body further to inquire into the proposal of a Royal Commission. The same Sub-committee was also instructed to advise the Council on another question, submitted at the Exeter meeting, by Professor Williamson and Dr. W. H. Miller, in the following terms:—

"That the Council be requested to ascertain whether the action of government, in relation to the higher scientific education, has been in accordance with the principles of impartiality which were understood to guide them in this matter; and to consider whether that action has been well calculated to utilise and develop the resources of the country for this end, and to favour the free development of the higher scientific education. That the Council be requested to take such measures as may appear to them best calculated to carry out the conclusions to which they may be led by these inquiries and deliberations."

Up to that moment, the two questions of scientific research and the higher scientific education, originating in different sources, had been quite distinct. When both, however, came before one and the same sub-committee of the Council, it was judged convenient that they should be considered together, and form the subject of a single report to the Council. The following was the report agreed to:—

"A meeting of this Committee was held, at which the following members were present, viz.:—Professor Huxley, Professor Williamson, Colonel Strange, Professor W. A. Miller, Mr. G. Busk, Mr. Francis Galton, Mr. Spottiswoode, Professor Hirst, Dr. T. Thomson, and Mr. Griffith. Its first act was to secure the accession of Dr. Hooker and Professor Tyndall.

"It was ascertained that the first of these resolutions originated from a Committee appointed at the meeting of the Association at Norwich, in 1868, 'for the purpose of inquiring into, and of reporting to the British Association the opinion at which they may arrive concerning the following questions:—

"'1. Does there exist in the United Kingdom of Great Britain and Ireland sufficient provision for the vigorous prosecution of physical research?

"'2. If not, what further provision is needed; and what measures should be taken to secure it?

In the report of this Committee, presented to the Association at Exeter, it is stated:—

"'That the provision now existing in the United Kingdom of Great Britain and Ireland is far from sufficient for the vigorous prosecution of physical research..... Any scheme of scientific extension should be based on a full and accurate knowledge of the amount of aid now given to science, of the sources from which that aid is derived, and of the functions performed by individuals and institutions receiving such aid. Your Committee have found it impossible, with the means and powers at their command, to acquire this knowledge. A formal inquiry, including the inspection of records to which your Committee have not access, and the examination of witnesses whom they are not empowered to summon, alone can elicit the information that is required; and, as the whole question of the relation of the State to science, at present in a very unsettled and unsatisfactory position, is involved, they urge that a Royal Commission alone is competent to deal with the subject.'

"After duly considering this statement, and having deliberated on the whole question, the following resolutions were passed:—

"1. That this Committee is of opinion that it is desirable that a Royal Commission be appointed, to inquire into the relations of the State to scientific instruction and investigation.

"2. That no inquiry will be complete which does not include the action of the State in relation to scientific education, and the effects of that action upon independent educational institutions."

This report was adopted unanimously by the Council, who resolved that the Lord President be solicited to receive the Council, as a deputation from the British Association, to urge upon the government the issuing of a Royal Commission to inquire into "the relations of the State to science."

The deputation was accordingly received by Earl de Grey, on the 4th of February last. The proceedings which took place on that occasion having been fully reported in the leading London newspapers, I need not here narrate them.

It has since been publicly announced that the government intend to advise her Majesty to issue the Royal Commission asked for by the British Association.

The foregoing brief narrative shows that the question has passed through three distinct stages. In the first stage, my original paper, and the instructions to the Committee to which it led, indicated the idea that government should be called on to take specific action, by founding institutions or otherwise, for advancing scientific investigation. In the second stage, it was proposed that government should be asked to institute an inquiry by a Royal Commission, before taking any such specific action. In the third stage, the government was asked to include in this inquiry not only the question of scientific investigation, but also that of the "higher scientific education."

I believe that my original paper has led to the belief that I am an advocate for the immediate organisation of extensive and costly institutions for scientific research, apart from scientific teaching of any kind, a belief which has caused me to be looked upon, in some quarters, as a rather dangerous character. I am glad to have this opportunity, the first that has been afforded me, of stating that though such were certainly the views indicated in my paper, I long since modified them considerably. Before the examination of the question had made much progress, I saw that it was absolutely necessary that a full and formal inquiry should precede any State action whatever, and, as I have already said, a Royal Commission for that purpose was first proposed by myself. Further reflection on the subject has convinced me that no action taken by the government can be either beneficial to the interests of science or just to the community at large, unless it be based on an exhaustive examination of the two main questions, What is now done, and what should be done, by the State to promote scientific progress? I may also observe that, though I did not originally propose for solution any question connected with scientific teaching, I subsequently assented to the coupling of "the higher scientific education" with the question of investigation, and I am still of opinion that both questions require equal consideration.

One other personal explanation I am bound to make. It may be imagined that, as a member of the Council of the British Association, actively engaged in this movement, I am on the present occasion to be considered as, in some way or other, the mouthpiece of that body. I wish to say that such is not the case. The British Association has fulfilled its part in bringing the matter before the government. The Society of Arts desire to supplement the action of the British Association, and have asked me, as an individual, to join them in so doing. I now, therefore, speak strictly in my individual capacity, and am personally responsible for whatever statements and opinions I shall lay before you. At the same time, I should say that I heartily approve of the course taken by the British Association, and that I hope I shall do nothing that can be in the remotest degree embarrassing to that body.

I regret to have occupied so much time with these preliminary observations, but they appear to be required, in order to present the matter in a clear light to those who may not be aware of the position in which the question before us now stands. Assuming that a Royal Commission will be issued, I will now venture to lay before you the questions which, at the present epoch, seem fit topics of discussion in connection with the expected inquiry. These are:—

1. The scope which the inquiry should include.
2. Some of the probable results of the inquiry.
3. The constitution of the Commission itself.

1. *The Scope of the Inquiry.*—The first thing to do will certainly be to take stock of what is now done by the State for advancing science. A reference to the Parliamentary votes shows a considerable expenditure on science, in some form or other. The British Museum receives upwards of £100,000 a-year, the South Kensington Museum £92,000, and the Science and Art Schools £74,000, but in these cases a large proportion goes to art, not wholly to science.* The Royal Observatories of Greenwich, Edinburgh, and the Cape of Good Hope, the Royal School of Mines, the Ordnance Survey, the Hydrographic Department of the Admiralty, are all scientific branches of the administration, supported by the State at considerable cost. Enormous sums of money have been spent on special inquiries of a scientific character, such as those on armour-plate structures, ordnance, ammunition, small arms, explosive agents, and projectiles. The Parliamentary votes show also £10,000 a-year as given for meteorological observations. We also find a large number of small sums, forming, however, a considerable aggregate amount, given in aid of the funds of various colleges, universities, and museums; in some instances towards the salaries of specified professors, in others towards general purposes. The Royal Garden of Kew receives £22,075; the Botanical Gardens of Dublin and Edinburgh receive respectively £1,931 and £1,893; £20,900 is spent on geological, and £92,790 on the Hydrographic Department and naval surveys, besides very large sums on other miscellaneous objects.† Some of the institutions above named issue reports, from which the results of the expenditure on them may be inferred. In other cases this is not done. The wording of the votes seldom conveys any useful information on the subject whatever, and sometimes conveys incorrect information. The grant of £1,000 a-year distributed by the Royal Society is an example of such inaccuracy. This is said, in the words of the vote, to be given to the Royal Society "to enable the society to carry on certain experiments for public objects," whereas, instead of being given, as here stated, exclusively to the Royal Society, or for public objects, it is given to the community at large, and a committee of the Royal Society undertakes gratuitously the very laborious task—which does not even receive nominal acknowledgment—of distributing it with the strictest economy and impartiality, to such persons, whether belonging to the Royal Society or not, as may prove their ability to make good use of the aid they solicit in prosecuting scientific research.

Now, the results supposed to be obtained by the large expenditure recorded in the estimates may be thus enumerated:—(1). The maintenance of the efficiency of the public services in matters of a scientific nature. (2). The teaching of science, directly, as by payment of professors, or indirectly, as by the maintenance of museums, botanical gardens, and the like. And (3), direct or indirect scientific progress, whether observational or experimental. What is wanted is, a clear statement of the degree in which these several results are attained in each particular case. With this information before us, we shall be in a position to arrive at trustworthy conclusions as to whether the money brings in each case an adequate return; whether the inadequacy of the return is due to defective organisation or to abuse; and whether, therefore, a more satisfactory result may not be obtainable in each case by a process of remodelling, without increased expenditure. We shall also ascertain, probably, that the whole expenditure in some particular case is needless, and is at present absolutely wasted. We shall learn, too, no doubt, that there is much divided, and probably much utterly undefined, responsibility in many of the cases in which large sums of public money are spent. Another fact, already patent, will be brought out prominently, namely, the entire absence of any pervading system by which the expenditure on scientific objects is regulated. Finally, it will

* The total amount voted in the Estimates, for 1869-70, to maintain the "Science and Art Department of the United Kingdom" was £225,254.

† The amounts above given are quoted from the Civil Service Estimates for 1869-70, those for the present year not having yet been published.

clearly appear that the expenditure is very partially distributed, some branches of science receiving a very large amount of assistance from the public purse, whilst others, of equal importance to the community, receive none at all. This taking stock of our present scientific arrangements, it can hardly be doubted, is an absolute necessity to the success of the proposed inquiry.

Much of the information above adverted to will bear more or less on the question of "the higher scientific education." But in indicating the scope of the inquiry in this direction, it is very desirable that a clear conception should be formed of the meaning of this phrase. My own conception of it is this. Public opinion has decided that science should form part of the general education given at large and public schools, and at the universities. Such scientific education should comprise the elements of scientific knowledge, and the results of scientific labour, so far as these results are generally accepted as settled. Teaching of this kind forms, in my opinion, a portion of the great educational question which has been for some time occupying public attention, and which is now in a fair way of being put on a satisfactory footing. To impose on the Royal Commission the consideration of such teaching would be doing the same work twice over, and adding, therefore, unnecessarily to their already most laborious inquiry. But beyond the scientific teaching of schools and universities, there is much to be done in order to train advanced students to become investigators and observers, and this I conceive to be the object intended to be described by the phrase "higher scientific education."

It is maintained by very high authorities that it is beneficial intellectually to the investigator himself to have to teach, on account of the mental discipline and the habit of precise thought which it imposes on him. At present, unquestionably many of our best investigators are teachers also, and in all Continental scientific systems the two functions are combined. Two conditions seem important. First, that an investigator should not be required to impart the mere rudiments of scientific knowledge, but that his students should be far advanced before they come under his tuition; they should, in fact, be men who had already gained some distinction at the universities or elsewhere, and who had resolved on following science as a profession. The second condition is that the labour of teaching should engross only a moderate portion of the time of the investigator, leaving him ample leisure and spare energy for original research. At present, this latter condition is precisely reversed in the cases of most of our professors engaged in investigation, and we accordingly only reap the benefits of a mere residuum of their highest faculties.

Another matter connected with scientific teaching is considered by persons engaged in that important occupation to require attention, namely, the possible effect on independent educational institutions of rival State schools of science. The apprehended interference with such interests may perhaps be obviated by restricting State aid to the "higher" teaching which I have attempted to define, leaving the preparation of students for such higher teaching to the universities and other institutions of an independent character. But before any rules on this subject can be laid down, it is obviously necessary that the exact amount and kind of action now taken by the State in respect of teaching, and the effect of that teaching, both on scientific progress and on independent interests, should be ascertained with the utmost care.

It is also desirable that the Commission should collect the fullest possible information regarding all foreign scientific systems, down to the latest period. I by no means consider that any of these systems in particular is so perfect as to justify our creating a servile imitation of it. But it is only the part of wisdom, before organising our own scientific administration, to examine carefully the results attained abroad, by nations whose experience in such matters is now very extensive. This examination will suggest many arrangements that we may safely adopt, and, no doubt, some that we should do well to reject. Not even the nucleus of a scientific system at present exists in England, and we are therefore the more free to shape, on the best available models, the organisation which a full inquiry will undoubtedly show to be necessary.

A great mass of facts connected with both scientific teaching and scientific investigation having been thus accumulated, the next step will be to digest and analyse them. The result of this most important process will be to show—first, what is redundant; secondly, what is imperfect; and, thirdly, what is altogether wanting. It will indicate cases in which separation is desirable, as, for instance, cases where the concurrent cultivation of two or more branches of science, not naturally allied, tends to impede the growth of each. Cases will also occur in which combination would be beneficial. But one of the most important results of the analysis will be the bringing to light the scattered character of our scientific efforts; almost every department of the State having charge of some scientific institution—the Admiralty of one, the War-office of another, the Board of Trade of a third, and so on, a dispersion which is absolutely prohibitive of harmonious system, of progressive improvement, of efficient superintendence, of economy in expenditure, and of definite responsibility.

The final process will be to reduce to order the chaos of which I have merely attempted a broad indication. This will probably consist in a total re-arrangement of the internal organisation and the official distribution of our scientific institutions, with a view to concentrated superintendence and responsibility. It will also involve a revision of scientific staffs and salaries, with all the attendant questions of patronage, promotions, distinctions, privileges, and pensions.

Such, as it appears to me, should be the scope given to the expected inquiry. I pass now to the second point which it will be well to consider.

2. *Some of the Probable Results of the Inquiry.*—The first of these will be the accumulation of a vast amount of facts and opinions, collected from every available source, and from the most competent authorities, regarding an extensive variety of subjects of which we are at present in a state of comparative ignorance. If the inquiry produced no other immediate fruits than these, it would have performed a priceless service. Another result will be that we shall see for the first time what are the principles which should determine the action of the State for the advancement of science. At present there exists the most violent conflict of opinion on this subject, from those who hold that State intervention in science is unjustifiable and disadvantageous, to those who desire such intervention to be universal. Between these extremes there lies the middle and more reasonable section of thinkers, who recognise in the State simply a machinery for doing, on the part of the community, whatever is generally advantageous to the great mass of the people, but which transcends the power of individuals to perform. To discriminate fairly between the branches of scientific exertion which should devolve on the State and those which should be left to private energy, is one of the most valuable results that can be expected from the inquiry.

We may hope, as another most important result, that a central ministerial administration of scientific affairs will be shown to be necessary. In all other civilised countries a Minister of State is charged with this duty. It seems absolutely impossible to organise or maintain in an efficient state anything like a harmonious scientific system, without a dominant authority presiding over the whole. There are already indications of a coming Minister of Public Instruction, to administer the proposed national system of primary education; it can hardly be doubted that he should also have charge of whatever relates to State intervention in science.

The creation of such new scientific institutions as may be proved to be necessary, is another result that may be

looked for. Though I have long been of opinion that the want exists, I do not think the time has yet arrived to indicate how it should be supplied. The inquiry will develop clearer and more consistent estimates of the extent of the want, and of the best mode of meeting it, than, in the absence of full information regarding existing institutions, anyone can now hope to form. The cost of new scientific institutions alarms many persons who have only superficially examined such questions, but it will be probably found that increased expenditure in some directions may be met by retrenchment in others, and that no great change in the aggregate outlay on science will have to be made. On the other hand, we may feel sure that no outlay whatever will be recommended by a Royal Commission, unless it be incontrovertibly proved that such outlay will be beneficial to the nation.

Eventually, the responsibility of sanctioning increased expenditure for scientific purposes must rest with Parliament, by whom any proposals of that kind will be most scrupulously examined.

I will now offer a few remarks on the last point, which seems to require immediate attention.

3. *The Constitution of the Commission.*—This is of vital importance. If its constitution be not such as to command, not only the confidence of the public generally, but also that of men of science, it cannot hope for success. The necessary elements in such a body seem to be administrative capacity, impartiality, and varied scientific knowledge. The first two elements will be secured by the nomination of persons versed in public affairs, and of high and independent station; the last by the due representation of the main branches of scientific activity. Probably four scientific members will suffice, to represent respectively, (1) mathematics, including astronomy; (2) chemistry; (3) physics; and (4) natural history. To give a decided preponderance to either one of these great subdivisions will create strong and well-founded dissatisfaction. However lamentable the fact, it is certain that men engaged in one branch of science are very apt to underrate the importance of all others. The decision of a physiologist on an astronomical inquiry, or that of a mathematician on a matter connected with biology, will be received with jealousy, a jealousy not by any means in most cases destitute of reasonable foundation. The subjects which will come before the Commission will be so difficult and so various, that four of the ablest men of science in their different departments will not be found more than will be necessary to give weight to the conclusions at which the Commission may arrive, and they should be men admittedly representative of their respective departments.

In the remarks which I have ventured to make, I have not dwelt on the importance to a civilised nation of progress in scientific knowledge. I have felt that I might safely take this for granted, in addressing the Society of Arts, a society whose efforts have been, during so long a period, devoted to the promotion of such progress, and who do not require to be told that our commerce, our arts, our national supremacy on land and at sea, and our everyday conveniences are, more or less, dependent on our application of the laws of nature and the properties of matter. Whether or not an exhaustive inquiry into the state of science in England is imperatively needed, and what should be the scope of that inquiry, are the questions which, I believe, we have to-day met to discuss. It appears to me that the time for such an inquiry is opportune.

At no period of our history has there been so great a readiness to place administrative power in the hands of the government. Public opinion acts now so energetically and effectually on the legislature, that the old jealousy of government interference has been almost entirely dispelled. The tendency of the day is rather to impose fresh duties on the government than to restrict its action. Men's minds, at the present time, view without apprehension, and examine with more impartiality and a higher discrimination than at any former period, proposals for radical changes. The nation has, moreover, been roused from the apathy with which it used to regard the ignorance of the masses, and is prepared for measures to redress the evil which, even ten years ago, would not have been listened to. It cannot be doubted that an equal readiness will be shown to examine with calmness and candour well-considered proposals to place on a proper footing a department of the State's duties which has never as yet undergone a strict and methodical examination. The nation requires primary education, and will enforce it upon those whom it is to benefit; it insists on the teaching of science in schools and universities; will it not approve of measures without which that teaching must be comparatively fruitless—measures calculated to attain the ends to which teaching is but a means—a more perfect knowledge of nature, and more absolute sway over her forces and her laws?

The Chairman, in opening the discussion, said it was pretty well understood that the government had agreed to issue the Royal Commission, and, therefore, speakers might spare themselves the trouble of arguing that part of the question, and come at once to the two more practical points—what should be the composition of the Commission, and what the scope of its labours.

Professor Williamson said that, before adverting to the scope and probable results of the Royal Commission which was to be appointed, he must be excused for saying one word as to the origin of the question. The gallant colonel had referred to the paper read by himself as the origin of the movement, but in order to make more intelligible what had been the feelings which had led to the government being asked to grant the Royal Commission, it was necessary to take cognizance of the fact that there had been two distinct movements, the one in which Colonel Strange took the leading point, and to which he naturally gave the principal importance, and also a movement of another kind, which, at the last moment, had been united with it by the decision of the Council of the British Association, the result being the two resolutions which had been read by Lieut.-Colonel Strange, and which, therefore, he presumed would form the basis of the present discussion. The question whether the State should or should not intervene in respect to higher scientific education, had, he thought, been practically disposed of, for government did in fact already intervene on a considerable scale, and on a continually increasing scale. Nor, he believed, was there any difference of opinion that government did in this way a considerable amount of good, and the movement in this matter was likely to be directed mainly to this, whether such action had been in a direction most serviceable to the development of a sysem of scientific teaching and investigation, or whether improvements might be suggested which would render its efficiency greater. In looking back to the statements which were made when the Department of Science and Art was founded, some truly admirable principles would be found laid down, and though it was true that scientific education was looked at chiefly from a material point of view, and that government contemplated mainly aiding the applications of science rather than extension of scientific knowledge, still one principle was put prominently forward, which ought still to be the guiding star in the matter, viz.—the principle of impartiality—in other words, that government should avoid even the semblance of attempting to enforce its own views of science and art upon the country. That principle was laid down with considerable emphasis in several of the original documents. At the time when that movement commenced, the question of education was not so prominently before the public as at present, for it was only recently that government had entered systematically on the question of establishing a system of national

education, so that it naturally occurred that the steps then taken were not adopted upon so comprehensive a view as must now be entertained. If there were one point of difference more than another in the view then taken, and in that which must now be adopted, it was this, that the material point of view must not be the only one. In dealing with education, it was not a question of soap-boiling and calico-printing merely, but it required to turn out a product of a different kind—the turning out of intelligent, right-thinking youths. This was a process which required to be directed on principles involving considerations of a far moro complex kind than those which were required in order to turn out an ordinary manufactured article; and he conceived there could be no doubt that the limitation which was originally imposed on the action of the State in relation to science could no longer be maintained. For this reason, it became particularly important that the inquiry should not only include those facts to which Colonel Strange had specially drawn attention—the present action of the State in relation to science—but more especially the natural resources of which the State had as yet taken no cognisance. Looking at the immensity of the problem of establishing anything like an adequate system of scientific education, it was evident that the utmost resources of the nation would be necessary in order to its satisfactory solution. If the State were to take the work piecemeal, as at first, it might be predicted that they would do much less than would be done on a system based upon a comprehensive view of all the national resources. At the present time there were various higher educational institutions, such as the Universities, which gave a certain amount of scientific instruction, and in the main government had as yet taken scarcely any cognizance of their resources, and had not systematised them in any way, so as to render them available in the great work which now had to be performed. With regard to the probable results of the labours of the Royal Commission, he could not help feeling that it was not likely to assume the form of a specific cut-and-dried plan, to be set up and maintained as such. He believed that the earnest and able men who would, no doubt, form that commission, would be quite aware how impossible it was to predict what would be best in such a matter, and would confine their recommendations to such as would foster and favour the development of such a system. A man need be a prophet in order to say what would be the final system of scientific instruction, for, in all probability, it would be some hundreds of years before perfection would be attained in this matter. He had no doubt, therefore, that the Royal Commission would be sufficiently impressed with the magnitude of the task entrusted to them not to put forward any rigid and professedly perfect system, but that the chief results of their labours would consist in showing how the national resources of the country could be best utilised, in order to develop the system of scientific education. In such an inquiry there was no fear whatever that any difficulties might be met with from special interests. All concerned in this matter would feel that whatever might be the best for the promotion of the general object would be best for all individuals concerned in it. If the government thought best to specially favour some pet institution of their own, let them do so. If their system were the best, it would be favoured perhaps by such a process; but if it were not so, they would never succeed in putting it at the head. It would be impossible for any government to force upon the country, even if they wished, a system not really in accordance with the requirements of the case, for there was no one line of human activity in which it would be so perfectly impossible for such a thing to be done as in that of scientific research. He felt quite convinced, however, that no such effort would be made.

Mr. Balfour Stewart, F.R.S., said that a subject like the present was all the better for being approached from various points of view, and he might, therefore, be permitted to classify under different heads the scientific investigations which they had come to discuss. Such investigations may be divided into three great groups, first, observational inquiries; next, those experimental inquiries in which time was not an essential element, and thirdly, certain experimental inquiries in which time was a necessary element. In the first place, with regard to observational science, he believed that government already recognised the responsibility of aiding, directly or indirectly, the various branches of this science, as for instance, astronomy, geography, geology, natural history, meteorology, and magnetism. Either directly or indirectly, the State at present did aid all these branches, and the only two which did not at present receive its aid were the two younger developments, viz., photography, and spectroscopy as applied to the celestial bodies. Such a commission as was now proposed would therefore, he apprehended, have to see, first of all, whether the aid given was sufficient; and, secondly, whether it was administered in the best possible manner, with reference to the branch of science he had mentioned. A second division included those experiments which did not require time as an essential element, in fact, the great mass of experiments. These might be divided again into two classes, those which could not be purchased by money, in which some discoverer pushed his discoveries into an unknown land, and found out some new law. Whenever a discovery of this kind was made, it was made, as he might say, in a nebulous form, and it then became the object of another class of men to condense this discovery, and to bring it into relation with known branches of knowledge. There then arose a large class of observations, the object of which was to find out certain numerical relations between that branch of science and those already known; and, in order to establish these numerical relations, or to find what was called the physical constants, it required a series of very elaborate experiments, and often a very costly apparatus, such as often were beyond the power of individuals to supply. The present position of this country with regard to this branch of science was very much below that of France and Germany. In France, through the aid of the State, the illustrious Regnault chose for his theme the steam-engine, and had made a most valuable and important series of investigations, and had found out a great many of these natural constants which he referred to. He did not think the same thing had been done anywhere else, and, at any rate, in this country we fell very far short in such researches. The result was, that the scientific men in this country, at the present moment, were in absolute ignorance of those corrections which it was absolutely necessary to apply to the readings of the best-constructed mercurial thermometers, so that all investigations in which the use of these thermometers was necessary were affected with an unknown error of this description. The third class of experiments were those which required time for their solution. The illustrious physicist, Sir William Thompson, at a meeting of the British Association, in 1857, brought this matter very prominently before it, and told them that, with regard to a large class of problems, we were at present in utter ignorance, viz., the investigation of those properties of matter which were altered more particularly by time; and a large class of problems of this kind had been absolutely untouched by scientific men, either in this country or elsewhere. But when one considered the position of most men of science in this country, it was no wonder that such was the case. For instance, a professor at any university could not afford to invest so much of his mental capital as would be required in a problem of this kind, for in the course of ten or twenty years he might be superseded by another professor, equally distinguished, but who directed his attention to another branch of science, so that the experiments began by the one might not be continued by the other.

There was, therefore, no temptation to any man to devote himself to the study of those properties of matter which required a long time for their investigation, though these were of a most important class; for instance, the properties of metals, the carrying and abrading power of water, the changes that the materials used in construction suffered from the lapse of time, and so on. Before they could venture to say what had happened in geological epochs, they must know what changes a body, such as the crust of the earth, would suffer during a long series of ages. In fact, experiments must be made which would require time for their accomplishment. On all these points, therefore, it was very evident that there was room for very great improvement.

The Astronomer Royal said he might, as one of the officers connected in a scientific way with the government, advert to the question before the meeting, but he trusted that any remark which he made would not be interpreted as implying any objection on his part to the appointment of a Royal Commission. As the best result of the appointment of such a commission, he looked to what was stated in Colonel Strange's paper as some of the probable results of the inquiry. He could fully support the statement made as to the sort of confusion and complication which existed in the relations between the State and the *quasi*-scientific institutions which it maintained, and might mention that, until within a few years past, he, as Astronomer Royal, had to exhibit one set of accounts to the Admiralty, another set of accounts relating to the same expenditure, but in a different form, to the Treasury, and a third set reconciling these two. Fortunately, this had been got rid of not long since. As to the general course of these things in Great Britain, he apprehended it had been this—originally there had been no distinct idea of promoting abstract science, but there had been a very distinct intention to promote and encourage applied science, with a very liberal interpretation in favour of speculative science. Having had a somewhat long connection with the government, he was quite competent to say that there had never been any unwillingness, as far as instances occurred to him, to promote liberally the purpose of speculative science when brought before the government, with a good cause shown, and upon the responsibilty of some person in whom they placed confidence. On turning over the matter in his mind, the final result of the question appeared to resolve itself into this—should there be an Academy? That was what it all came to at last. The administrative government could not be expected to know much about science; they must trust to others, and the question was, in what way they could trust to this. At present they trusted a great deal to their responsible officers; for instance, they trusted a great deal to himself in some matters. Bodies might be constituted to which they might trust a great deal more, but it must be in the way of trusting others, and in that way it appeared to him that they must look at the question, was it desirable that they should have a salaried academy, composed of the best members they could find, under an obligation to devote a portion—perhaps the larger portion—of their time to objects of science generally? He was not prepared positively to object to that, although formerly he had not thought so well of such a scheme as some scientific men did, but he certainly recognised the advantages which had resulted from the constitution of such a body. For instance, in his own science of astronomy, although the principles of the lunar theory had been well established, the development of it in a strictly algebraical form was due in great measure to a prize offered for that subject by the French Academy of Sciences. At the same time, he did not think that any proposal of a prize would would have led to the investigations which brought to light the existence of the planet Neptune. He did not think any prize offered by an academy would have produced that prodigious advance in spectroscopy which led Mr. Bunsen, from the impulse of the moment, and Mr. Lockyer, from a long and varied course of investigation, to make those astonishing discoveries with regard to the solar disc. Therefore he gave in his adhesion to the possible appointment of an academy in rather a limited way, but it was desirable, he thought, that this result should be borne in mind as one of the leading consequences to which the investigations of the Royal Commissioners might or might not lead. In the next place, he would remark that there was one matter mentioned in the paper to which he could not agree. He did not think it possible to train investigators—at any rate, he did not know how it could be done. It appeared to him that a great deal might be done by pursuing a course somewhat similar to that which had been taken by the government in entrusting the Royal Society with funds for the purpose of promoting scientific investigation. The grant which was at present made to the Royal Society was a small one, but as far as it went, it was most carefully bestowed. To that he could himself testify, for a short time ago he attended a meeting of the committee, in which the question of making a considerable advance of money for instruments for a specific purpose was entertained, and the present construction of instruments was most carefully investigated. In the main, he thought the action of the government in this way must consist in supplying money. Even in this case, however, it might perhaps be desirable to require greater publicity and public responsibility, by means of a published account of the expenditure. Another question might arise, whether it would not be well to inquire into the course of scientific education now given in our universities. There was perhaps no man connected with either of the universities who entertained a greater affection and admiration for his *Alma Mater* than he did, but still he had himself found, as he had openly stated in the Senate-house of the University of Cambridge and other ways, that there was a deficiency in the scientific education there given; and in the course of last year he had himself given gratuitously to the university a course of lectures on magnetism, because that important subject was entirely omitted from the curriculum. It appeared to him very desirable that they should keep that question in view, whether our great educational institutions should not be bound to pay more attention to science? In conclusion, he thought the probable results alluded to from the establishment of the Royal Commission would be extremely valuable, and, without pledging himself to any course which he should or should not be disposed to adopt, he hailed with satisfaction the step which had been taken by the Society of Arts on this occasion.

Dr. Miller thought the question which the Royal Commission would mainly have to consider was that of funds. No doubt the difficulties which the government had to meet, in the consideration of the questions urged upon them by men of science, were mainly those which had been stated with great force by the Astronomer Royal. It had been distinctly shown by Colonel Strange that it was from no parsimonious motives that the government frequently hesitated to grant money. If it were distinctly understood that a great object was in view, and that men who understood that subject applied to government, it appeared to him that men of science had never yet received any but the most respectful consideration. The real difficulty always was to ascertain that the recommendation was founded upon adequate knowledge; and one great portion of the duty of this commission appeared to him to consist in determining the kind of way in which men of science were to approach the government, for the purpose of carrying out the objects which they desired. Gentlemen representing great branches of science, like the Astronomer Royal, were met by the government with liberality; and scientific bodies, such as the Royal Society, when they made an application, after careful consideration of the objects they had in view, were also listened to with

respect, and in the majority of instances their applications were granted. It appeared, therefore, that the great difficulty on the part of the government was to be sure that what they expended was wisely laid out. Another point for consideration would be to ascertain how far the action of the government was really advantageous in granting money for the purpose of favouring scientific education. It had been well stated by Colonel Strange, in his address, that the greatest possible confusion prevailed on this subject. Money was given largely, with a desire to favour this object, but many men of science felt that the way in which it was distributed at the present time was far from being judicious. In many cases the government granted to existing universities certain sums of money; Regius professorships were established in various branches of science; and in other cases institutions had sprung up intending to promote the same objects, which had struggled on without any aid from government. The result was, that the institutions founded by the government, not professedly but really for the purpose of affording scientific instruction, became direct competitors with those institutions which received no public aid. All these conditions ought to be investigated by a commission of this kind, and the result would no doubt be instructive and useful. Allusion had been made to the grant of a certain sum which was advanced to the Royal Society, and he might be allowed to add, being the treasurer of the Royal Society, and knowing intimately the manner in which this fund was administered, that, although there was no public statement officially made, it was regulated in such a way that, on the application of any member of Parliament, a statement could be given of the exact way in which this money was expended. He mentioned this to show that it was very easy to introduce into any prospective arrangement a security for a public statement being made, of the exact manner in which sums of money were dispensed by those who were made trustees for the government in this way.

The Rev. Arthur Rigg said he had been for thirty years seeking to promote scientific instruction in England; but before government was asked to help us, he thought we ought to do something to help ourselves. The Universities of Oxford and Cambridge were at the present time advancing science in their own particular way, but the prejudices of former habits and routine there established were a very great obstacle in the way. For instance, the University of Oxford offered very liberal scholarships, from £50 to £100 a-year for a period of five years, to open competition for proficiency in science; but when the student who had obtained such a scholarship entered the university, he was met with this great difficulty, that although he had obtained a fair amount of classical knowledge, he must pass the university examinaton, extending to from 15,000 to 20,000 lines of Latin. He knew an instance of a young man obtaining one such scholarship, who for the first two years of his career attended to no scientific subject whatever, being fully occupied with his classical studies. He thanked the Astronomer Royal for the higher scientific education which he had received from him more than 30 years ago, and from that time he had been engaged in scientific work. Since 1849, downwards, many efforts had been made, which it would take too long to enumerate, to establish scientific education on a better footing; these efforts had commenced and died out again, and they were now, in 1870, renewing discussions which took place more than 30 years ago. There was one more remark he might make, that he feared people were far too apt to consider science simply in its relations to trade and commercial success; for instance, physiology was studied chiefly with a view to its bearing on medical practice. He presumed this would not be the sole scope of the inquiry of the Royal Commission, or of the various educational bodies for scientific purposes which it was hoped might be established. Another error, which was too frequently made, was with regard to museums. No doubt these were valuable in themselves to those who had received scientific education, but the mode in which they were spoken of very often reminded him very much of putting an encyclopœdia into persons' hands in order to teach them the alphabet. If the Royal Commission could by any process promote a system of teaching rather than of lecturing, and of experimental teaching rather than of showing experiments, it would promote the development of scientific investigation by those who had a taste for such pursuits, and the ranks of observers would thus be recruited at a comparatively small cost.

Mr. Edwin Chadwick said he would venture a few remarks on the administrative point of view. Anybody who considered the subject must agree with the conclusion which had been advanced by the Council, that all money granted for educational purposes, superior as well as inferior, ought to be under the disposal of one body; and that the whole education of the country, primary, secondary, and superior, for art and for science, ought to be charged upon one department, giving its exclusive attention to the subject. The mere putting together of things, bringing them under one eye, and considering them in their mutual relations, would of itself be attended with great public advantages, and he could not believe that anyone would advocate grants being continued to be given in the same way in future as they had hitherto been. For example, grants were made to the British Museum for its mineralogical collection and additions, and similar grants were made to the Museum in Jermyn-street, and there were thus two collections of objects, the inferior one, in the hands of people who did use them for teaching purposes, and the other, the superior and most expensive one, in the hands of those who did not, although it was not their fault they did not. In the same way there were different bodies bidding against each other with the public money for specimens of natural history and other objects when they were in the market, the greater portion of funds being in the hands of the British Museum, although it had no teaching powers, but merely those of curatorship. In fact, it might be considered as a large curiosity shop, ministering chiefly to mere dilettanti curiosity, instead of to systematic scientific instruction. It was evident that the British Museum grant, which was perhaps the largest, might be greatly utilised. Further, it was as well to state that, while considering the question of superior education, it was possible to lose sight of what was extensively required in the way of scientific instruction in secondary education. It was very clear, to anybody who looked at primary and secondary education as it ought to be, that at any rate in secondary education, elementary science ought to enter in a very large degree, and the question therefore became of importance to consider how that scientific education could be supplied. He had heard school-teachers say that, of all classes of objects which they found accessible to the minds of children, those of natural history were most interesting; but they taught these subjects separately and unscientifically, without order or method. Professor Owen told them the other day, and he had since given him many important illustrations of its truth, that scientific natural history might be taught much earlier than people generally supposed possible, and would not be only valuable as particular instruction in the subject taught, but also in training the mind in method. School teachers asked why could not they be taught, or have access to professors who would instruct them how to teach the requisite science? It was clear that there was no reason why this access to learned professors should not be afforded; and he believed the professors generally (at any rate, he could speak for the learned gentleman whom he had already referred to) would be delighted to have the opportunity of teaching, and utilising the collections under their care for the

benefit of public education. It had been said that they could not expect to educate investigators; but he believed that, by teaching science generally in our schools, a great body of scientific observers would be spread not over England only, but over the whole world, and that from amongst them distinguished investigators would arise and make use of their opportunities. For these reasons it appeared to him that the administrative question lay within a very narrow compass, and that, without any extra outlay, the mere juxtaposition of the subjects before one authority could not fail to conduce to economy, and largely to efficiency. He could appeal to their noble chairman whether his experience in Parliament did not lead him to the conclusion that much more impression would be produced by an application for a vote coming from a department in the shape of an annual report, which stated what had been already done, at the same time that it showed how, with more means at command, something better might be done. This was the result of the French orderly reports, which influenced public opinion generally, and also saved much discussion in the Senate. There was an annual report by the Minister of Education, which gave an account of progress, not only in superior, but also in secondary and primary schools, and by following that example he believed they could much augment the efficient application of the votes already granted. At any rate, the demands of primary education ought not to be altogether neglected; and something might be said in favour of mechanical science, the importance of which did not seem to be fully recognised in the paper of Lieut.-Colonel Strange. According to his (Mr. Chadwick's) experience in the public service, a great deal might be done, by trial works and examinations, to settle questions for the advance of science, which were beyond the means or the interest of private individuals. For instance, on one occasion, by a grant of six or seven hundred pounds which he had obtained for the purpose of trying experiments as to the dimensions of drain-pipes, the carrying-power of water, &c., with the result that they were now able to drain three houses or three towns at the same expense which had heretofore been required for one; and such experiments as to the bearing-power of water, as had been noticed by Mr. Balfour Stewart, required to be carried further. In the same way, the Society of Arts had promoted experiments with regard to the heating-powers of different stove grates and the economy of fuel and light, which had been very useful as far as they went, but they required to be carried much further; and it should be within the power of a competent educational board to recommend to Parliament such objects of research. At all events, it was quite clear that the resolution of the Society of Arts, in favour of a comprehensive department of education, was a most wise one, and the Royal Commission might do valuable work in aiding in its application.

Dr. Mann said he would venture to propose a resolution, in order to give a definite expression to the opinion of the meeting, but before doing so, he would take leave to say, on behalf of his friend, Colonel Strange, lest there should be any misapprehension as to his views in the matter, that he quite concurred in what had been said by Professor Williamson, that it was of extreme importance that nothing definite or settled should be fixed upon in the first instance. After many years spent in public work, he might say that there was no one principle more clearly established to his own mind than this, that it was always a mistake, in dealing with matters of a complex kind, to commence with a ready cut-and-dried line of action. On the other hand, it was of the utmost importance in all such matters to proceed gradually, like a builder, day by day, week by week, and even year by year, taking advantage of every new fact which experience supplied, to modify the final structure. Professor Williamson seemed to have had an idea that Colonel Strange wished to begin with some fixed system, but this was not the case, though no doubt he had a very clear and strong idea in his own mind as to what was required. Still he (Col. Strange) was sincerely desirous that everything should be left fully open for consideration before any measures were adopted. With these remarks, he would beg leave to move:—"That this conference desires emphatically to affirm the conclusion of the British Association for the Advancement of Science, that a Royal Commission to inquire into the relations of the State to science is very desirable, and to recommend that the scope of the inquiry be made as wide as possible."

Mr. William Botly seconded the resolution.

The Chairman said he believed there would be no difference of opinion about the resolution which had been submitted, but before putting it to the vote, he must be allowed, as the mouthpiece of the Council of the Society of Arts, to express the thanks of the meeting to Lieut.-Col. Strange for the able paper which he had read, and to the learned gentlemen who had been kind enough to join in the discussion. As allusion had already been made to the great evil of divided responsibility, he might be pardoned for reminding the meeting that, not many years ago, he had raised his voice in the House of Commons to try and remedy the existing state of things. He there stated, in terms which the present Prime Minister of the Crown admitted to be reasonable and just, that the large sums of money voted for museums and scientific institutions were not made so available as they might be for the purpose of teaching art and science. Although some years had now elapsed since he had received that testimony from both sides of the House, nothing had yet been done to remedy this great grievance, but he now looked forward with hope to the Royal Commission taking stock, so to speak, of our national institutions, and ascertaining whether too much money was not given in one direction and not enough in another. The Astronomer Royal and Professor Miller had borne witness to the liberality with which successive administrations had endeavoured to advance the interests of science when they saw their way clearly so to do. He hoped the Royal Commission would be able to give a word of advice on this point, and would enable the government to do that which of course was very difficult, even if it should be thought advisable, namely, to deal with the existing directorial interests of those large bodies of trustees of our national collections, who at present were not responsible either to Parliament or to the country. His friend, Mr. Chadwick, had appealed to him as a member of the House of Commons, whether an appeal for a vote for the advancement of scientific education would not have much more weight if made by a minister who was responsible for the education of the country, and who could explain to the House why he wanted these sums of money, and to what purpose they were to be applied. He had no hesitation in answering that question in the affirmative; and it might raise a smile when he mentioned that one reason for coming to that conclusion was that, last year, when he wished to ask a question as to the national collections, he found that, if he put his question at all, he must put it to four five different members of the government, and perhaps to one gentleman who was not a member of the government at all. He, therefore, was obliged to put his question to the Prime Minister, as representing the collective wisdom of the government, although those who really had to supply the answer were sitting around him. Before putting the resolution, he would also add that the Council of the Society intended to draw up and present to Lord De Grey, the President of the Council, a report of what had taken place at this conference, including a list of the names of the gentlemen who had attended it, and pointing out to him the suggestion which had been made that the scope of the Royal Commissioners' inquiry should be as wide as possible.

The resolution was put and carried unanimously.

The Chairman then proposed a vote of thanks to

Lieut.-Col. Strange, which was carried by acclamation.

Mr. De La Rue, F.R.S., said the conference had been very ably presided over by Lord Henry Lennox, who, as they all knew from his action in Parliament, had always taken great interest in the advancement of scientific education; and he would therefore venture to propose a most cordial vote of thanks to the noble lord for his services on that occasion. He looked upon this conference as the germ of a course of action which would tend very much, not only to the advancement of science, but also of the commercial interests and prosperity of the country, for without scientific education it was very evident that England could not expect to hold her own under the weight of competition which was now springing up. He need only point to the efforts which were now being made by Prussia, and which were being carefully watched by France, to recall to the recollection of the meeting how very important it was that England should not be behind-hand. He was, therefore, very glad to learn that the matter would not be allowed to drop with that meeting, but would be followed up in the way mentioned by their noble chairman, to whom he begged leave to propose a most cordial vote of thanks.

Mr. Charles Brooke, F.R.S., in seconding the proposition, said he felt convinced that it was quite impossible for England to maintain the position which she had hitherto occupied, unless some comprehensive system of scientific education were adopted. In the present day, when the results of scientific inquiry were so completely mixed up with material progress in every direction, it was impossible for England to maintain her position amongst the nations of the earth unless some great improvement were made in our educational arrangements.

The resolution was carried unanimously.

EIGHTEENTH ORDINARY MEETING.

Wednesday, 6th April, 1870; Charles Hutton Gregory, Esq., in the chair.

The following candidates were proposed for election as members of the Society :—

Billing, Archibald, M.D., 4, Grosvenor-gate, Park-lane, W.
Curtis, James, 13, Moore-park-road, S.W.
Filliter, Freeland, St. Martin's-hall, Wareham, Dorset.
Girardot, E. G., 60, King Henry's-road, Primrose-hill, N.W.
Mardon, William, Christchurch-chambers, 99, Newgate-street, E.C.
Ryder, Rear-Admiral A. P., United Service Club, S.W.
Wire, Travers Barton, Croom's-hill, Greenwich, S.E.

The following candidates were balloted for, and duly elected members of the Society :—

Bourdeaux, John, 7, Clarence-place, Dover.
Cracroft, Bernard, 4, Austin-friars, E.C.
Cuthbertson, James, 30, Newgate-street, E.C.
Day, Arthur, Lifford-lodge, Barnsbury-park, N.
Harding, James, 20, Nicholas-lane, Cannon-street, E.C.
Sartoris, Edward John, M.P., 9, Park-place, St. James's, S.W.

The discussion on Mr. W. Bridges Adams's paper on "Tramways for Streets," adjourned from March 11th, was opened by—

Mr. Booth Scott, who entertained so great an opinion of the importance of this subject that he believed the introduction of tramways would cause a complete revolution in the traffic of the metropolis. Whenever a promoter of a tramway company appeared before a vestry, district board, or any other street authority, he brought with him a very pretty little model of the tramway and roadway; the little bits of wood which represented the paving stones being exactly on a level with the rails, and the cars running as evenly as possible. He also brought a short piece of the rail, full size, with a groove half an inch in width, and three-quarters of an inch in depth, but he studiously avoided any reference to curves or junctions, points or crossings, although this was really one of the principal difficulties which would have to be contended with if tramways were extended throughout the thoroughfares of the metropolis. On the wall was a plan showing the junction of the different roads at the "Mother Red Cap," at Camden-town, on which there were five routes of omnibuses, and 568 journeys were performed by 'buses each way along that route. In the Bills before Parliament there were only two tramway routes proposed, straight up the Camden-road to Holloway, and also through High-street to Hampstead, and there would be but two points or junctions, and four crossings; but if tramways came into use at all, they must inevitably usurp and appropriate every route along which it had been found profitable to run omnibuses, and there must inevitably be a line to Highgate, and also one to St. John's-wood, the consequence of which would be that there would be 20 points and 40 crossings, which was a very important consideration. On the table was a full-sized model of a point as it existed at Birkenhead and Liverpool, with the exception that at the former place the tongue was moveable, whilst at Liverpool it was fixed, the moveable tongue being found objectionable; still, where it was fixed, there was a piece of iron, not four inches wide, but, as the model would show, six inches in length, four inches at one end, and at least ten inches wide at the other. Then, with regard to the curves; on the table there were also two full-sized models of curves from Birkenhead, one of which showed that the groove became widened from half an inch to about two inches, which was the necessary effect of the action of the flange in going round the curve. These rails were found so objectionable in working that they had been replaced by flat steel plates four inches wide, but in a very short time these became worn, as the second model showed, into a double irregular groove, with a sharp tongue in the bed of the groove. The Camden-town junction might be taken as an extreme case, but still it was necessary for those who had the superintendence of the thoroughfares to see what would be the effect of tramways when they were thoroughly extended, and not wait until difficulties were forced upon them before providing for them. The laying of so many lines of rail was a very good reason for urging that the road itself should be relaid, and then came the question, at what level with the roadway should these rails be laid? On two occasions he had asked the engineers of the tramway companies, and on one occasion he was told the rails were to be level, and when he drew the attention to the fact that the roadways themselves were not level, he was informed that they would follow the contour of the road, but in that case the one rail would be some three inches below the level of the other, the effect of which would be a constant friction by the flange upon the groove on the lower side, which would soon cease to be only half an inch in width; and the great advantage of the grooved rail, as now advocated, was that it was of such a narrow width that it could not cause any inconvenience by horses' shoes or wheel tyres getting into it. If the rails were laid level, as the outer rail of each pair would be seven or eight feet from the centre of the road, where the surface would be three or four feet below the crown, there would be a drop of from six to ten inches in the level, which would make the road dangerous. On the other hand, if they only got the extreme fall of three inches by cutting off the crown of the road, it would weaken the concrete foundation on which the rails were laid by reducing the depth, so that where the most

heavy continuous traffic came there would be the weakest foundation, unless the whole road were thoroughly re-made from kerb to kerb. He, therefore, came to the conclusion that the only proper way of introducing tramways would be not to cut a channel in the existing roadway and put the tramway in, and make the surface up to that as nearly as possible, but by making a new road altogether. It would be exceedingly difficult to make granite paving, and certainly macadamised road, level with the surface of the channelled rails, and he believed the only possible way would be by some adaptation of asphalte. But even that would not get rid of the objection to four straight joints throughout the whole line of roadway. They all knew that the Haymarket separated two parishes, and one parish paved one side with stones about four inches wide, and another the opposite side, with stones about three inches in width, so that there was always a straight gutter down the centre, which was extremely objectionable, and was often the cause of accidents; but wherever a tramway was laid, there would be four of these straight joints, which was a very serious matter for consideration. With respect to the effect of tramways on the other traffic, they were told that wherever tramways existed they directed the traffic and kept it in order; but this was the result of what was called the rigid system; and certainly he did not think the on-and-off system would be applicable to London. Taking Oxford-street for an example—not because it was the most thronged, because whilst 1,254 omnibuses passed along it each way every day, 1,530 passed along the Strand, and 2,056 over London-bridge — it appeared that there was something like three 'buses in less than two minutes. However, taking into account that at some period of the day five or six were passing almost together, the average might be taken as one omnibus every half minute, or one tramway car every half minute. Of course the promoters of tramways said they did not claim the monopoly of the road, but what would be the effect on a road on which a tramway car was passing every minute? In a street like Oxford-street he supposed they would not venture to travel faster than six miles an hour, which would give a distance apart of 88 yards every half minute; but, considering that this must be taken each way, there would only be a clear interval of 44 yards. Now, in Oxford-street, carriages were frequently stopping at shop-doors, and as the street was not sufficiently wide for more than the tramway, which took up 18 feet in the centre, and one carriage standing at each kerb, any one driving about would have only 44 yards in which to dodge the tramway cars. In driving east or west, of course they might get upon the tramway, and follow the cars at the rate at which they were travelling, but in order to go any faster the carriage would have to perform a zig-zag motion. It had been said on a previous occasion by Mr. Haywood, that if the trams were introduced into the outskirts they would soon come through the metropolis, but what would be the effect in Regent-street, say at four o'clock in the afternoon, in the season? for even at present there was such a block that carriages were obliged to proceed at a walking pace. Then, again, how would it affect the business streets in which retail dealers carried on their trade? For instance, a publican taking in his barrels of beer, or a baker a waggon-load of flour? Many streets were so narrow that there would not be sufficient space for anything to pass between the tramway car and a waggon standing at the kerb, and in many others there would not be room for the tramway car itself to pass a waggon. The consequence would be a block until the waggon and its load was disposed of. It might be said that the Streets Traffic Act might be applied, and if tramways were laid by a central board, through which the profits could be derived for the benefit of the community at large, no doubt the publican or baker would submit to the inconvenience, in consideration of the benefit which he and the rest of the public derived therefrom; but, on the other hand, he would feel extremely annoyed if he were thus incommoded in his business for the benefit of a private company. With regard to the tramway cars themselves, and the use of steam or hot-air engines, it had been suggested that the cars should carry 20 inside, and 30 or 40 outside, but he was rather of opinion that small handy omnibus cars would be more convenient, say a one-seated omnibus with plate glass in front, and he also hoped there would be cars of different classes. A great deal was said by the promoters about the advantages which would be gained by the labouring classes in cheap fares for long distances, and he had no doubt that cheap fares would pay; but, on the other hand, a lady going along Oxford-street from the Marble Arch would rather wait a few minutes and pay a double fare in order to have a ride in an exclusive omnibus than be thrust in with those who did not choose to pay more than the lowest fares. There might be 1d. and 3d. fares, and both might be made to pay. To sum up, the conclusions he came to were that tramways could not be laid in paved streets without causing inconvenience to the ordinary traffic, but that the exigencies of the traffic of London were such that tramways would be necessary as a relief, the consequence of which would be that the whole system of traffic would be revolutionised, and the roads must be subsidiary to and built upon the tramways. That introduced the necessity for some authoritative body to control the various companies, if, in an evil day, companies ever obtained the control of public thoroughfares. It did not seem at all difficult to institute such an authority—the Metropolitan Board of Works, for instance. With such a central authority a comprehensive scheme might be devised, with the routes, fares, and times fixed, at which private companies might be invited to tender for the conduct of the traffic; for he did not think it would answer so well for the central authority to manage the traffic itself as to let it out by tender. In this way London, in a short time, might have one of the most magnificent systems of intercommunication possible, and he hoped that such would soon be the case. In January, 1866, he proposed that a fully considered, well-digested, and comprehensive system of tramways should be designed and laid out for the whole metropolis; that an authoritative board of representatives be established, to be called, say, the Metropolitan Tramway Board; that the Metropolitan Tramway Board shall construct the tramways; that the board shall fix and define the several routes, shall determine the frequency with which the cars are to run, the fares to be charged, the rate of speed, and other details of management; that the board shall let by tender the right to work the several routes, separately or in groups, subject to those times, fares, speed, &c., yearly or for terms of years. It is not suggested that the board should work the tramway traffic, but that the board should merely construct the tramways, and let by public competition the privilege of working the traffic on conditions determined by the board. To widen the area of competition, it might be found expedient for the tramway board to provide the tramway cars. The competition would then be open to all persons possessing the number of horses required to work a route or group of routes. That the drivers and conductors of the tramway cars shall be licensed by the board, and shall be sworn constables during the period of license, the license being revokable for bad conduct. In the event of an obstinate cabman, or van driver, or rival omnibus driver, persisting in occupying part of the tramway, so as unnecessarily to prevent the passing of a tramway car, a "tramway constable" could exercise more authority in hastening his movements and clearing the tramway than any individual unauthorised to act in any capacity beyond that of a "conductor." That the board shall have power to borrow the money necessary for constructing the tramways, or to establish a guaranteed stock, to be called, say, the Metropolitan Tramway Stock; that the tramways should

be constructed gradually, and not too rapidly. The advantages of such a scheme seem to me to be obvious. It may be taken for granted that the annual receipts, by way of rents, would greatly exceed the cost of maintaining the tramway, and the whole width of roadway, plus a high rate of interest on the first cost of constructing the tramways; and thus the cost of making, maintaining, and repairing the roads would be defrayed by those who used them, and the annual surplus would be available in reduction of the general or paving rate. A board such as he suggested would be in a position to deal authoritatively with the several gas, water, and other companies. Arrangements might easily be made for the removal of the principal mains into side streets, along which tramways would never be required; small service mains being laid along the main thoroughfares clear of the tramway. By the adoption of some such scheme as this, the public—the community at large—will derive every advantage that can be obtained from the establishment of the improved mode of travelling. If the Metropolitan Tramway Board possess authority to issue guaranteed stock, the public can invest therein, the public being the guarantors. When the routes are let to the contractors for working the lines, the rents will go partly to pay off the borrowed money, partly to maintain the tramways, and the residue to the maintenance of other roads, so reducing the general or paving rate of the metropolitan parishes. If the guaranteed stock is to be paid off in the shortest possible time, the sooner will the investing public receive back their investment, but the whole rate-paying public will not so soon, or to so great an extent, obtain the reduction of the general or paving rate. If, on the other hand, the paying off of the guaranteed stock is extended over a longer period, the whole ratepaying public will sooner derive the advantage of a reduction of the general rate, but the investing public will have to wait longer for the repayment of their investments, receiving interest in the meanwhile. And so with respect to the rates of fares, and the intervals of car running. If the intervals between the running of the cars be short, and the rate of fares low, the rent paid by the contractors will be comparatively small, but the public will have the advantage of frequent cars and low fares, though with a smaller reduction of the general rate. If, on the other hand, the intervals be longer, and the rate of fares higher, the rent paid by the contractors will be large; the public will have the advantage of a greater reduction of the general rate, but will not have the advantage of such frequent cars or such low fares. And so also with respect to the extension of branches from the main routes. If branch lines of tramways were constructed along roads, the traffic upon which would not produce a profit upon the outlay for construction (where a private company would consequently not be induced to incur the outlay), the locality accommodated by the branch lines would reap considerable advantages, and the community at large would be benefited. But since the rents would be comparatively small, the general rate would not be reduced, as the rents might not be sufficient to pay the cost of the branches. Whereas, on the other hand, if branch lines were constructed only where they would be profitable on the outlay, the Tramway Board would avoid any unprofitable outlay, but the travelling public would not be benefited, nor would outlying districts be so well accommodated. Another advantage will be found to arise from the ease with which routes may be altered and new routes arranged. It will, and does happen, as the metropolis is enlarged, that fields become transformed into suburbs, and outlying villages become a connected part of the metropolis; but the existence of vested interests in established routes prevents or delays the establishment of other routes that would be more convenient to the public at large. He knew the circumstances of a case in point, where, in consequence of the opening of two railway stations at the extremity of the route, the customers of a line of omnibuses have been drawn away, so that the route has been reduced considerably in length, and the profits materially reduced also. A "time" that was worth hundreds is now almost valueless, and yet the intervening fields (when a "time" was valuable) are now covered with houses. By diverging into a new route to a different point of the metropolis, the line would be made profitable; but the new route would run along streets already partially served by another line of omnibuses; and the palpable accommodation to the public is rendered impossible by the existence of the vested interests of the old line. In such a case as this, it would be only necessary for the Metropolitan Tramway Board to re-arrange the routes, and let them according to such re-arrangement, and the increased value of the one route would counterbalance the diminished value of the other. If routes were let for a term of years, clauses could be introduced into the contract providing for such alterations. The board might have power to construct branch tramways to large factories and depôts, and arrangements might be made for conveyance of heavy goods during night, when the tramways would be unused by the cars, and also during the day by means of vans travelling, as railway vans now do, at a rate equal to that of the cars.

Mr. Redman said no one could over-estimate the subject under discussion, upon which he might venture a word or two, having lately been professionally engaged in reporting upon one of the tramway schemes, and having been for many years connected with the subject. Though it had only recently attracted general attention, the subject of tramways was an old one, like the Thames Embankment, which had only just been carried out after 20 or 30 years' discussion and Parliamentary inquiry. As far back as 1825 a tramway was proposed to connect the East and West India Docks and London, running along the Commercial-road, one of the finest avenues out of London. In the first instance, this was looked upon with some disfavour, as it was supposed that a rail projecting above the surface of the road, and only adapted to the use of vehicles with flanged wheels, might prove detrimental to the general traffic; they subsequently withdrew their opposition, but the bill was nevertheless lost on standing orders. Attention was then directed to the objection which had been raised in Parliament, to an ordinary paved road being the only means of communication between the docks and the metropolis, and ultimately a fund was raised for the purpose, and a stone tramway laid down in order to meet the objection which had been made to an iron road. That stone road was designed by Mr. James Walker, a well-known engineer, ably seconded by Mr. Alfred Burgess; and one of the resident engineers was Mr. Bidder. The results were certainly very remarkable. The first cost was somewhat heavy, being £10,000 a mile, but it had worn remarkably well, considering the tonnage which passed over it. For the last twenty years he had been engineer to the trust, and during that time the whole line had been relaid once, and about half three times. The length was two miles, the width of the road 82 ft. between the houses, and 55 ft. between the kerbs. On each side there was a 9 ft. stoneway, and the tramway was a single line on the south side, the remainder of the road being macadamised. The annual import and export tonnage connected with the docks passing over this tramway was about 300,000 tons, and in addition to that there was a large general vehicular traffic, amounting to about 300,000 vehicles a year. The great difficulty with such a line of tramway was to adapt it to the various gauges of vehicles, which ranged from 4 ft. to 7 ft. The result was that the 4 ft. gauge vehicles, which were of rather modern origin, laid hold of the straight lines of the joints, just within the tramstones, whilst the extreme wide-gauge vehicles laid hold of the outer joints. This was one great difficulty with all tramways—there was always a tendency to lay hold of the straight joints, and this occasioned a difficulty in the keep-

ing the ordinary road surface even with the tram surface. In the first instance, this tramway was laid down exclusively for the heavy goods traffic to the docks, and guard stones, slightly projecting, were laid along the edges to serve as a guide for waggons, but in consequence of objections raised by the drivers of omnibuses and other vehicles this was afterwards abandoned, and in relaying the road it was made quite flush. In the first place also the tramway was made to follow the contour of the road, but that was found objectionable, and it was now laid quite level. At that time the different qualities of stone were not so well known as at present, and the result was very remarkable. The larger portion was formed of Aberdeen granite, another large portion of Herm granite, a stone from the Channel islands, and the remainder of granite from Guernsey. The Aberdeen stone, which was originally 12 inches thick, now averaged only eight inches, having lost four inches in the four years; the Herm granite had lost from two to three inches; and the Guernsey had lost little more than an inch. This was a good example of what might be done by stone tramways, and had been so referred to by the late Lord Palmerston, who also drew attention to their frequent use in Northern Italy, especially in Turin. Mr. Page, in his tramways on Westminster-bridge, adopted cast-iron plates, the result being very similar in appearance to the stone tramways in the Commercial-road. For some reason or other, however, the tramway-plates, which were affixed to blocks of wood, were in two pieces, and there was a straight joint between the two the whole length of the tramway. The result was, as could be seen by any one walking over the bridge, that every vehicle that possibly could got into the line of joints, and the trams were already assuming the hollow curved shape recommended by Mr. Adams. With regard to the extension of any system of this kind in London, he did not take quite the same sanguine view as was adopted by the professional adviser of the Board of Trade, but he had no doubt that some such system must be adopted in order to cope with the enormous and daily-increasing traffic; but the difficulty of introducing such a system must be very great where there where something like three-quarters of a million of people flocking together every day, and concentrated at such places as Temple-bar, Aldgate, Bishopsgate-street, and Gracechurch-street, though, no doubt, when generally established, there would be one or two northern and southern lines into which the north-east and south-east, north-west and south-west, would be made to converge. The question of tramways seemed to have attained its recent position very much on the principle of *vox populi vox dei;* but whether this were true or not there were many important considerations to be borne in mind in introducing such a system into London which did not apply elsewhere. Not only was there a business traffic which was hardly measurable for its magnitude, but there was an enormous carriage traffic, and that carried on by cattle of the finest quality, such as no other city in the world could rival. This, therefore, was not a mere vestry question, nor was it one to be dealt with by any one class of the community exclusively; it affected the whole population, and should be dealt with on broad and comprehensive principles. But to compare tramways in London with those in a quiet little German town like Stuttgard, as had been done, was quite absurd. Referring once more to the question of materials, after finding the great abrasion which Aberdeen granite underwent, he was induced, some time back, to turn his attention to cast iron, and on the table was a small model showing the surface he had applied to a weighbridge at the West India Docks, over which the whole import and export tonnage passed. The spaces between the projections of the surface were very much diminished and the projections themselves increased in height; the jarring was thus got rid of, and the result showed that, with an annual tonnage of 300,000 tons passing over it, the duration of the cast-iron plate would be about 50 or 60 years. It was rather curious that Mr. James Walker, as far back as 1830, had a cast-iron plate somewhat similar in appearance laid in one of the tramways on the Commercial-road, and it was now to be seen there opposite Limehouse tollgate. He had not been able to obtain a record of the earlier results, but during the last 20 years he had had it weighed from time to time, and found that it would be lessened about one inch in 50 years. There was no doubt in his mind that the prejudice against iron was very much of a bugbear, and that it might be used much more extensively than it was. He had as yet heard of no accident arising on Westminster-bridge, even from Mr. Page's smooth plates, and he might add that the hard Herm granite blocks on the Commercial-road were found at times extremely slippery. However, during the 20 years he had had the management of that tramway, he knew of no accident that had not arisen from the carelessness or culpability of the driver in some way.

Mr. Botly said for many years he had taken a great interest in the subject, and thirty-five years ago had written and read a paper on "Locomotion on Common Roads," illustrated by some drawings of his own preparation. The scheme which he then proposed met with great opposition in his own neighbourhood, namely, that of Gloucester and Cheltenham. They had had a very trustworthy opinion given during the debate, by the Town Clerk of Manchester, and one which, from that gentleman's character and position was entitled to very great weight. For his own part, judging from all that he had seen, he believed that they would be doing very wrong if, at all events for a year or two, they encouraged the use of metropolitan tramways anywhere except in the outskirts of London, where the ordinary thoroughfares were of great width. There were two systems now before them, one the rigid and the other the on-and-off system, and he believed that it would require very great consideration before they would be able to decide which system would be the best to adopt, especially in the City. One very important point had been mentioned by Mr. Chadwick, and that was one of a sanitary character Mr. Chadwick had stated that if metropolitan tramways were adopted, the poor would be able to be carried a few miles out of London at a very small cost.

The **Hon. Captain Stewart** said it would be almost presumptuous in him to address the meeting, after the scientific evidence which they had heard, but for the fact that the subject of tramways had two bearings—one a scientific one, which he must leave to scientific men, and the other a general one, upon which he might presume to form an opinion. The discussion that evening had been almost altogether confined to the details of the subject, whereas on the former occasions the general question had been more fully gone into. They had heard chiefly the extreme views which were taken on the matter. Mr. Haywood had told them that the question of tramways was the great question of the age, that it involved an antagonism between plutocracy and democracy, and that the latter would be sure to win. Speaking neither as a plutocrat, which he was sorry to say he was not, nor as a democrat, which he was glad to say he was not, he thought that that kind of argument was a false one, and if they got into a discussion of antagonism between classes they would probably arrive at what was the bane of all legislation, namely, class legislation. He thought that the plutocrat, who paid the greatest amount of taxes to the country, had as fair a right to be considered as a man who paid nothing, and he had as much right to use the road for which his money paid, as the poor man had who simply used roads for which he had not paid. He did not at all wish to pooh-pooh a question of this sort, for he was really in favour of tramways, but he thought they must pursue a middle course. They must not take them into districts or streets where they would obstruct

the whole of the traffic; but in broad thoroughfares they would be of great use to the metropolis, and be a great boon to it, but if they were taken into narrower streets, where they would obstruct, not only the rich man's carriage, but also the merchant's waggon, or the butcher's or baker's cart, they would find that tramways, instead of being a boon, would be an injustice and an injury. Ho had seen tramways in many of the cities of the world, and to his mind the most perfect tramway system was that of Vienna, where they were laid along the broad streets and were of great use to the population, and not only the democracy, but the plutocracy and the aristocracy travelled by them. They had a way there of getting over the difficulty which had been raised about the points, which he might be allowed to mention. Instead of having angles where several large streets met, the rails stopped entirely, and the passengers changed carriages. He could not see why this plan could not be adopted here, or what disadvantage there would be in it to passengers who had come from long distances. There was also a very convenient tramway at the Hague to a watering place in the vicinity. All that he had seen of the working of tramways brought him to the conclusion, that if a tramway was laid down where it was not inconvenient to other people, it was a great advantage, but that other people had a right to be considered. Tramway cars would only stop at indicated distances, where passengers would get in, and they would not require half the number of vehicles which now blocked up the streets. With regard to the feelings of the persons who would be injured by tramways passing their houses, he must say that it was rather a Utopian idea to suppose that a butcher or a baker would not object to a tramway which did him harm because he was told that it was for the general good of the community. As a broad rule, he believed that if tramways were kept to the middle of the streets, they would get all the advantages from them that they wanted, without interfering in the least degree with the fair and just rights of those who lived along the sides of the streets.

Mr. Hyde Clarke thought that the honourable gentleman who had just sat down, and who had made some very just remarks on the subject of class legislation, had rather misunderstood the purport of the observations made by Mr. Haywood, who had not intended any political allusion, but only meant to call attention to the fact that in this question of traffic it was the mass of the population that must dominate. The whole result of the discussion, he believed, was that tramways were a necessity for the mass of the population, and that they must be carried out with as little inconvenience as possible, and with due consideration to each individual portion of the population. The necessity of tramways being admitted on all hands, it was exceedingly desirable that tho question of their establishment should be settled as early as possible, more especially ln the interests of professional and manufacturing men, because it would bring to them a large amount of new work. They were on the eve of a very great change with reference to the conveyance of traffic, and the sooner an improvement of the kind now proposed was carried into effect, the better it would be for the country at large, and for the technical interests concerned. One incidental result of the establishment of tramways would be that we should be able to participate more than we had hitherto done in the extension of tramways and light railways in other countries. It was very desirable to settle in advance the whole of the details, so that no capital might be wasted in the introduction of a new system, but it must be said, on the other hand, that it was only by the working of the system that they could obtain a knowledge of any defects that might arise, and ascertain how to remedy them. He thought, however, that they might safely place themselves in the hands of the many able engineers who would be sure to take the question in hand, and that they ought not to deprive the public of a great advantage, because of some little defects that must necessarily attend a new enterprise. Any attempt to protect the interests of any class of omnibuses or private carriages against against tramways would end as all such attempts had hitherto done. People had attempted to protect wherries against steamboats, and stage coaches and turnpike roads against railways, but they had only subjected themselves to a great deal of inconvenience in so doing, and we ought to profit by the result. Having admitted the necessity of the system, of which they had adequate experience elsewhere, and for which they had ascertained that they had a sufficient amount of technical skill at home, it was essential that the whole question should be settled, and to this end the present discussion had contributed to a very great degree. Many had come into the room with their opinions undecided, but their minds were now made up, and they were indebted to Mr. Adams for having brought the subject forward, and thereby giving many gentleman an opportunity of expressing their opinions, and stating the results of their experiences.

Mr. George Edward Harding, C.E., New York, U.S.A., read the following:—Having been invited to give a brief account of the adaptation of tramways in meeting the wants of the American public, I shall be only too happy if any mention of the every-day experience of their value to the citizens of the United States shall be deemed even of slight service; and whatever information I may be able to afford is entirely at your disposal. I may mention that within the last eight months I have had the opportunity of observing the workings and many advantages which the tramway offers for the convenience of the many in the cities of New York, Albany, Philadelphia, Brooklyn, Jersey City, Boston, Portland, Cincinnati, Chicago, Baltimore, Washington, Pittsburg, and other places of less note on my side of the water, and Liverpool and Paris upon this, though of course my experience is more extended in my own city of New York, where for years I have daily availed myself of their advantages. Perhaps the so-called "Belt-road," or tramway, in the last-named city, exemplifies to a greater extent than some others the feasibility of street-railways in crowded streets, where an immense traffic and carriage of heavy merchandise, with other disadvantages, would soem at first sight to render their introduction a perfect nuisance. This tramway skirts the city of New York on those streets through which the bulk of the heavy traffic tends, heading the harbour piers, whero is not only the exporting and importing by all the lines of foreign and home shipping, but several of the freight depôts for our largest railroad and canal inland transportation companies. Here, also, the many ferries from Brooklyn, Jersey City, Williamsburg, Staten Island, &c., land and receive thousands of passengers and teams daily, and yet, notwithstanding that these streets are not by any means noted for their width, I have never seen there the blocking of vehicles, which any of the gentlemen present can for themselves witness from my office windows in Broadway a dozen times of a morning, which only the strenuous exertions of experienced policemen can unravel. Surely the opponents of street tramways should not hold up Broadway as a model thoroughfare, from which such nuisances are happily excluded. Broadway, a wide, straight, comparatively level street, is now subject to the sway of omnibuses, who ignore and crowd out other vehicles, and their attendant policemen, for without the latter at each corner a continual snarl of vehicles would ensue. The very pertinent question must arise in the mind of tho observer, why are these street police only stationed on Broadway, where no vulgar street cars are allowed, and not in equally crowded streets where the tramways exist? That a double line of tramway has not been long since in Broadway, is only due to the exertions of Mr. Stewart and others, who fear the carriages

of their lady shoppers would be interfered with, of course backed by the powerful interests of the omnibus companies. There is also a strong dog-in-the-manger spirit—no one of the many seeking this coveted charter willing to allow such a mine of wealth to pass from their hands. Ann-street, Fulton-street, Church-street, and others, some of them not over 20 feet in width, and yet our most busy thoroughfares, afford every day examples of the real advantages of a tramway-car to make churlish drivers of heavy drays keep their line and prevent inextricable blocking. To the introduction of tramways or horse-railroads much of the rapid increase in size and wealth of New York and its suburbs is notoriously due, since its peculiar position has rendered a cheap, rapid, and convenient mode of transit imperative to its growth. Should tramways be abolished in New York to-day, and omnibuses substituted in their stead, one can hardly realise the disastrous effects sure to ensue. Why, then, if tramways are all that their opponents urge,—if, as I was informed the other day (to my great surprise, I must confess), if tramways embarrass business, destroy roads, ruin cities, are an incubus and a burden, a perfect failure in all senses,—engineering, business, and financial,—why, then, in the name of common sense, do the Americans invoke such utter disaster to them and theirs by their continual and persistent extension and multiplication of these evils in all their cities? Yet these, I understand, are the arguments used in England. Again, in regard to the cleanness of the cars. That a line of cars used only by colliers would not be so acceptable as one arranged for the convenience of the city merchants, we can readily understand, but I have never seen horse-cars as filthy as some omnibuses I could name, though similar causes would give like results in either case, except that the cars, by affording far greater facilities for ventilation and access, would always be preferable in cleanness and comfort to the 'bus, especially in rainy weather. In summer, many of our cars have open cane or hard wood seats; and in winter, a strip of Brussels carpet tacked on is all that is necessary, as the smooth running of the cars renders a cushion not essential. By this arrangement no vermin or dirt can be collected, and with removable wooden gratings in the floor all dirt passes away. On the central lines more luxury is displayed. Certainly the side method of entrance is more available than a rear-door for collecting fares by conductors, &c. In New York, printed rules forbid the carrying of large parcels or baskets into a car, and they must be deposited on the front platform with the driver; of course a small parcel can be readily placed under the seat of the passenger, out of sight and way. On those lines used by the poorer class more bundles would be seen than on the central lines, where a bundle is the exception. On these lines the cars, during the early hours of the day, are used mostly by under clerks, salesmen, &c.; at a later hour the merchants and professional men; during the middle of the day by ladies going or returning from their shopping, then the merchants returning, and finally, by the same class who first occupied them, which obviates very evidently one objection that might be urged. I suppose about six miles per hour is the running time. From my house steps I have the option of stepping into a Fifth Avenue and Broadway omnibus, which would also pass the steps of my office, but I much prefer walking a block to the cars, and walking from the terminus of the tramway to the office, three blocks away. Even then by the cars I reach the office in just 25 minutes, by the 'bus in not less than 40. I save 15 or 20 minutes, and have the privilege of reading my morning paper with ease, which in a rattling, jumping 'bus is impracticable altogether. I suppose I live about the centre of the line, and yet I always have a seat, if not at first, by waiting for a block or two, as the inmates are constantly changing. A defect in the New York system is that of taking up or setting down a passenger at any point, as your 'busses do here. I think at intervals of about 300 yards, flag-stone crossings should be placed in the pavement; a person desiring to take a car could easily walk the nearer distance while waiting, and as the horses would soon learn these stations, much wear and tear would be avoided, as perhaps five or six would be changed at each of these spots, where they are now distributed at as many different points. The use of the flat rail flush with the road affords great benefit to heavy vans, facilitating the transportation of large loads, expediting commerce, and saving much horse-flesh. This, I believe, is conceded by all. I can see no difficulty in an engineering (or any) sense for which England, being able to profit by the experience of America, cannot readily provide and guard against. In legislating upon this subject, with the duties and obligations of the tramway companies clearly set forth and defined, the urged objection—that dishonest companies in America have sometimes dodged the responsibilities which a loosely-drawn charter imposed—will but render you the more attentive in this respect, though this is not a valid argument against the system of tramways. It is a well-known fact that, though Mr. Stewart has successfully opposed a charter for a Broadway tram below Fourteenth-street, yet he himself offered 2,000,000 dollars for such a charter. I say below Fourteenth-street, for perhaps the opponents of the street-car have omitted to mention that it is only on the lower half of this thoroughfare that no tram exists. For 26 squares, viz., from Fourteenth-street to Fortieth on Broadway, there has been, for many years, in most successful operation, a double track, although in width this portion cannot at all compare with that lying below. From Fourteenth-street to Twenty-third-street (now the most fashionable "shopping" portion of Broadway), we have, besides the double lines of street-cars, two of the largest omnibus companies in New York, using the same roadway up and down; and here pass as many private carriages as at any other point in the city; and yet, from the fact that these very cars keep the lines of vehicles in their proper course, no blocking is ever seen, though from Seventeenth-street to the Twentieth-street the kerbs are barely 28 feet apart. That Broadway below Fourteenth-street, three times this width, would be absolutely ruined by flat tram-rails, and yet not a single complaint nor warning example is offered from their supposed or real inconveniences in the same street where the width is so limited, must appear to an impartial mind just a little singular, to say the least

Mr. John Haworth, of Salford, said he merely rose to contradict a statement which had been made during the discussion with reference to the "on-and-off" system. It had been said that the system was a failure, but such was not the case, for it was a success. It had been at work in Salford for eight years, in one of our busiest roads, and one where the traffic was conducted in a most extraordinary manner. The traffic there, in fact, was the worst conducted traffic in the universe, and if Sir Joseph Heron had been present he would have corroborated that statement, but the system to which he had referred had worked there most satisfactorily for eight years, and, no accident arising from it, had been proved before the corporation. He had testimonials in his possession from the Salford corporation, which would prove that the system was not a failure but a success. If there had been time he intended to have laid before the meeting an adaptation of the "on-and-off" system, which he had prepared especially for use in London.

The Chairman informed Mr. Haworth that if he would send his scheme to the Secretary of the Society the most important and valuable portions of it would appear in the *Journal*.

Mr. John Jones thought that sufficient credit had not been given to Mr. Adams for the very valuable suggestion he had offered as a solution of a difficulty between contending forces. It seemed to him to be rather a reflection upon the mechanical skill of London that they

should be able to ride very comfortably on any of the roads which surrounded London, but that when they come into London they should be subjected to a series of concussions which were most uncomfortable. Mr. Adams's plan appeared to him to offer a very easy solution, and they had already got half of it at work in the shape of the gutters all along the streets; and to say that the people who managed the paving of the metropolis were unable to put down two gutters instead of one was most monstrous. He had heard one gentleman denounce as disgraceful the system under which London had been paved in so very creditable a manner. He knew that the various vestries who had the control of paving gave a considerable amount of thought to the question, and were quite alive to it in all its bearings. There could be no reason, that he could understand, why, if they had done so much, they dould not do more, and he thought it would be only necessary for the vestries to see a piece of work laid down on the system now proposed, and they would very quickly adopt it. In the West Strand district they were spending on five miles of streets £3,000 a year for keeping the streets in order; they were paying for pavement sixteen shillings per square yard, and Mr. Adams's estimate for the gutter did not much exceed that. One reason why the proposed system should be adopted was, that the roads belonged to freeholders along the sides of them. It was sometimes said that the roads belonged to the public, but that was only nonsense. The public had a right to go over the roads, but the roads themselves belonged to the freeholders, as was proved by their being able to construct cellars under the roads. Another reason in favour of the scheme was that the inhabitants of a district paid for the roads; and another and a very important one was, that the eharacter of every neighbourhood depended very much upon the character of the roads; and the character of trade depended upon the class of cconveyances that passed along the roads. Fleet-street had been almost ruined by omnibuses, which carried people who used to walk home from the City; and none of the high-class businesses were to be seen there which existed twenty years ago. It was always well that the people who had to deal in a market should take into their own hands the control of the traffic and the approaches, and the conveyances coming to that market, and therefore he thought it was a very sensible thing that the vestries should have control over all the accesses to their neighbourhoods, and that they should themselves take care of the roads on which the business of the various neighbourhoods so much depend. Mr. Adam's plan seemed to provide for everything; and engineering must be at a very low ebb indeed if it could not bring a road up to the edge of his iron rail. He believed that that difficulty might easily be overcome. Of course there must be regulations, and the carriages might have to be adjusted to the peculiarities of different districts. In Paris, the carriages were all long and narrow, because the streets through which they ran were formerly very narrow, and the same thing might be necessary in London. If they had narrow streets, they must have narrow carriages. He did not see why the whole road should not be covered with these gutters, so that they might have a thoroughfare without friction, without waste, and without dust, and, therefore, without the necessity of having to pay the large sums for watering the streets which they were now continually called upon to do.

Mr. W. Bridges Adams said—Those who may have patience to read and compare carefully the paper and the discussion thereon will, I think, find that most of the objections are answered in the paper itself, but I will briefly go over the heads. Mr. Wilson raised the question as to the width of guage. It is obvious that the first consideration must be the form of the body, having reference to the convenient seating of the passengers and easy entrance and exit. For crowded streets, side sitting, shoulder to shoulder, with end entrances, has been found best. A body six feet in width would provide for this, being one foot less than the top width of the hind wheels of ordinary omnibuses. With the ordinary omnibus the wheels must be extended sufficiently to admit the body between them, and the width of that is four feet six inches only—very inconvenient. Wheels for the rails being kept under the body, the guage may be regulated according to convenience, and, as a general rule, the guage may conveniently be half the width of the body. If the passengers be seated transversely a greater width is desirable on the score of economy. Seated longitudinally, a body 6 feet wide by 20 feet long will carry 26 inside passengers; seated transversely, a body 8 feet wide by 20 feet long will carry 40 passengers inside, and the 8 feet width would do with a four feet guage. Mr. Wise was, therefore, right in saying that the width of body must govern the width of guage. Mr. Gore assumed that I advocated the "off-and-on" system. This is a mistake. The fact of laying down a rail presupposes that the vehicles are to run on the rail because it requires the smallest amount of haulage. But the "rigid system," of being unable to run off the rail under any circumstances, involves very considerable difficulties. A break-down of a tramway vehicle or any ordinary vehicle crossing over must of necessity stop all traffic behind it, just as is the case on a railway, till the obstacle be removed. We call this street way a tramway, but in truth it is a railway, requiring all railway appliances, such as points and crossings, and sidings, and turntables, at specific places. On a railway, people prefer a break-down to happen as near as possible to a siding. But in crowded streets the break-down may occur anywhere, and, therefore, my proposition of channel rails has for its object the desirable facility of drawing the vehicles off the rails when needed to pass round the obstacles or break-downs which unexpectedly occur, and thus leave the traffic unimpeded. Supposing a tramway with flange wheels from the Marble Arch to the Bank, a break-down on the Holborn viaduct would stop the whole line till removed, and the passengers would be in a state of bewilderment. It is therefore highly important so to construct the vehicles that, on an emergency, they can run, not as a choice, but as a necessity, on the ordinary surface of the road, till they can again get on the rail. The vehicles described by Mr. Gore, on four rigid wheels, with a base only one-third the length of the vehicle, must be constantly surging up and down, and to right and left, with great friction, and could not run at all on the common road. Everybody knows that a long wheel-base is essential to steadiness; but a long wheel-base, if rigid, is unfitted for curves, unless the wheels and axles be made to radiate. Shortening the wheel-base and overhanging the ends does not get rid of friction, but involves oscillation, and the "hogging" of the vehicle. With regard to using the tramways, there can be no doubt that they should be available for every class of vehicle, whether public or private, the weights per wheel being regulated by law, as on the old turnpikes, and also the speeds. "Nursing" would, of course, cease. Mr. Hemans simply countersigned the statements of Mr. Gore, and the same reply may serve. Mr. Morris said that "the roads were the highways of the people, and not of the district in which they happened to be." This is quite true, but no convincing argument why the road should be "made over to private companies for twenty-five years without limitation of dividends, and paid for at a valuation"—goodwill and all—at the end of the period. Mr. Morris was decidedly against the "off and on" system, which had been tried as the Howarth plan. Mr. Morris thought "that any plan for allowing carriages to leave the rails would involve wider carriages and a different construction." The only difference of construction would be in the arrangment of the wheels and axles, and every existing tram carriage or omnibus could be altered with little difficulty or expense to suit the channel-rail system. The flange-rail system is especially

adapted for a monopoly of special vehicles. The channel system is adapted to universal use, and would, therefore, no doubt, be objectionable to a company desiring monopoly. Sir Walter Sterling inquired why the system of tramways tried some ten years ago had been a failure. I suppose Sir Walter alludes to the London tramways of Mr. Train. Tramways in the provinces have not been failures, though no doubt very defective. Mr. Train's plans failed from faulty structure, both in the system of rails, which rapidly wore into ruts alongside and disintegrated the whole, and also by the rigid construction of the vehicles, which were hard of draught, and required the application of railway paraphernalia in the form of points and crossings. And they were only experimental lengths, in inconvenient localities —"from nowhere to nowhere." Mr. Greaves was right in saying that the flange system was bad in itself, and the structure of the permanent way bad also, and also in his description of the depôts of American tramway carriages. And it is quite true that the "radiation of the axles" is a necessity if we look "at the grand thing in all tramways, reducing the fraction to a minimum." But he was not happy in his proposition to run flangeless wheels on very narrow rails without any guidance other than that of the driver and horses. The result would not be better than in the case of any other tramways subject to have ruts worn along their edges. The model exhibited by Mr. Greaves of the radial carriage is an illustration of a system produced by me as far back as the year 1837, and treated of in a volume, published by Charles Knight, entitled "English Pleasure Carriages." I gave them the name of Equintal Carriages, and a number of them were built and sold to various carriage users for road purposes; and one was built for the rails of the Birmingham and Gloucester Railway Company, a four-wheeled, four-bodied first-class, jointed in the middle, so that each axle could radiate to curves of a chain and a-half radius. The vehicles for the road were of two separate varieties, some constructed with a jointed body and others with a perch connecting the bodies, and regulated by a cross-bar, on the mode shown by Mr. Greaves's model. One of the latter class vehicles designed by me was built for the Duke of Wellington, and was capable of six changes into two-wheel and four-wheel vehicles for one, two, or four horses. It was a hobby with the Duke, who scarcely ever used any other carriage; but it was by no means a hobby with his servants, who had to put it through all its various changes continually to exhibit to visitors. If such vehicles are to obtain for tramways without rail guidance they will require a wide track, and probably the best road for them would be what are called stone trams. But there are two objections to them for tramways. First, both axles are obliged to radiate together to the same angle at the same time, which is not favourable for severe curves; and with a given length and breadth there is a great loss of sitting space by the division, together with inconvenience in entrance and exit. The omnibus design shown by me in "Pleasure Carriages" provides for entrance and exit right through. Mr. Chadwick gives us very clearly the statistics of the sanitary advantages to be gained by easy and cheap transit to the suburbs, and beyond, of great cities; and also brought out the engineering fact gained by the experiments of the French Government that a horse can draw on a tramroad three and a half times the load of an ordinary road at the same speed, and two and a quarter times the load up a gradient of 1 in 100. And he is also thoroughly alive to the advantage of substituting chemical and mechanical power for haulage instead of horses. If the advantage of tramroads be, say 2½ to 1 in saving haulage by horses; with the mechanical horse, the reduction in cost by engine and train would probably be something like seven-eighths of the present horse system on the ordinary roads, or a reduction from 8d. to 1d. Captain Tyler said "there was a little difficulty in defining what was a tramway, and saying where a tramway left off and a railway began." Here is one definition: A tramway consists of a rail with a rising flange and a plain wheel. A railway consists of a plain rail and a wheel with a falling flange, and there is less friction and more oscillation with the railway by reason of the gravitating action of the curved wheels. Therefore the Brixton and Whitechapel tramways, so-called, are in reality railways in all but the name, and in working will require points and crossings, and sidings, and turntables, and other paraphernalia, including pointsmen, just as though it were a railway worked by locomotive engines. But it is by no means a good permanent way, and the repairs will not be so easy even as the packing of cross-sleepers on an ordinary line, as eight to nine inches of paving will have to be taken up on each side of the rail, instead of the twelve inches of ballast, called "opening out," on the railway proper; and, though ruts will not form in the paving stones, there is no interlocking of the rails and stones together to keep them at the same level, and there is timber to rot. Capt. Tyler, in describing the Salford tramway, says "the vehicle is like an ordinary omnibus, with wheels running on flat surfaces, and a small wheel in front working in a groove, which keeps the carriage in its position on the rails, this little wheel being constructed so that it could be raised out of the grooved rail and dropped into it at pleasure." In truth, it is an illustration of an attempt to utilise a mechanical absurdity, which has long grown into a proverb under the name of "a fifth wheel to a coach." To use this wheel a third or middle rail is needed, and the object is to prevent the front axle and wheels from radiating, and so save the trouble of guiding the horses. But this is done very imperfectly, and with enormous grinding friction and wear if the pole wags; and whatever effect it may have on the front wheels it has none on the hind wheels, unless the rails be perfectly level transversely. If there be any transverse inclination, the hind wheels will run off, one on the inside of the rail, and the other outside, and so cut up ruts. Wide level stone tracks would be far better than such rails. Capt. Tyler states the exact fact in saying "the great difficulty, and that which had given tramways a bad name in this country, was that the tramway preserved its surface while the loose stones on either side got into holes, so that on crossing you sometimes got such a jolting as would almost take your wheel off." I thoroughly agree with Captain Tyler in his clear perception that before long tramways will run along the sides of all our streets and roads, and into and across private parks, with coachmen turned into engine drivers, for the advantage of the resident gentry, carrying them on to the public roads, and this in no distant future." Mr. Briggs (of Philadelphia) was a decided opposer of tramways, considering them generally mischievous to the city communities in America. "They had destroyed their roads, ruined their cities as far as travelling in them was concerned, had embarrassed the business of the country, and had merely enabled some unscrupulous speculators to engross the public streets for their own private advantage. There was formed by degrees along each side of the tramway a deep irregular rut, which it was next to impossible to drive any private carriage along, or diagonally across. And though all vehicles had a right to run on the rails, the car conductors and drivers bullied them and nursed them in such a manner as practically to deprive them of the right. Moreover, the cars were used for carrying all kinds of commodities, bundles, parcels, and provisions, including 'dressed hogs,' and very badly dressed passengers." Mr. Briggs went on to say "that he looked forward to the improvement of the roads, and the use of vehicles with large wheels on them, as the true direction of progress, all the wheels being of equal size." Analysing the objections of Mr. Briggs, they resolve themselves, first, into bad municipal laws, badly put into execution, and leaving the regulation of public vehicles wholly to speculators and jobbers; secondly, to bad

engineering in the construction of the tramways. With regard to the first objection, Mr. Briggs should be aware that in London also, parcels and passengers, and babies, and other "small deer" are carried by certain lines of omnibuses, and not by others. And why not, if the various cargoes be sorted? The old stage coaches carried everything; people and sacks of corn, and pigs and fowls, only not inside, "the curled darlings of our nation" being always held in reverence, a practice which will in time grow up in the States also. With regard to the improvement of the roads and road surfaces, it is a question first of cost, and next of efficiency. The best surface is that of hard, elastic metal, iron or steel. The worst, brittle loose stones. If the metal surface provides automatic guidance for the wheels, a very narrow strip will suffice. With wheels travelling over a very large surface, the whole road must be covered at a greatly increased cost. Under no circumstances can the stone be so used as to diminish friction to the utmost limit, or anything approaching to the iron. This difference Mr. Briggs proposes to make up by the use of large wheels, but large wheels increase dead weight considerably; their advantage is that they span the inequalities of the rough road and diminish the blows in effect. But they are chiefly advantageous on the level. Up an incline they increase the haulage resistance both by back leverage and dead weight; and, moreover, they are very costly to keep in repair. When Hansom cabs were first brought into use they had wheels six feet in diameter; they were costly to make, very heavy, and wore out rapidly. The inventor of the cab was Mr. Hansom, the architect of the Birmingham Town-hall. He had become enamoured of the Liverpool town cart, with high wheels and a deep cranked axle, and, with the help of some friends and a company, he took a patent for applying the principle to a London cab. One day a strange-looking two-wheeled vehicle drove up to my door, and a stout gentleman got out to ask if I would take a ride with him to give my opinion of it. The entrance was in front, and the driver sat outside on the off-side. Passing the edge of the wheel with some difficulty, my new friend and I got inside, and it was certainly a tight fit for two. We were driven off over a soft piece of road, and presently came on a piece of rough stone pavement, whereon I called out lustily to stop, and got out. "What is the matter," asked my friend?—"Why, it is a cart! You have forgotten the springs!" "Well, I thought it was rather hard!" he replied. The next alteration was to put springs to the seat, with none to the floor, inducing a very odd kind of riding. But neither did that answer, and the matter was turned over to Mr. John Chapman, who produced the now existing Hansom, my contribution to which was the plan of driving from behind, over the roof. The 6ft. wheels were found not to answer, and were diminished to 5ft. 6in., then to 5ft., and finally to 4ft. 6in., at which they were found practicable, and that is the size usually adopted for the hind wheels of omnibuses. The class of omnibus to which Mr. Briggs calls the attention of engineers will be found in the volume on "Pleasure Carriages," four wheels, each 4ft. 6in. in diameter, and the body bending at the centre. But I prefer the radiation of small wheels on rails to the radiation of large wheels on common roads, for obvious reasons. The inconvenient arrangement of entrance behind and also to the roof, alluded to by Mr. Briggs, has been governed in street omnibuses by the desire of keeping down weight and bulk, sparing space and horseflesh. Sir Joseph Heron illustrated the general condition of the public mind, alive to improvement, but fearful of making some mistake difficult of rectification; and, no doubt, Mr. Briggs's picture of tramway abuses in the States will prove a very valuable corrective against like abuses here. Mr. Haywood "had no more doubt of the ultimate success and extension of tramways than had Captain Tyler, and that it was the case of the great convenience and comfort of the hard-working many against a much smaller inconvenience to the few. He also was of opinion that municipalities, and not vestries, should govern the system of roads in their respective districts, and that the system must ultimately prevade the length and breadth of the land. He also was of opinion that one of the inherent defects in tramways, or street railways, in all towns, was, that it led to bad paving. In Liverpool the tramways were already subsiding, and wearing into ruts. The general tendency was to wear outside, and immediately alongside the road a long rut, and this was the real objection to tramways." Mr. Haywood also sees that the question of "mechanical haulage against horse traction is only a question of time, whether for goods, merchandise, or passengers." Mr. Malcolm spoke good common-sense as to the administration of the tramways—that individual skill and enterprise should be called for to construct and work them, subject to municipal control under municipal ownership. I would add to this—also for municipal profit as a generally improved mode of collecting municipal revenue. Having gone through the details of the discussion, it will appear that, apart from any question of administration, the really important question is how to construct the road and vehicles, so that we may get a permanent structure, with facility of preventing blocks and impediments in the process of working, together with the minimum of resistance to haulage. All testimony goes to the fact that ruts form rapidly along the course of the rails; and Mr. Haywood considers this to be caused by the want of a system of break-joint, keying rail and road together. So satisfied is Mr. Haywood of this, that when he lays down cast-iron gutters in the streets he casts them in joggles, or teeth, alternating with paving stones between them, break-joint. There is another mechanical consideration, how to keep the rail and road at the same level. The surface on which the wheels run is one thing, whether a channel for a half-round tire, or with a groove for a flange-wheel; the mode of application is another. The theory of a paved or macadamised street is a flat arch abutting at the kerbs. But however solid this may be transversely or longitudinally along the line of the curbs, it must, and especially on a wide street, be weak longitudinally towards the centre. If a pair or two pairs of flanged rails be laid longitudinally along the central part, the longitudinal strength will be equal to their strength as beams. This is precisely the principle on which fire-proof floors are constructed in buildings. In looking at the system of tramway I propose, it will be seen that the section of my tram-rails resembles that of house floor-beams, viz., a vertical rail with a top and bottom flange forming side channels on which the brick arches abut in the case of the house floor, and the paving stones or macadam in the case of the tramway. As the rail joints are firmly fixed by elastic fishes, the whole length of rails acquires an equal longitudinal strength, and the road structure thus becomes far stronger than one on which no rails are applied. It will be seen that the granite blocks of the road rest in the side channels of the rails and on the bedding of concrete, the upper part of the blocks being chipped away to make room for a layer of asphalte, which is an elastic and not a brittle substance, and sustains the rail without hardness or damage. It will also be seen that, the granite blocks being bedded under the rails, there can be no vertical joint exposed to wear, nor can there be any sinking either of the rail or the granite independently of each other; and it will also be seen that the granite blocks are laid break-joint, and the whole system is far firmer than an ordinary road without rails. A very small portion of asphalte appears between the rail and granite, and there is no tendency whatever to form ruts any more than with the ordinary surface. There is no tendency in the granite to separate from the rail, and if laid in good concrete the stones will become immovable. With regard to the channel, a width of five inches and a depth of $\frac{3}{4}$ will give a lateral incline of one in three, perfectly easy for a wheel to enter, and quite safe against running off the rails, the more especially as both wheels

on each axle act both to right and left, and not in one direction only, as on railways proper. Yet there is no difficulty in drawing the vehicle off when required, as all the wheels and axles are radial, and the spring tires and gravitation action of the vertical bearing shackles will always keep the wheels running in the centres of the rails by self-action when not purposely turned off. In laying down the rail temporary gauge ties, clipping over the top, with wood blocks to keep the rails steady, are used, the lower flanges of the rails resting on the concrete foundation; the paving stones are then placed in position on the side channels and run in with cement; the hollow under the rails is then run in with liquid asphalte, and the whole is complete. If the asphalte ever gets loose it can be replaced by the same process. Of course for city use the rails will require to be heavier than for the suburbs. No permanent tie-bars are used. There is no reason why in this system a carriage should not be able to travel from Pentland Firth to the Lizard, precisely as in the old posting time, turning off and stopping on the road whenever desired, and resuming the track at will. Nor is there any reason why a man should not have a travelling house like the gipsies if so inclined, and without the gipsy's difficulty of transit. But the condition must be uniformity of gauge, proper wheels and axles, and limitation to a maximum weight on each wheel, and a given rate of speed; and there is no reason why the existing omnibus throughout the whole municipalities of England should not be converted at a very moderate cost to the uses of the tramways. Stone trams in crowded streets have been advocated, as giving greater facility without guidance. No doubt they are an improvement on small paving stones, as they do not tilt or shift. But their cost is heavy—£6,000 per mile. Cast-iron may be used with greater advantage in lengths of 4 ft. by 1 ft. 3 in. wide, and ribbed below to the depth of 4 inches, the weight of each casting being 3 cwt., about 400 tons per mile; cost about £1,500 per mile, or one-fourth that of the stone; and they can be cast with curved channels. Thus each line of tram presents three surfaces, 5 inches width if hollow, for automatic guidance, and two surfaces, 5 inches wide each, for plain wheels. The total external width is 6 ft. Thus, in this arrangement, carriages may run all four wheels, guided with radial action and spring tires; or ordinary omnibus wheels or cab wheels suiting the guage may run in both channels, or if not suiting the guage, they may run with the wheels on one side in the channel, and the wheels on the other side on the plain tram surface, yet with the advantage of automatic guidance. And thus there will be no tendency for the wheels of ordinary vehicles to cut ruts alongside by slipping off the rails. Spring tires will prevent all blows and wear, and with the castings made heavier, there would be no difficulty in running spring-tired light engines on them. But there is one drawback, in case of repairs to the road or sewers the traffic must be stopped. With wrought rails they could be supported by cross timbers below, and the traffic of the tram vehicles proper go on as usual.

The Chairman said:—In closing this discussion, I do not propose to sum up what has been said by the distinguished and able gentlemen who have taken part in it, but rather to lay before you some general conclusions for your consideration. The first great question to be settled is, are tramways likely to be of public advantage? To commence with first principles, that which has most contributed to the progress of traffic has been the diminution of surface friction on roads; and, if good details and arrangements are adopted, surface friction must be greatly diminished on tramways as compared with common roads, and a consequent saving in the cost of traction may be expected. This saving, being divided between the public and the workers of tramways, should give cheaper rates to the passengers and greater profits to the carrier. But there are clearly limits to the districts where tramways can be properly introduced, and interference with the public good, by inherent defects, by mismanagement, or otherwise, may render their use undesirable; and, in any case, all points affecting such questions will require careful control. Among the possible evils of tramways would be the interference with general traffic, the causing of injury to common roads, the slipping of horses on tram-plates, and the interference with access to water, and gas pipes, and telegraphic lines, although it is to be hoped that the adoption of subways will soon lead to the disappearance of this last objection. There is an obvious limitation to the use of tramways caused by the width of streets. The precise measure of that limit it would be premature at this moment to fix; but it would probably exclude tramways not only from the heart of London but from a large portion of all large towns. The remedy for many objections may, no doubt, be found by good structural details and by judicious general regulations, still, considering the unavoidable limitations and difficulties, I think we shall find that if tramways are largely and advantageously worked, it will be principally in wide trunk streets, and in the populous suburbs of large towns, extending, perhaps, to rural districts, as feeders to railways. The second question of importance is the consideration of the principal mechanical conditions which should be attached to the construction of tramways; and these, I think, may be laid down as follows:—1. Uniformity of gauge in any one district, and uniformity of character of tram-plate and wheel. The evils of different systems are too obvious to require argument. 2. Simplicity and strength of tram-plates and compactness with the adjoining roadway. It appears that compactness with adjoining roads has not yet been satisfactorily accomplished, either here or abroad, on roads of large traffic. 3. Avoiding, as far as possible, interference with other traffic, and injury to common road carriages, and slipping surfaces for horses feet. The first two points can, perhaps, be more readily dealt with than the last. 4. The diminution of friction and blows to the utmost practicable extent, flange friction being a serious evil as well as rolling friction. 5. Facility for traversing curves and passing from one line to another, and the avoidance at the same time of the complications and expense, and the danger to other traffic arising from switches and crossings. 6. Simplicity and facility of working as affected by the carriages used. Many of the structural requirements above named would be met by the use of granite tramways, but their cost seems to be an objection. The plans brought forward by Mr. Bridges Adams can only be finally judged by experience, but they seem to meet many of the mechanical necessities of the case. The tram-plate is simple and strong for its cost, and the use of an asphalte bed would appear to give fair hopes of making a good joint with the adjoining road. The small depression in the tramplate sufficient for guiding purposes would probably be little felt by other carriages. The friction would be very small, and flange friction would be entirely avoided. It would allow the easy traversing of curves and passing from one line to another, and would entirely avoid switches and crossings. It has this notable advantage, that it might be used in the simplest way with vehicles of ordinary construction, to which, however, a spring tyre, as proposed by Mr. Adams, would be a valuable addition, as saving wear. The third great question is, the best mode of carrying out, constructing, and working tramways, with the extent of government or other control to be adopted. The commercial spirit of the country, and the prevailing feelings with regard to public enterprise, perhaps point to the conclusion that it would be desirable that tramways should be mainly executed and worked by joint-stock companies; although, if municipalities desire to undertake them, on terms favourable for the public, there are well-known examples in favour of such a course, to be found at Manchester, Glasgow, and elsewhere. But if tramways are to be of extended use, great loss, great inconvenience, and great disappointment may be avoided, if the public will give up some of their fear

of centralization, and give adequate powers of direction and control to governing bodies. I do not presume to lay down any general scheme, and I cannot but think that such a scheme would be best elaborated by a Royal Commission, after careful investigation of the whole question. Ultimately, it may probably be found that the Board of Trade would be the department best suited for the chief administration, and that the authorities charged with local powers of control should have as wide a composition as possible, to counteract the influence of local interest or prejudice. Thus, in London, the Metropolitan Board of Works, and, in large towns, the borough authorities, would offer greater securities of successful action than detached parishes. It is now my duty to ask the cordial expression of your thanks to Mr. Bridges Adams for the excellent paper which has led to this valuable discussion on a great question of the day. I have had the advantage of his friendship for about thirty years, during which he has brought out some inventions of great public value, but from which he has derived far less benefit than others. You know how many years ago he pointed out the advantages of tramways; and if in this, as in other matters, his aspirations have been in advance of the age, he has had the satisfaction of seeing much good to his fellow men result from the labours of his life; and I believe him to be so true a philanthropist as to look upon such results as his best reward.

Mr. Hyde Clarke proposed a vote of thanks to the chairman, which was carried unanimously, and acknowledged by Mr. Gregory.

Mr. R. Briggs writes :—

"Will you permit me to add a few words in explanation of what was said by me at the meeting of the Society on the 23rd ult., as I find that some writers who have quoted my free expression of the abuses and difficulties accompanying the use of tramways and their carriages in the cities of the United States, have assumed further that my condemnation extended to such ways and carriages in all localities, and under any conditions of possible improvement. It should be observed that my description referred to the faults of management, the wants of lawful control, (either by absence or by non-enforcement, of the law) and to the duty of preservation of the roadway where there is heavy or considerable traffic, inherent to the longitudinal track, the iron bars of which cause or induce ruts, using the American example to illustrate the point. The more carefully weighed statements of Mr. Haywood, at the same meeting, give due importance to the need of balancing the want of cheap and comfortable personal transport for the suburban population, with the other requirements for traffic in the City (or in the cities of England, to take the general case). The introduction of street tramways in the minor thoroughfares, beyond the business portions of all cities, can be regarded as inevitable; whilst I endeavoured to hold up in prominent view that the American system should be profited by, not through following, but as a lesson to learn from. No engineer is warranted in saying that an engineering difficulty is insurmountable, nor is it justifiable to assume that a change at some future time (or even presently) in our private and public road conveyances may not be wished for or accomplished to the advantage of the community.

"A most serious trouble in America comes from ice upon the rail, or within the groove, from the flange of the wheel necessitating either a broad surface below the tread, or a large groove with well-opened sides. Here in Great Britain, a rail can be adopted with a groove only sufficiently wide for the flange of the wheel, so narrow that no English carriage tire can catch in it. Such a rail, with a row of deep serrations upon the upper side within the wheel-track, intended to form a fast hold for a horse, has been employed upon the Liverpool tramways and upon the Whitechapel route here in London.

"It is no more than justice to the contractors who have built their lines, to acknowledge their improvement on the American practice.

"It must be admitted that constant watchfulness and instant repair will measurably relieve the timber from rutting along each side of the rail. As I do not wish to have imputed to me intentional misrepresentation or exaggeration, I would state that the surprising load of peach baskets was seen by me on the Lombard and South-street line in Philadelphia. That, by computation, the greatest number of passengers which a large New York car can take is 80 or 90 adults, whilst a Philadelphia car can only take 60 or 70. The tops are not seated in either cars; the heat in summer and the cold in winter making the roofs uncomfortable; and only in few cases are they constructed to carry passengers.

"The habit of crowding passengers, standing up, loads the cars to the limit of haulage by two horses. As to the actual speed of travelling, I find by an examination of the times, compared with distance, I can now remember that the average rate, from end of line to end of line, in Philadelphia, on one of the best routes, is four miles per hour, which gives $3\frac{1}{2}$ miles in the business portions, and $4\frac{1}{2}$ miles in the uncommercial districts. I trust that English usages and laws may on this point, as in others, prove examples to us in America, and not warnings."

Mr. W. Lloyd Wise writes :—

"I attended last evening's meeting, accompanied by Mr. John Haworth, the inventor of the "on-and-off" system of tramways and vehicles adopted in Salford and Geneva, but, as there were so many speakers, the time allowed to Mr. Haworth, who came to London expressly to take part in the discussion, was too limited to admit of a full explanation of his system, while I, like others, was prevented from speaking at all. Under these circumstances, I trust you will favour me, as a member, by inserting this communication in the *Journal*. I will commence by describing Mr. Haworth's system as laid upwards of eight years ago, along Chapel-street, Salford, and Broad-street, Pendleton, which form one continuous street under the two names. There are two T-iron rails, each three and a half inches wide, for the wheels to run upon, and they are made so that their upper surfaces are level with the road. In the centre, between the two T-iron rails, there is a third rail, two and a half inches wide, formed with a groove along its upper surface; in this groove a small guide-wheel works, which the driver raises and lowers by a treadle when the vehicle is required to leave the trams and run on the ordinary road. The three rails are fixed on longitudinal wooden sleepers, three and a half inches wide by six deep, the tongues of the rails being let into the centres of the sleepers; the cost per mile is about £1,200. The line belongs to, and is worked by, the Manchester Carriage Company (Limited), and the vehicles employed are omnibuses, carrying 36 passengers, whereas ordinary Manchester omnibuses carry about 40, but the reason is that during a part of their journey the tramway 'busses have to travel up hill, where there is no tramway, and they have only two horses instead of three, as employed for the larger vehicles. The tramway omnibuses have ordinary wheels, all four, however, being of one diameter, namely, 42 inches. The diameter of the guide-wheel is about 16 inches. The vehicles are fitted with ordinary breaks, and the drivers state that there is no perceptible difference between stopping on the trams and on the ordinary roads, they being able to pull up within about an equal distance in both cases. The trams were specially put down to suit the Manchester omnibuses, and, consequently, are not much used by ordinary vehicles, because the gauge is too wide. They are much liked by the inhabitants, because the noise of the passing vehicles is deadened, and no accidents have occurred by the slipping of horses on the trams. They are also liked by persons who use the

omnibuses, because the vehicles run so much more steadily, and with so much less noise, than on the ordinary roads, that passengers can comfortably read while travelling.

"The system was introduced to the notice of Mr., now Sir William Fairbairn, in his capacity of President of the British Association, in 1861, and he, being much struck by its novelty, suggested that it should be laid down for trial in Salford, where it has been working most successfully ever since.

"For large cities, like London, Mr. Haworth proposes to dispense with the guide-wheel and the groove in the centre rail, and to use that rail simply as a guide for the drivers to sight by, in connection with the poles of the vehicles or the heads of the horses, and thus keep the track. I am in possession of some facts relating to the Liverpool tramways, but as they have been alluded to by other parties in the discussion, I will not now trouble you with any remarks on the subject.

"I like Mr. Haworth's plan, because it is calculated to benefit the general traffic of the streets, and does not necessitate the employment of specially constructed vehicles; moreover, as any vehicle can readily leave the line and return into it, special facilities may be afforded to those which are heavily laden by giving them the preference in using the trams, and thus not only relieving their horses, but also saving the roads and reducing the cost of maintaining them. In connection with such a system it would, I think, be advantageous to employ steam omnibuses, such as are now being introduced in Edinburgh. I will just trouble you with a few extracts from a letter I have received from the designer of one of these vehicles, Mr. Andrew Nairn, of Leith. He says:—"The subject of locomotion through the streets of our towns and on common roads has occupied a good deal of my attention for a considerable time back, both for the transporting of light and heavy goods and passengers. I have no doubt that ere long steam will be generally employed in those branches of traffic, but the engines must not be noisy, as ordinary locomotioves are, nor smoky. Some time ago, I designed an omnibus to work with compressed air, the reservoirs being under the passengers' seats. This, no doubt, would be a capital motive power, but the expense for plant to keep the reservoirs charged would be great. Latterly I designed the steam omnibus, the subject of this letter, and in setting out I kept two things constantly before me, namely, to have the appearance of the carriage, as much as possible, like that of the ordinary omnibuses now in use, and also to have the least possible noise and smoke while working. The first step I took towards accomplishing the last-named result was, to have a large excess of heating surface in the boiler, and for this purpose I employ Field's patent tubes, consequently I do not require to contract the exhaust-pipe. The boiler is of the upright type, and is set on the front of the carriage, a double partition separating it from the inside of the carriage. The cylinders (three in number) are placed at the rear of the carriage, under the conductor's foot-board, the connecting-rods being coupled direct on to the driving axle. The exhaust steam is first discharged into a large receptacle; thence it passes to the boiler, where it gets superheated and dried up; thence along a horizontal funnel under the ouside passengers' seat, making its exit at the rear over the conductor's head. By these means the disagreeable puffing of the exhaust is avoided. This funnel has two outer cases of iron, between which a current of cold air constantly passes, so that no heat can be felt by the passengers outside. The boiler is also made to burn coke, rendering it smokeless. The result of this arrangement is, that when the carriage is running, there is only a continuous invisible stream issuing from the funnel. The boiler is fed from a tank underneath the carriage, capable of holding 160 gallons. The wheels that I have at present are fitted with wood, about 9 in. wide, built end on. There are three of them, each 38 in. diameter, but they are merely experimental. I intend to put on my patent fibrous tyres, protected by cross steel plates; but the wood seems to stand very well. By running on the macadamised road, the wheels have clothed themselves with a tyre of macadam equal to the road itself.

"The two driving-wheels are not rigidly fixed to the axle, but they are attached by a brake strap to a brake pulley keyed on the axle, so that the carriage can turn the sharpest corners, each wheel adapting itself to its relative speed. The front or steering wheel is carried by a fork, and steered by the man in front. The springs are all made very sensitive, being provided with india-rubber washers.

"Altogether the omnibus is scarcely distinguishable from those now in use, the whole machinery, boiler, &c., being hidden from view. These machines in no way damage the road, rather the reverse, and they can be guided with the utmost precision anywhere, and are capable of running at high speed when necessary. Where tramways exist they would be admirably adapted for that kind of traffic.

"In conclusion, I may remark that in my opinion tramways will not be found suitable for crowded thoroughfares, nor do I think that any tramway will be likely to give permanent satisfaction to the public unless worked on the "on and off" principle, so as to accommodate the general traffic of the streets without arbitrary traffic regulations."

CHEAP RAILWAY TRAVELLING.

The following correspondence has taken place between Mr. G. W. Jones, the author of the paper reported in the *Journal* of the 4th March, on "The Causes and Consequences of High Charges for Passengers by Railway," and Mr. James Allport, the manager of the Midland Railway, in reference to the discussion which took place on the reading of that paper.—

25, Essex-street, Strand, 15th March, 1870.

Dear Sir,—In my paper read before the Society of Arts on the 2nd inst., in answer to Sir D. Gooch's assertion that "any reduction of fares would be prejudicial to the interest of the shareholders, for people will not constantly travel because they can go cheaply," I said, "Perhaps it would not be possible to furnish an answer better calculated to refute both the opinions expressed in this short sentence than by a simple statement of the result of the operations of workmen's trains on the Metropolitan Railway;" and I showed that "in the first year that company carried 151,000 workmen only, at a penny the journey; the next year, 350,000; the next year, 455,000; in 1868, 580,000; and last year, 765,000," which figures abundantly show that "the people will travel because they can go cheaply," and you acknowledged the correctness of these figures. I further stated that "the manager acknowledges that these trains are as productive as any trains that run upon the line;" but this assertion you disputed in terms as follows, as reported in the *Journal of the Society of Arts* of March 4th: —"It is quite true that the Metropolitan Company, last year, carried 750,000 workmen, the fare being a penny the journey, and the distance traversed was 4,200 miles; the total receipts would be, therefore, £3,000 per annum," and you were "quite certain that any man practically acquainted with railway matters would say that no trains could be run for anything like the amount per mile which that sum would give when divided, and, consequently, the Metropolitan Railway, although they carried 750,000 passengers, must have lost by them considerably."

Now, 4,200 miles, divided into £3,000, gives 14s. 3d. per train mile, which is more than four times the average produce of the passenger-trains on the great railway you superintend, that being, as nearly as possible, 3s. 4d. per train mile; and it is three times as much as the average

receipts on the Midland Railway for all trains, goods and passengers included. You will greatly oblige me, therefore, by explaining your assertion, which I have just quoted.

The last words of that assertion, spoken by a gentleman of your high standing as a railway manager, are understood by every reader, and few take the trouble to analyse the figures, and compare them with well-known facts; they, therefore, have a much weightier effect than any statement made by me upon the subject, however carefully my data may have been selected. I feel it advisable, therefore, to give you the opportunity to explain the statement before I myself endeavour to correct it.

As you may not have at hand a copy of the last Metropolitan Railway report and accounts, I send you a copy by this post, by which you will see that the total half-year's expense is £81,221, and the total train mileage 709,133. This gives an average cost of 2s. 3d. per train mile, including all the "general charges," law, compensations, rates and taxes, government duty, agents' commission, interest on bankers' balances, and omnibus working expenses.

I shall anxiously await your answer.—I am, &c.,

G. W. Jones.

James Allport, Esq.

Midland Railway, General Manager's Office, Derby, 19th March, 1870.

Dear Sir,—On my return home, I find your letter of the 15th inst., on the subject of cheap travelling.

There is evidently some mistake in the figures given relating to the increase in the number of passengers carried by the workmen's trains on the Metropolitan Railway, as, from a conversation I have had with the manager of that company, since the matter was spoken upon at the Society of Arts, I learn the number carried in 1869 was more than 100,000 less than the number named by you.

A mistake has also crept into the report of the remarks I made at the Society of Arts' meeting, arising, perhaps, from my speaking somewhat indistinctly, as instead of the mileage of the workmen's trains being 4,200 miles, it is really between 30,000 and 40,000 miles.

I am quite satisfied of the correctness of the views I expressed with reference to the unremunerative character of this description of traffic; and there are a variety of circumstances connected with the working of such traffic with which persons not officially connected with railway companies have not an opportunity of being acquainted; and as regards the Metropolitan Railway, I am confirmed in the views I expressed by the manager, who tells me their workmen's trains are not remunerative.—I am, &c.,

James Allport.

G. W. Jones, Esq.

25, Essex-street, Strand, 21st March, 1870.

Dear Sir,—I am honoured by the receipt of your favour of Saturday's date, in reply to my letter of the 15th inst.

I send you enclosed a copy, from the company's books, of the number of workmen carried on the Metropolitan Railway in the year 1869, *i.e.*, from 3rd January, 1869, to 1st January, 1870, from which you will see that the number stated by me at 765.000 is strictly accurate, indeed within the mark, and these figures are furnished to me by direction of my friend, the manager. I have also Mr. Myles Fenton's direct authority for stating, in reference to the workmen's trains, that "the receipt per train is equal to the others, but the cost of specially running these trains is something greater." This arises simply from the fact that, in order to run these trains, the traffic commences at 5 a.m., instead of 6 a.m., and the staff have to be on duty so much earlier, and three trains only are run within that hour, whereas seventeen trains per hour are run in other hours of the day; consequently, the comparative cost is so much greater.

As regards the number of miles run by workmen's trains, pardon me for saying your correction is more at fault than the original statement. By Act of Parliament, the Metropolitan Railway Company are only required to run one train per day each way. The distance is $7\frac{1}{4}$ miles, and, omitting fractions, 14 miles a-day for 50 weeks would be 4,200 miles, as stated by you, and this, I think, will account for the error originally made by you. But the exact facts are as follows. In consequence of the profit obtained by working these trains, the company run three trains per day instead of one train only. This, at $7\frac{1}{4}$ miles, gives $43\frac{1}{2}$ miles per day, or 13,572 miles per year, the cost of which, at 2s. 3d. per mile, would be £1,526 17s. Then, 765,000 pence is £3,187 10s., which, after deducting the cost, would leave £1,660 13s., or more than 100 per cent. profit, and that after allowing all expenses. But that would not be fair to the workmen's trains. If we omit the extraneous items named in my letter, which the running of trains cannot affect, the cost of trains on the Metropolitan Railway is 1s. 9d. per train mile only. This would reduce the cost to £1,187 11s. only, and, deducted from £3,187 10s., leaves £1,999 19s., say £2,000, or nearly 200 per cent. profit.

How a loss can be shown against these figures I am at a loss to conjecture; and if I have been guilty of any omission or error I will truly thank you to set me right.
—I am, &c.,

G. W. Jones.

James Allport, Esq.

The following is a copy of the statement inclosed:—

Metropolitan Railway.

Passengers conveyed by Workmen's Trains, from Jan. 3rd, 1869, to Jan. 1st, 1870, being a year minus one day:—

January	3 to 9	8,902
,,	16	9,055
,,	23	9,235
,,	30	8,898
February	6	9,908
,,	13	10,272
,,	20	11,154
,,	27	11,379
March	6	11,963
,,	13	12,402
,,	20	12,506
,,	27	10,210
April	3	11,285
,,	10	14,297
,,	17	15,307
,,	24	16,041
May	1	16,677
,,	8	16,794
,,	15	17,188
,,	22	13,146
,,	29	16,745
June	5	16,819
,,	12	17,141
,,	19	17,293
,,	26	16,916
July	3	16,393
,,	10	16,649
,,	17	16,787
,,	24	16,435
,,	31	16,301
August	7	16,650
,,	14	17,273
,,	21	18,434
,,	28	18,371
September	4	18,276
,,	11	18,230
,,	18	18,383
,,	25	18,514
October	2	18,679
,,	9	18,375
,,	16	18,456
,,	23	17,372
,,	30	16,277

November 6	14,579
„ 13	13,806
„ 20	13,854
„ 27	13,702
December 4	13,006
„ 11	13,443
„ 18	14,378
„ 25	12,072
January 1	8,108
Say for 1 day	664*
	765,000

Midland Railway, General Manager's Office, Derby, March 26th, 1870.

Dear Sir,—On my return home, I find your letter of the 21st instant.

I cannot understand how the discrepancy between your information and mine arises, as I also obtained mine from the manager of the Metropolitan Railway.

I am still of the opinion I expressed with regard to the unremunerative character of this description of trains; and if the differences between the particulars you have and those which have been furnished to me are not so great as they appear to be, I don't see that it has any material bearing upon the question of running workmen's trains on the railways generally.

I have the assurance of the manager of the Metropolitan Company that the trains are not remunerative to them; and if this is the case in a district like that through which the Metropolitan Railway passes, it will be easily understood by anyone, even if they have not had any experience in the working of a railway traffic, that it is quite out of the question that such rates as those proposed by you would pay railway companies where the district passed through is not so favourably situated as regards population.—I am, &c.,

James Allport.

G. W. Jones, Esq.

26th March, 1870.

Dear Sir,—In justification of the statements contained in my paper, I feel it necessary to publish, in the *Journal of the Society of Arts*, the correspondence which has passed between us on the subject of the labourers' trains on the Metropolitan Railway. If you wish to add anything to what has been stated, I shall be glad to be favoured with your further communication, which shall be added to it. Awaiting your reply, I am, &c.,

G. W. Jones.

James Allport, Esq.

Midland Railway, General Manager's Office, Derby, 28th March, 1870.

Dear Sir,—I am in receipt of your letter of the 26th inst., in which you intimate your intention to publish the correspondence that has passed between us on the subject of cheap fares.

You will be aware that it is not usual to give newspaper publicity to correspondence without the assent of the parties interested; and as there will shortly be a meeting held in London, at which a paper on this question will be read, I think that, instead of adopting the course you propose, it would be much better to attend the meeting, when full opportunity would be afforded you of joining in the discussion which will afterwards take place.—I am, &c.,

James Allport.

G. W. Jones, Esq.

25, Essex-street, Strand, 29th March, 1870.

Dear Sir,—I am anxious to avoid doing anything "unusual," and I should be sorry to do anything discourteous to you, but, in my first letter, I gave you distinctly to understand that my object was publicity—to confirm the correctness of my assertions; and, with that view, I felt it "advisable to give you the opportunity to explain the statements you had made." You have done so; and it is open to you still to make any further statement or explanation, or to deny the correctness of anything I have advanced, and it shall all appear with what has already been written. No letter on either side has been marked "private," and the thought of their being private communications has not been entertained by either of us. I do not think, therefore, there is any room for complaint if the explanatory correspondence be published in the same *Journal* in which the questionable statements were originally made.

As regards "the parties interested," the question at issue is a matter of opinion, at present, in which the public and railway shareholders alone are interested. I have no individual interest in the matter, except as one of them; but I have a strong opinion that the principles I am advocating are founded on reason and common-sense, and will eventually prevail; and the observations made by you at the Society of Arts have tended so greatly to obscure, if not to counteract, the facts which I had been at so much pains and trouble to collect, that I feel justified and bound to use every honourable endeavour to set the matter right. That I do not exaggerate the importance of your observations, the leading article in the *Leeds Mercury*, of the 22nd inst., a copy of which I send you by this post, will at once convince you. I cannot consent, therefore, to let the matter rest until chance may give me an opportunity of introducing, casually, an explanation.

I am, &c., G. W. Jones.

Jas. Allport, Esq.

No further communication has been received in answer to the above except an acknowledgment from a clerk of the receipt of the last letter.

G. W. Jones.

7th April, 1870.

Midland Railway, General Manager's Office, Derby, 30th March, 1870.

Dear Sir,—In the absence of Mr. Allport, I have to acknowledge receipt of your letter of the 29th instant.

Mr. Allport will return at the end of the week, and your letter shall then be handed to him.—I am, &c.,

R. Speight.

G. W. Jones, Esq.

CORRESPONDENCE.

ON A GOLD CURRENCY FOR INDIA.

Sir,—I have just returned from Italy, and one of my first occupations has been to read the report of the discussion on the subject of "A Gold Currency for India," at the India Conference of the Society of Arts, which has appeared in your *Journal*, the last part of which, however, only reached me at a late hour last night. I greatly regret that I was unable to be present at the two last meetings of the Conference, for the subject is one in which I have felt the deepest interest for years, and my regret is increased by the impression which has been left upon my mind by a perusal of the proceedings. I confess it appears to me that, notwithstanding the great ability shown by some of the speakers, and the earnest spirit in which Mr. Fitzwilliam spoke when closing the Conference—and no one is better acquainted with the subject, or has laboured more zealously to bring about the re-introduction into India of a gold currency than himself—the discussion came to a tame and fruitless conclusion.

I observe with much concern that Dr. Boycott denied, and that Mr. George Campbell doubted, the desirableness of superseding the present silver currency of India by a gold one. To these opinions, I would oppose that of Sir Charles Trevelyan, who considers the silver money of India to be as great a barbarism as the iron money of Sparta;

* The produce of each day exceeds 1,000; this, therefore, is within the mark.

of Mr. Laing; of the commission which had Sir William Mansfield for its president; of the Chambers of Commerce of Bombay, Madras, and Calcutta; and of the mercantile community generally. I am as great an advocate of a paper currency, based on a metallic standard, as Dr. Boycott can possibly be, but I can see little hope of a paper currency being widely adopted in India for many long years to come; and when I turn over in my mind the capabilities of India as an agricultural and producing country, and reflect on the vast development of her trade which is likely to follow upon the extension of railways and works of irrigation, and upon the opening up of districts which have hitherto been inaccessible in consequence of the want of roads, it seems to me that a gold currency for such a country and such a trade is an absolute necessity. Every day brings evidence in support of this view of the case. Already I hear of growers of cotton in some districts getting yields of 150 to 200 pounds of cotton per acre out of their land, under an improved system of agriculture, instead of 60 to 80 pounds per acre, as they did of old; and the recent discovery of coal at Chanda is a most fortunate and encouraging event. Of course, I calculate upon the application of wise legislation to trade, though I may be sanguine in doing so, for our Indian government has already destroyed the trade in saltpetre by imposing an exorbitant export duty upon the article, and is rapidly destroying the trade in rice by much the same policy —by retaining an export duty upon the grain which it cannot bear.

I dwell upon this point, for it seems to me until we fully recognise the fact that a silver currency is miserably inadequate to the wants of such a country as India, and that a gold currency is simply a necessity, we shall not see the change made. Let us once be convinced that the change must be made, and then all the difficulties, all the conflicting theories, all the bewildering calculations which now stand in the way of its adoption will disappear; and a bold, practical, clear-headed statesman will do the thing I for one so earnestly desire to see effected. Dr. Boycott expresses a fear that the change would disturb the commercial and social state of the country; but ought such an apprehension to stay the progress of science, and silence the teachings of political economy? What change of system was ever made without interfering with some fancied right or privilege, or interest? If we wait for a time when all classes of people shall pray for a change, and when all theorists on the subject of currency shall be of one mind, we shall wait for a time which will never arrive.

I cannot believe that it is difficult to decide what quantity of gold should be contained in a sovereign, to be coined in India, to represent the equivalent of ten rupees. I presume that, by calculating the cost of gold in Australia or elsewhere, plus the charges of purchase, of transport to India, and of seignorage, the exact quantity could be ascertained; and I believe that if such a sovereign were to be coined, its intrinsic value would be found to differ so little from that of our English sovereign that the two coins would soon circulate freely side by side.

It seems to me that, in order to change the standard from silver to gold, with as little disturbance to the public mind or to private interests as possible, it would be advisable to enact that, for five years after the adoption of a gold currency, silver should be a legal tender to any amount, and that for the next five years it should be a legal tender to the extent of five hundred rupees only. At the expiration of the ten years the silver rupee would fall quietly into its right place as a subsidiary coin.

I expressed these opinions in a communication wich I took the liberty to address to you before I left London in January last. I believe you were good enough to read my letter to the meeting, but, as it does not appear in the report of the proceedings, I am anxious to repeat them now; and, as I was unable to state them in person, may I request that you will allow my letter of this day to appear in your valuable *Journal?*

I venture, in conclusion, to suggest that, as the opinion of the Conference, notwithstanding partial differences, was decidedly in favour of substituting a gold currency for a silver one in India, a deputation from the Society should wait upon the Duke of Argyll for the purpose of urging the adoption of the measure. If the Committee should resolve to take the step I propose, the Conference will not have terminated its labours without arriving at any practical result, and there can be no doubt that the representations of so influential a body as the Society of Arts would command the earnest attention of the Government of India.—I am, &c.,

Andrew Cassels.

51, Cleveland-square, April 5th, 1870.

USE AND ABUSE OF TOWN SEWAGE.

Sir,—Not being a member of the Society of Arts, I did not see or hear of Mr. Stanford's letter until it was forwarded to me by a friend.

The utilisation of town sewage is a very large question. It is perfectly impossible to exhaust it in one paper, the reading of which is expected not to occupy more than an hour. In the paper which I read the other day, I touched on as many points as an hour would enable me to glance at; but Mr. Stanford is, I think, unreasonable in complaining that my paper was not exhaustive. It could not be exhaustive, it was only a sketch; but if he had read it carefully, he would have seen that instead of stating that "the number of population required to manure an acre" was 40 or 45, I said that, if the population was a stationary one, "not less than one acre to every 40 or 45 persons" would be required. This is a very different thing, and as I was combating the views of those persons who think that one acre to every 100 or 150 persons is enough, I was anxious not to appear in their eyes too extravagant in my demands for land. But if Mr. Stanford was a farmer as well as a chemist, he would know that tho manurial products of 40 or 45 persons, thoroughly dissolved and washed into the ground with water, could be absorbed to a far greater extent, by two or three crops in the year, than could the 40 tons of farm-yard manure, 10 cwt. of guano, and 10 cwt. of bones, which he says "would undoubtedly yield a better crop," which statement I assure him is altogether erroneous.

With regard to the views of Dr. Spencer Cobbold, they are perfectly familiar to me, being no novelty, but have been held by him for many years. Dr. Cobbold's researches are well known, and have been most valuable and instructive to the medical profession; but I would submit that the title of the pamphlet referred to by Mr. Stanford, "A New Entozootic Malady arising from the Utilisation of Sewage," is sensational and misleading in the highest degree, inasmuch as there is no such malady, and it has no existence except in Dr. Cobbold's fears; and with regard to the particular form of parasitic disease, termed Helminthiasis, which is so fatal in Africa, I shall believe that there is a serious danger of its spreading in this country so soon as Mr. Glaisher certifies that the climate of Great Britain is identical with that of the African continent. And terrible as the picture may be drawn by Dr. Cobbold, it would not make me pause an instant in my endeavour to utilise sewage by surface irrigation, for I believe that it has absolutely nothing to do with such operations in this country and climate.

Mr. Stanford complains that I did not make another quotation from his paper read at Exeter, but for this I had two very sufficient reasons. In the first place, I was quoting entirely from memory, the transactions of the British Association not having been published at the time I wrote my paper; secondly, the extract which he gives I disagree with *in toto*, and believe to be altogether erroneous. This I say without any desire whatever to

detract from the value, in other respects, of Mr. Stanford's paper. I listened to much of it with great interest; I made Mr. Stanford's acquaintance with great pleasure, and I look forward to securing him as an able advocate of sewage irrigation, so soon as he understands the question, which, he must allow me to say, he does not at this moment. But, as he was kind enough to promise to visit my Romford farm in the course of the summer, I shall be most happy to afford him every opportunity and facility for picking holes in my system. Meanwhile, I would ask him to believe that I am as honest in my views and intentions as he is, that I have nothing to conceal, that I know no weak point or serious drawback in the system which I advocate.—I am, &c.

W. Hope.

GENERAL NOTES.

Ventilation.—The Royal Danish Society of Science, among other prizes, has offered one for the best essay containing an investigation of the movement of the air in a system of ventilation. The essay may be written in English, French, German, Danish, or Swedish, and must be sent in before October, 1870.

Bishop Temple on Industrial Art.—We are entered upon what a foreign philosopher has called "an industrial phase of society," that is, the time has come when he who can do the most for the benefit of his fellow-creatures, either in the way of instructing them or in the way of comforting them, in promoting either their improvement or their happiness, whether a labourer with his head and his heart, or a labourer with his hands, will be reckoned as the most important person in society. We are come to the time. It was not so once. Once, on the contrary, the greatest man was the fighting man. But it is quite certain that the arts of industry, all the various employments which are put together under the head of labour—and allow me to include my own work as the work of a labourer, too—all these employments must very soon take the first rank, above all others. The man who will rank lowest will be the man who is thoroughly idle; and, for my part, I have always felt the deepest sympathy with the command of St. Paul, that if a man would not work he should not eat. Now, if this is to be the most important thing in society, viz., this employment of every one for the good of his fellows, it is clear that we want to study all the principles and rules by which labour of every kind is regulated, and the more we can spread the knowledge of those principles, the more we shall improve the whole state of the country. That, I say, is one reason, but it is not the only reason, why I feel so deep a sympathy in such schools as yours. Another reason is this. These schools provide one most important means by which men of all classes, including even the lowest, can, if they have any ability at all, really get some thorough cultivation of their minds. There can be no greater improvement to anyone's mind than that he should thoroughly master the principles of his own work, that by which he is to live, that which is to occupy his time and his thought, that to which he is to give all the desires of his heart, the employment to which, if he is a thoroughly good workman, he would really wish to give a good and hearty service. Now, there is nothing, I say, which does so much for man as that he should thoroughly master principles—as that when he is at work he should know not only what to do, but why it is done; that he should understand the reason for everything he is doing; that he should be able, if new circumstances required him, to learn something quite new, to pass, without any very great difficulty, from one branch of his own particular employment to a kindred branch. All that really cultivates the man more almost than anything else you can teach him.

The Effects of Frost upon Plants.—M. Prilleux, in a paper on this subject, has shown that if the thaw is conducted gradually, the plant will always recover.

Diamonds.—It is stated that Professor Tyndall has succeeded in igniting a diamond in oxygen, by the concentrated rays of the electric light, and that he is confident in his ability to ignite the diamond by the invisible rays from the same source.

A Swedish School-room.—We are informed that M. Fahnehjelm, the Swedish Commissioner for the forthcoming series of Annual International Exhibitions, has applied for permission to exhibit a full-sized model of a school-room, just as it exists in the country parishes in Sweden, with all the books, maps, apparatus, forms, desks, &c., in order to give a complete idea of the Swedish system of elementary instruction. Her Majesty's Commissioners will, there can be no doubt, gladly place a sufficient space at the disposal of the Swedish Commissioner for so interesting an exhibit. It is to be hoped that encouragement will be given to other countries to follow this excellent example. An easy comparison of international appliances for educational purposes would be most useful to visitors to the Exhibition, and would be beneficial and stimulating to the countries exhibiting.

Coal Fields in Labuan.—Mr. Pope Hennessy, the Governor of Labuan, in a speech to the Legislative Council, on closing the session of 1869, has given a striking account of the immense benefits these fields promise to yield, not to England only, but many foreign nations. Labuan is less than 50 square miles in area, and yet it is estimated by competent authorities to contain 400 million tons of workable coal of good quality. The most approved system of mining is adopted. The native workmen, though employed at a depth of 240 feet from the surface, enjoy good health, and they are also earning high wages. The Queen's ships on the China station, and the Admiralty depots at Singapore and Hongkong are being now supplied from these mines; and contracts have been made to furnish the Manilla steamers, the French Government of Saigon, and the Dutch mail steamers from them also. Moreover, the opening of the Suez Canal has stimulated the demand for this coal. Labuan is becoming of great imperial value as a naval station. The convicts make the bricks used at the colliery, and put the coal on board the steamers.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½.
British Architects, 8.
London Inst., 4.
Social Science Assoc., 8. Mr. Charles Lamport, "On Pauperism and Self-help."

Tues ...R. Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on "The Dressing of Lead Ores." 2. Mr. R. Price Williams, "The Maintenance and Renewal of Railway Rolling Stock."
Photographic, 8.
Ethnological, 8. 1. Mr. J. C. Atkinson, "On the Danish Element in the Population of Cleveland, Yorkshire." 2. Mr. H. M. Westropp, "On the Ancient Tribal System of Ireland." 3. Dr. Donovan, "On the Brain in the Study of Ethnology."
Social Science Assoc., 8. (At the Society of Arts House.) Dr. Guy, "Health and Disease in their Economic Relations."

Wed ...Geological, 8. 1. Prof. Owen, "On the Fossil Remains of Mammals found in China." 2. Dr. A. A. Caruana, "Further Discovery of the Fossil Elephants of Malta." (Communicated by Dr. A. Leith Adams.) 3. Mr. T. P. Barkas, "Brief Preliminary Notes on a large Coal-measure Reptile from the Low Main Coal Shale."
Graphic, 8.
Microscopical, 8. Mr. H. C. Sorby, "On the Colouring Matter derived from the Decomposition of some Minute Organisms."
R. Literary Fund, 3
Archæological Assoc, 8.

Thur ...Mathematical, 8.
London Inst., 7½.

Journal of the Society of Arts.

FRIDAY, APRIL 15, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

APRIL 20.—"On a Practical Method of Meeting the Spelling Difficulty in School and in Life." By ALEXANDER J. ELLIS, Esq., F.R.S.

APRIL 27.—"A Narrative of the Works of the Suez Canal." By DANIEL ADOLPHUS LANGE, Esq.

MAY 4.—The Society's Conversazione at South Kensington Museum.

MAY 11.—"On Railways for India." By W. P. ANDREW, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

MAY 18.—"On International Money of Accounts, independently of International Coinage." By JACOB A. FRANKLIN, Auditor of the Society; in sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1854.

MAY 25 (At Three o'clock).—"On the New Organ in the Albert Hall of Arts and Sciences, South Kensington." By I. WILLIS, Esq. At this meeting Sir Michael Costa will preside.

CANTOR LECTURES.

The third course of Cantor Lectures for the present Session will be given by Professor A. W. Williamson, F.R.S. The course will consist of four lectures, "On Fermentation," to be delivered on Monday evenings, the 25th of April, and the 2nd, 9th, and 16th of May, at 8 o'clock.

LECTURE I.—MONDAY, 25TH APRIL.

Chief varieties of fermentation.—Chemical processes which take place in the best known processes of fermentation.—Other chemical processes analogous to them.—How these cyclical processes are distinguished from ordinary processes of chemical action.

LECTURE II.—MONDAY, 2ND MAY.

Cyclical action analysed: 1. In known cases; 2. In less known cases.—Theory of "contagiousness" of chemical action.—Composition of yeast, and changes which it undergoes.—Assimilation of food by yeast plants during life.—Decomposition of yeast plants during life.

LECTURE III.—MONDAY, 9TH MAY.

Propagation of ferments.—Prevention of fermentation.—Germs in air: how removed; how destroyed.—Processes for arresting fermentation.

LECTURE IV.—MONDAY, 16TH MAY.

Wine-making and wine keeping.—Chemical changes which improve the quality of wine.—Chemical changes which deteriorate the quality of wine.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course will be issued with the next number of the *Journal*.

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum, on Wednesday evening, the 4th of May. Cards of invitation are in course of issue.

NETHERLANDS INTERNATIONAL EXHIBITION.

The Diplomas and Certificates awarded to British exhibitors at this Exhibition have been received by the Society of Arts, and can be had on application, by the parties entitled, or their duly authorised agents.

LIBRARY.

The following works have been presented to the Library, and the thanks of the Society have been communicated to the donors:—

Three Lectures on Education. By Adolph Oppler, L.C.P. Presented by the author.

Our Ocean Highways; a Universal Route Book. Edited by J. Maurice Dempsey.

Synopsis of the Patent Laws of Various Countries. By Alexander Tolhausen, Ph.D. Presented by the author.

The Euphrates Valley Railway. By W. P. Andrew, F.R.G.S. Presented by the author.

Abstracts of the Various Specifications relating to the Preservation of Food. By W. H. Archer. Presented by the author.

On Art Training. By J. G. Crace. Presented by the author.

Dunham's Multiplication and Division Tables. Presented by Bernard Cracroft.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

INDIA COMMITTEE.

A Conference on the subject of "The Through Route to India," was held on Friday evening, April 1st. The chair was taken by W. MAITLAND, Esq., late President of the Calcutta Chamber of Commerce, and the Conference was opened by Mr. HYDE CLARKE.

Mr. Hyde Clarke said:—It is a very great pleasure to me to resume this subject, for it involves questions greatly affecting our commercial interests in England and in India. I have had the fortune to bring forward the subject in this room on previous occasions. This evening it is a great gratification not to have to repeat old words, but to have to report progress. Under such circumstances, I do not propose to lay before you, at this meeting, a detailed discussion on any particular routes, but rather to leave anything that may be said in that respect to the particular advocates of such routes. I do not propose, for instance, to

enter into the consideration of what, on the present occasion, may be considered the most advisable plan. I am quite content to take any line which will attain the main object, that of getting to India in the shortest possible space of time, and on that there can scarcely be any difference of opinion amongst us. It is certainly an object at the present day to achieve the greatest amount of commercial facilities, because we must never forget—and we too often do forget it—that in our Indian empire we have 200,000,000 of people, or one-fifth of the human race. It is scarcely possible to think that that can ever be forgotten, but yet we know that it is so, and often on the most important occasions. It is of the greatest importance to the world commercially, and not the less important because it promises to open undeveloped countries, in Turkey, in Asia Minor, and in Syria, to the citizens of this country and of America. The same effects which, on a smaller scale, were produced in the sixteenth century from the discovery of America and its influence on the enterprise of Europe, are now being produced on a larger scale in our own day, within half a generation. It is to that California has contributed, not only by giving us gold, but in stimulating enterprise by that gold. It is under these circumstances that a through line to India must, in the nature of things, open to us the resources of Turkey, of Asia Minor, and of Syria—and you must not forget that point—of our own Indian empire. On former occasions, when I brought this subject before you, I had to treat of political considerations which embarrassed it, and the financial difficulties which had to be surmounted. You all know the great zeal and great efforts which have been made to obtain from the government of this country encouragement for the Euphrates Valley line, and that success has not as yet attended this endeavour. Then, two years ago, there were likewise financial difficulties to be encountered; indeed, they were of such an extent that the enterprise was looked upon as almost a vision, and as scarcely within the compass of probability that the large amount necessary to execute any portion of that railway could be found. It was supposed that, without the guarantee of England, means could not be obtained to construct a through route to India. I was one who advocated applying the united resources of Europe as the means of furnishing capital; but fortunately within the last two years circumstances have changed. I am sorry to a certain extent, because it favours the policy of those who wait and do nothing. It was so in this case; yet we have made very great progress, and this I attribute to three principal causes. First, the completion and bringing into operation of the financial measures for the Roumelia Railway; second, the opening of the Suez Canal; and, third, the progress of the modern railway system. While we are talking of a through railway to India, a portion of a line from London to Calcutta is already accomplished. It may be divided into three portions, that which has been already accomplished, that which has been undertaken, and that which is not yet decided upon. From our end the line passes through Constantinople, and of this the part to the Danube is already in operation, and that from the Danube to Constantinople is provided for. Then, there remains still a large portion between Constantinople and India, to which I shall afterwards refer. Then, we come to India, and in India we have a large portion indeed of the undertaking which has already been accomplished. Therefore, of the through railway from London to Calcutta we have on the London side a large portion in operation, and on the Calcutta side likewise a large portion in operation. Thus, as regards Bombay, we have a through line from Bombay to Calcutta, and we shall be in a situation soon to have a connection likewise from Kurachee. So that we have already insensibly a large portion completed and prepared—it may be said insensibly, owing to want of zeal on the part of the English government. A very good example has been set to India by the Ottoman government, with regard to the Roumelia Railway. While the government of India sits still, and limits itself to the expenditure of three millions of money yearly, Turkey, with very small resources and embarrassed finances, has made enormous sacrifices in order to obtain railway accommodation. The second benefit, which, though apparently indirect, has in reality very great influence, is the opening of the Suez Canal. This route was considered for a very long time as the rival of the Euphrates Valley Railway. M. Lesseps, however, always stated that they were not rival undertakings, but were calculated to help each other. The Suez Canal is already producing very great influence on Bombay. Bombay, being the point most accessible, is obtaining greater influence, and is becoming the centre of India, so to speak. Now, the more you increase the trade of Bombay, the more you augment its political importance, the more do you render it necessary that there should be a direct railway route from the centre of the empire to the entrance and outlet from our vast Indian possessions, by the railway system which is now in progress. Then let us look what Bombay really is. It is not merely the out-port of India—not merely the place for commerce, but it is in itself a place of great enterprise and resources, having influence upon markets which are comparatively unknown. And what has been done on the coasts of Africa and Arabia is being carried out through Bombay, and particularly by the native merchants of Bombay. The more you develop the resources of Persia and Asia Minor, the more you render this railway necessary. These regions, which in ancient days were the chief commercial parts of the world, will in a very few years become important tributaries to the whole world. We see that the route from Constantinople to the head of the Persian Gulf by the Suez Canal constitutes almost a circle, and yet the advantages of the sea route are such that the trade between the extreme point of the empire is taking place through the Suez Canal, and a line of steamers has been established through the Suez Canal to Bagdad. The result must be to promote the commerce of that part of the Ottoman Empire. The more you increase that local commerce, the more you ensure the completion of the direct line which will carry our merchandise, passengers, and troops from one part of our empire to another. I say that every development of traffic must ensure the progess and completion of all the railway system. These are two chief causes which, during the last two years, have tended to advance this undertaking, but I will briefly again refer to the extension and development of the railway system in India itself—a development which will be greatly promoted by the means of transit that are furnished by the Suez Canal. Having called your attention to those railway undertakings which are already accomplished, there remain for our consideration the various projects which have been brought forward for making a railway through Asia Minor, and down the great rivers to the Persian Gulf. There have been various plans proposed. I will not go into long details, but will simply refer to the two general schemes which have been proposed, the one by General Chesney and Mr. W. P. Andrew, which will pass through Asia Minor by Aleppo, and through the Euphrates; and one which has been proposed by a gentleman whom I am glad to see present, the Hon. Captain Stowart, who has taken very great interest in the undertaking, and has the support of Mr. Chenery, which would commence further to the eastward of Asia Minor, and would enter the valley of the Tigris. It is unnecessary for me to consider the merits of the various schemes. I should have been glad to accept either as the accomplishment of the through line, but as we have present some of the representatives of these plans, I shall leave it to them to discuss the matter. But the period has come when one of these plans—the plan by Captain Stewart, or the plan of Mr. Andrews, must in some way or other be carried out. The moment the Ottoman government finds itself relieved

from the pressure of its finances on account of the Roumelia Railway, wo know that it intends to carry out its own line. It was, in fact, in compliance with that policy that a concession was granted to Captain Stewart and his friends. Since then the position of the Turkish government itself has very greatly improved. At the period when they granted the former concession, and gave a guarantee, which, however, was found of very little value, the government was embarrassed, its relation with the various English companies engaged in railways in Turkey was misunderstood, and, therefore, it was proposed to promoto its guarantee by a collateral one, afforded by the various governments of Europe and India. The resources of the Ottoman government have, however, been found self-sufficient to place their European sections on the market, and in a short period propositions will again be put forward for a line through Asia Minor and Syria, and it will then be found that the position of the government will be still stronger by the establishment of their credit, by the opening of the Roumelia Railway in part, and by the development of general resources which will arise therefrom. The Ottoman government has suffered much from the conduct of the directors and contractors of the English companies in Turkey, and from the charges and repudiations made by them to cover their own breach of duty towards their shareholders and the public. The Smyrna and Cassaba Railway has, however, shown that railways in Turkey under their management can pay a dividend, and clear the guarantee, and this at an earlier period than any guaranteed railway in India earned a clear income. That most unfortunately conducted undertaking the Ottoman, or Smyrna and Aden Railway, is now earning a profit, and has received very large sums from the government on account of guarantee. That the Ottoman government can scarcely have been in the wrong in adjourning the demands of that company, is proved by the fact that since the opening about £100,000 had been spent to complete the line. The Varna and Rutchuk, another mismanaged railway, is still working at a loss, although there can be no doubt there is a great traffic in the district. It has received large sums from the government, and is engaged in completing its line and plant. The Kustenjee Railway, which has no guarantee, is earning a dividend from local traffic. All these circumstances show an improvement, and are calculated to inspire confidence. When these facts come to be better understood, it can no longer be supposed that the government is capable of neglecting its duties or avoiding its obligations, and it therefore stands stronger before the public of Europe; indeed, these very directors are amongst the first to acknowledge their obligations to the Ottoman government. Now, having shown you that we have got to a period when there is no demand upon our government for a guarantee, nor upon the Indian government, you will ask me what remains for the government and for ourselves to do. We have still got to do something. We may, it is true, stand still, and wait for Providence, and we shall suffer as before. Having laid the foundation of railways in Turkey by English money and English co-operation, we have lost what we had naturally a right to expect, the construction of the Roumelia Railway. Although we contribute some of the capital, the benefit will go to Austrians and to Frenchmen. So it will be with the Asiatic portion of the through railway. After our labour of years in connection with the Euphrates Valley Railway, the Ismail and Scutari, and Captain Stewart's line, we shall very likely lose the Asiatic sections of the railway, unless more regard be shown for our national interests by the home government and that of India. It is almost idle to tell you that if the railway is to be carried out as far as Bagdad or Bussorah, we shall reach the nearest points of India by abridging very materially the journey to the Persian Gulf. With regard to the political advantages, they are self-evident, nor is it at all necessary that I should refer to those vital objects which have often been mentioned here. On the one hand we have the Suez Canal opened, and on the other side of the Atlantic we have had the Pacific Railway opened—one of the greatest triumphs of engineering skill of modern days. It shows us we can travel great distances with great facilities, even through a distance dividing one great ocean from another. With regard to international communication with India, such measures must greatly increase the amount of progress in proportion as there is a close contact with Europe. The European element must be introduced into India to a greater extent than at present; for if we wish to raise India in the scale of civilization it must be by a greater infusion of that element, not by books and newspapers merely, but by the actual presence of tho European.

The Chairman said they had all listened with great interest to the way in which Mr. Hyde Clarke had treated a very interesting subject, which was then open for discussion.

Mr. Vesey Fitzgerald said he was very much impressed with what Mr. Hyde Clarke had remarked with regard to the development of commerce which had followed the opening of the Suez Canal, and he could endorse what Mr. Clarke had said with regard to M. Lesseps' opinion on the subject. It was perfectly obvious that the growth in wealth and importance of Bombay must be powerfully increased by the increase of communication between England and India. Every branch railway which converged to Bombay fed the great Indian peninsula, and led to an increase of commerce and an accumulation of wealth, all of which things fully demanded the attention of the people both of England and India. He always believed that at these conferences they met for the purpose of getting information, and he had no hesitation, therefore, in asking a few questions. He wished to know if tho Suez Canal had yet had any effect upon the commerce of Persia and Bagdad?

Mr. Hyde Clarke said that he had a letter from Aleppo recently, which said the trade there was already very much affected, and that goods which had been sent through Aleppo formerly are now transmitted direct by the Suez Canal.

Mr. Fitzgerald said that when he was in Egypt, three years ago, he visited the Suez Canal, and was informed that very great results were to be expected in the neighbourhood of Bagdad, but certainly the development which Mr. Hyde Clarke spoke of was very much more striking. He (Mr. Fitzgerald) was able to testify as to M. Lesseps being in favour of the Euphrates Valley route to India, as Mr. Hyde Clarke had stated. The truth was, that M. Lesseps was a man of very extensive views, was most anxious for the advance of civilization, and was quite aware that enterprises of such nature ought to aid each other. Tho establishment of a communication between India and England was very important. It was a discovery of modern times that a railway had really a tendency to increase the wealth of a community, especially in land. In India the statistics showed a general increase of the revenue in the value of land. He was informed that the means for carrying out the Euphrates Valley Railway must mainly be obtained from grants of land. He would like to ask Mr. Hyde Clarke if that had been the caso with tho Roumelia Railway.

Mr. Hyde Clarke said no concessions of land had been granted. It had been by direct guarantee, but there was no objection on the part of the Ottoman government to favour land settlement. The government of Turkey had been desirous to promote this, but had been deterred from doing so, because anyone under the protection of a European government might set a local governor at defiance. He could prevent the police from entering

not only his house, but his land, could refuse to pay taxes, and could plead the privilege of being a European subject. This was, however, in course of reform.

Mr. Fitzgerald said he would venture to remark further that he was strongly of the belief that, with regard to the communications with India generally, they should not rely upon one line only. Political contingencies might arise which would interfere with it. He thought it was very important to bear that in mind.

The Hon. Captain Stewart said he regretted that, owing to circumstances beyond his control, he missed the beginning of Mr. Clarke's address, but he had to thank that gentleman for the kind way in which he had mentioned the interest he (Captain Stewart) had taken in one of the projects for a through route to India. He thought that the great difficulty which had been experienced in these undertakings had been the scepticism with which the public received them. Persons seemed to forget the advances that had been made in railway enterprise; and if, some fifty or sixty years ago, a meeting had been called to establish a land communication with India, it would have been looked upon as an idiotic proceeding. The first project that was suggested was, of course, that of sailing ships going round the Cape of Good Hope; then they had steamships; then they had the overland route; and subsequently, the great Suez Canal. The subject that was then before the meeting had been on the tapis for twenty years, and had always been laughed at, in the same manner as the Suez Canal was laughed at. He could not forget that the *Times* laughed at that undertaking, and for long had refused to insert anything in favour of it; but, as people now began to see, the *Times* was not always right. One great argument they heard was, that direct communication would not pay. They were told that the expenses would be so great that the other routes—the overland—would carry most traffic. He believed that was quite false. He believed that it was generally understood that, wherever the mails went, the greater part of the traffic would go. It was not the traffic which created the railways, but the railways which created the traffic. There was one point which had not been mentioned, viz., that the Russian Government were alive to the subject, and were pushing their railways from the Black Sea through the Caucasus with great rapidity. He did not know whether the Poti and Tiflis line was completed, but no money had been or would be spared to bring it to a permanent success. Then they had already established a telegraph line to India, and he believed messages could be sent cheaper in proportion on that line than on any other. Want of confidence in Turkish guarantees was the chief difficulty in the question of a through route. He was glad to hear Mr. Hyde Clarke take up the cudgels on the behalf of that country. There was no doubt the Turkish government had been unfairly treated in certain cases. India was a country that had now been colonised for a considerable time, and had had all the advantages of science and English enterprise and government, and yet there was barely a railway in it that did more than pay the guaranteed interest; and they might therefore confidently conclude that, although Turkey did not yet pay five per cent., there was not the slightest reason why it should not do so eventually. There was, no doubt, a great future for Turkey. It wanted the capital they could give it to make it one of the finest countries in the world. Its resources were great, and the whole commerce of Europe would go through its territories, not only towards India, but towards our other Eastern possessions. He had strong opinions of his own that the Tigris valley was better than the Euphrates valley. Their duty was, however, to try every means in their power to push forward the construction of a line through Asia Minor, so as to reach their Indian possessions in a much shorter time than they did at present.

Mr. Locock Webb said he had for some years taken considerable interest in railways, and the conclusion he had come to with regard to the result of railway enterprise—and that from his own observation, as well as from the experience of others who had considered the matter—was that, as a rule, the extension of railways promoted the commerce and prosperity of a nation, and, if carried out economically, they were always good paying enterprises. If they looked at the result of railways in this country, they would find that they had cost a great sum of money. The London and North Western Railway cost between £38,000 and £40,000 per mile. Although the Great Western cost something under that, if they considered the returns of the whole railway system, they would find that the railways paid something more than 4 per cent. on the entire capital, some more than that, some less. The Stockton and Darlington paid 10 per cent., the Great Northern did not pay quite as much as 10 per cent, but sometimes more than 6 per cent. There was also a line in Cumberland which paid as high as the Stockton and Darlington. He came, therefore, to this conclusion—railways were paying concerns, and no man could put his money in a safer investment. Now, with regard to the land. Some years ago there was a committee on railways, and a very celebrated contractor gave this evidence—The value of land through which railways passed in India had certainly increased 4 or 5 per cent. They knew what it was in England. In the suburbs of London, adjoining the railway, the effect was certainly to double, if not treble, the value of land. Then what was the result of railways on commerce; towns had sprung up, as it were, in a moment at points to which railways converged; and they found also that the commerce was greatly increased from town to town. They might expect that they would do equally as much for other countries as they had done for England, and he therefore concluded they ought to be promoted. It was not that England had not capital enough. There was a redundancy of capital. It was not that there was any doubt that they ought to have the speediest possible means of going to their Indian possessions. Then what was the cause? It might be said that one great cause was that there had been many losses, and that therefore there was a want of confidence. That might be true to a certain extent, but that want of confidence was only three or four years old, while the enterprises had been before the world for twenty years. Again, he asked, what was the cause? He believed that the main cause was the backwardness of the English government. Look at the Suez Canal. Was not England interested in that undertaking, yet they put their hands in their pocket and would do nothing for it. If anything wanted doing, could they get the government to move one step? He hoped that the hint of Mr. Hyde Clarke would be taken up by those who had influence in the proper quarter. He hoped it would be clearly shown that, if the government remained much longer with their hands in their pockets, and their eyes shut, they would suffer, and England would go down the hill, till at last engineers from France, Austria, and America would carry off all the great enterprises, and British money would go elsewhere. He heartily hoped that steps would be taken to carry out this very great undertaking of a through route to India. He had not considered the matter sufficiently to say which route he should prefer, the line by the Euphrates or the line by the Tigris; but he would say this—in his judgment there could be no doubt that some line ought to be established to bring India nearer home.

Admiral Ommaney said he quite agreed that Mr. Hyde Clarke had made out a case for action. He thought that the best route to India, both politically, commercially, and socially, was to establish a line through Constantinople to India. There could be no doubt that having a line to the north-west of India would be a very great advantage, and he thought that a railway through Asia Minor, embracing the cities of Damascus, Aleppo, and others, to the Persian Gulf, was the one to select. Asia

Minor was one of the foremost upholders of this scheme. Make a railway, and it would enhance the value of land tenfold, and advance civilisation twentyfold. He hoped some energetic action would follow their meeting. It would be more to the credit and renown of England if they did something in the matter. He heartily concurred in the sentiments expressed by Mr. Hyde Clarke, and he hoped they would not be lost.

Mr. Fitzwilliam said he had seen the advantages of the communication with the route through Turkey, and he could fully corroborate what Mr. Hyde Clarke had said, and could bear testimony to the immense importance, politically, commercially, and, he might say, socially, of increasing the means of communication between England and India. He felt that, much as had been done in India, much more might have been done but for apathy on the part of the government. Then the interference of the government had prevented enterprise and their railways from doing as much as they ought to have done, and had delayed them in their execution. He felt that it was time to wake up from this lethargy. Three enterprises had been hinted at; one proposed by the late member for Surrey (Mr. Allcock), one by Mr. W. P. Andrew, and lately the Hon. Captain Stewart had brought forward another. There was no difficulty about a route, if they could only get the government to assist them. He hoped that public opinion would be induced by that meeting to the consideration which ought to be given to the question, and to press upon the government the importance of such an undertaking.

Mr. Wallace Harding said he quite agreed with that portion of Mr. Hyde Clarke's paper with regard to the necessity of a through route, but still he certainly anticipated that Mr. Clarke would have favoured them with some definite scheme. All his address seemed to be taken up by a eulogy on the importance of the scheme. Although Mr. Clarke knew that there was a great want of money in India, yet he told them they ought to blame India for not spending millions. He did not think they ought to call upon government to assist them at all. If things could be carried out by private enterprise, it would be much better. He quite agreed with the importance of this through line, but he could not agree that it should be under international control. Look at the Suez Canal. If war were to break out, complications would arise which would place this country in a position of great difficulty. That was one principal reason why they ought to endeavour, as far as possible, to keep a tight rein, and maintain a control as much as possible over the Euphrates Valley Railway, which would give access to their Indian railways. They were bound, as Englishmen, to keep that control over the line; not to obstruct the enterprise—he did not mean that—but to control it.

Mr. Hyde Clarke, in reply, said that for a considerable period he began to think he had made no observation upon which they would be able to raise a discussion, but, however, they had very fortunately been disabused of that idea by Mr. Harding. That gentleman had complained that he had not supported any definite scheme; but if his friend had heard the beginning of the address, he would have remembered that at the very outset he (Mr. Clarke) stated that he should not do so. He did not intend that night to advocate any particular plan. He was sorry Mr. Harding had expressed himself so strongly against enforcing the duty of government in discharge of its legitimate functions. When they had heard his friend Mr. Fitzgerald, who had taken an interest in their Indian empire, complaining both of the government of India and the home government, those complaints were entitled to considerable respect. There was at the present moment some very erroneous notions abroad as to government functions in matters of private enterprise and public duty, and these ideas were very much encouraged by such sentiments as those expressed by Mr. Harding. What had been asked of the government was not interference, or that they should furnish capital; all they had asked for was legitimate cooperation. Although the Roumelia railway started with the 'vantage ground in Turkey of England finding a considerable portion of the capital, yet, by the apathy of the government, all the advantages of that undertaking had gone to other countries. Other countries got the work, while England found the capital. Mr. Fitzgerald had referred to the land question, and it had been also treated by Mr. Locock Webb. There was no doubt that railways greatly augmented the value of land. It was so in Turkey, and the government engagements would be repaid by that increased value. Unfortunately, their Indian government did not understand that fact. He had been charged with contrasting the bankrupt government of Turkey with the government of India. Turkey was not in a state of bankruptcy, as was generally stated, but had always met its claims, and made great sacrifices to do so. What he (Mr. Clarke) said was that the government, though in embarrassed circumstances, had made the greatest effort to promote railway enterprise, and he did say that it was an example to India. When Mr. Harding talked of the alleged deficit in India, and the impossibility of the government undertaking the making of public works, what was their exertion in comparison with the small resources and embarrassed state of Turkey? But the government of Turkey does what the government of India does not. It seeks to obtain legitimate means to develop the resources of the empire, not from the current revenue, but from capital, and that is what the government of India must do by a public works court, charging the early interest to capital; and when that is done, we shall cease to hear of a deficit of current revenue caused by an expenditure on public works.

The Chairman, in moving a vote of thanks to Mr. Hyde Clarke for the paper he had read, referred to the discussion which had followed, and said that if all were on one side there would be very little interest indeed in any discussion, and if there were any objections to a question it was quite proper they should be brought forward. The last gentleman who had spoken had evidently done so under a misapprehension, for whenever the government influence and support was spoken of it did not necessarily mean money to be paid by government. It was very well known that a great deal of moral support might be given by government. They knew very well what had been visible before their eyes the last few years, with reference to the government of France in strengthening the hands of those who undertook great enterprises. The government of India had also done a little in that way, but they could not help feeling that the government of England was very remiss in such matters. That the great enterprise, the Suez Canal, was not well received in England was well known, and yet England was likely to benefit by that enterprise more than any other country. The spanning of the Isthmus of Panama by a railway had also been referred to, but the English government had given the idea no encouragement, not even saying "God-speed." That the enterprise of making a through railway to India, either by Constantinople or some other route, would take place sooner or later, there could be very little doubt. It was merely a question of time; and when they looked at such works as the Suez Canal, the railway across the Isthmus of Panama, the Atlantic and Pacific Railway, and several others; and when they remembered that they had nearly a complete system of telegraphic communication between England and India, and that it would soon be an accomplished fact, there could not be a shadow of a doubt that an enterprise like the through route to India would soon be carried out. Although events had not got forward with regard to this railway as well as could be wished, yet he could not doubt that the enterprise would shortly be carried out. The wise man had said "There was nothing new under the sun," but if Solomon could arise and see what was about being

done he would perhaps modify his words in some respects. That these great things would be carried out in one day was not to be expected; that they would benefit India and England he doubted not; and he quite agreed that these great undertakings should be international. Great roadways, like the one proposed, or the Suez Canal, or the Isthmus of Darien, should be respected by all the world, and the agreements should never be broken, and the enterprises should be brought forward in such a manner, and completed in such a way, that they would remain open to the whole world.

The vote of thanks was carried, and the Conference terminated.

CANTOR LECTURES.

The third of a course of lectures on "The Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," was delivered by Dr. Benjamin Paul, F.C.S., on Monday, the 21st March, of which the following is an abstract:—

In regard to the use of fuel for producing very high temperatures, it is necessary to remember that the temperature produced by combustion depends more upon the way in which the heat generated in any case is disposed of, than it does upon the actual quantity of heat. This fact is of especial importance in the use of fuel for each operation in the working of iron. To heat iron one degree requires about one-fourth as much heat as is needed for heating an equal weight of water to the same extent, and if it be assumed that, in the operations of welding or puddling, a temperature of 1650° C. be requisite, then a ton of iron would require 460,000 heat units to bring it to that temperature. Such a quantity of heat would be furnished by the combustion of about 130 lbs. of carbon, while the consumption of fuel in puddling amounts to upwards of a ton for every ton of iron.

The cause of the large consumption of fuel lies in the fact that, since the work to be done in puddling iron can only be done at a very high temperature, the product of combustion must be discharged at that temperature. If it is remembered that for every pound of fuel burnt there is at least 13 lbs. of gaseous combustion product, requiring 3 units of heat to raise its temperature one degree, it will be evident that there is a great loss of heat in this way, or about 5,000 units of heat for each pound of fuel burnt. This corresponds to $\frac{5}{8}$ of the total heat of combustion of coal. Moreover, if any operation requires the combustion product to be discharged at 1650° C., it is only the heat corresponding to the temperature in excess of this which can be useful in heating the iron or other material being operated upon, and at the same time counteracting the cooling influence of conduction and radiation, which takes place to a much greater extent when there is a considerable difference between the temperature of a surrounding atmosphere.

Hence it is desirable, in such cases, to burn fuel in such a way as to produce the highest possible degree of heat. To take the instance already mentioned, of a furnace discharging the combustion product of 1,650° C., if the maximum temperature produced were 2,000°, the proportion of heat utilised, relatively to the fuel consumed, would be much larger than if the maximum temperature were only 1,700°. In the former case, for every 5,000 units of heat wasted in the furnace gas, 1,050 units would be utilised, while in the latter case only 150 units would be utilised for the same amount of waste.

The smelting of iron ores is another case of the use of fuel which presents several peculiarities, both in regard to the necessity for high temperature and otherwise.

For the mere reduction of the oxide of iron in the ore, only a small proportion of carbon is needed to effect the chemical change of abstracting oxygen from the metal. Every pound of iron requires for this pupose only one-third of its weight of carbon. The reduction of the ore is effected in the smelting furnace by carbonic oxide, a gas containing, relatively to carbon, only half as much oxygen as carbonic acid.

The formation of this gas is one of the characteristic features of the iron-smelting furnace, which is a cylindrical shaft filled from the top, from time to time, with the iron ore, fuel, and fluxes, in due proportion, while at the bottom a vigorous combustion is maintained, by means of a strong blast of air forced into the shaft. At the point, the fuel is burnt to carbonic acid, generating its full amount of heat and causing the fusion of the spongy iron already reduced from the ore, together with the earthy material mixed with it. As these melt they sink down, and their place is supplied by fresh quantities. The gaseous product of combustion rises in the shaft, and, coming in contact with the red-hot carbon, the carbonic acid it contains combines with a further proportion of carbon, and is thereby converted into carbonic oxide, thus furnishing material for the reduction of iron ore at those parts of the furnace-shaft above the zone of fusion and perfect combustion of carbon. This ascending column of gas has of course at first a very high temperature, which is gradually reduced by contact with the colder materials of the charge, partly also by the conversion of carbonic acid into carbonic oxide. But, notwithstanding this transfer of heat to the solid contents of the furnace, the gas escapes from the throat, or upper end, at a temperature of from 500° to 1,000° C., thus carrying off with it a very large portion of the heat generated by the combustion of the fuel. In order to form an idea of the amount of heat thus wasted, it must be remembered that, although the quantity of carbon required for reducing the iron ore amounts to only one-third of the weight of the iron smelted, still the necessity of producing a high temperature for melting involves the consumption of from one and a-half to three tons of fuel per ton of iron, and consequently the gaseous combustion product discharged from the upper end of a blast surface amounts to from seven to fifteen times the weight of the iron made.

Considering the high temperature of the gas discharged from an iron furnace, this fact alone would indicate the large waste of heat, or, in other words, of fuel, that takes place in this case. Attempts have been made at various times to apply the heat contained in this waste gas to the heating of boilers or other purposes, and they have been to some extent successful. But the most important fact in reference to the use of fuel in the blast furnace is the presence of a large amount of carbonic oxide in the waste gas; for, so far as this gas is the alternate product of the operation, the heating effect produced is the same as if only a portion of the carbon had been completely burnt to carbonic acid. Then, it must be remembered, that carbon burning to carbonic oxide generates only one-third of the heat which the same quantity would generate in burning to carbonic acid, and therefore the ultimate quantity of heat generated in a blast furnace does not amount to more than one-third of what the fuel consumed is capable of giving.

Taking the average consumption of fuel to be twice the weight of the iron made, there is only one-sixth of it which is fully effective in the reduction of the ore, and of the remaining portion nearly two-thirds escapes as gas, without generating the amount of heat that would result from perfect combustion. So far, therefore, as regards the condition in which the gaseous product of combustion is discharged from a blast furnace, the only portion of the fuel consumed so as not to be farther available as a source of heat is that equivalent to the reduction of the ore, or about 16 per cent. of the total fuel consumed. Of the heat corresponding to the remaining 84 per cent. of the fuel, the greater portion leaves the furnace in some form or other, either as sensible heat in the gas, loss by radiation and conduction, or as heat capable of being generated by further oxidation of the combustion

product. Only a small portion of that heat is turned to account in the furnace, in heating the descending solid materials of the charges as the gas passes through them.

Of late years the waste gases of smelting furnaces have, therefore, been carefully collected and used as fuel under boilers or for other purposes, but one of the chief disadvantages of this material as fuel is, that the temperature it is capable of producing is not very great.

The maintenance of a high temperature in the upper parts of a blast furnace, and the heating of the descending materials of the charge, are of importance in preparing those materials for passing rapidly through the chemical changes that take place lower down, and for undergoing fusion afterwards, when they reach the bottom of the shaft. Both the iron ore and the coal require to be heated in this way, and it is mainly on this account that there is need for a certain proportion of coal in the charge. However, if heat could be supplied to the charge at the upper parts of the furnace otherwise than by burning fuel at the lower part of the shaft, it would be possible to reduce the proportion of fuel requisite in the charge relatively to the quantity of iron made. At the same time the rate of heating would be quicker in consequence of such a reduction in the quantity of material in the charge. It is in this way that an advantage is gained in the use of hot air for supporting combustion in working an iron smelting furnace.

But there is another circumstance which renders the use of hot blast a means of effecting economy both of time and fuel. The actual quantity of heat generated in a blast furnace is useful only in so far as its proportion to the quantity of material through which it is distributed admits of the requisite temperature being produced. If the gaseous combustion product corresponding to one ton of iron made can be reduced to one half, then this requisite temperature would be obtained by burning only half as much fuel; and though the quantity of heat generated would also be reduced to one half in this latter case, the effect, which is alone of importance, in the blast furnace—viz., the temperature produced—would be the same as when double the quantity of fuel was burnt. The fact that the combustion of fuel in the blast furnace is, in its ultimate result, only a partial oxidation, giving rise to the generation of only one-third of the heat it is capable of producing, is another reason why a reduction of the quantity of fuel consumed in the furnace, and a substitution of some extraneous supply of heat, contribute to economy of fuel in smelting iron. The greater the substitution of extraneous heat for that resulting from combustion in the furnace, the more is the necessary air-supply reduced, and since this amounts in all cases to the largest part of the material supplied to a furnace in smelting iron, while, at the same time, it contributes most largely to the quantity of the gross products of the operation, it will be evident that any limitation of the air supply, as well as of the gaseous product that is discharged at a high temperature, must, so far as it admits of the required temperature being produced, be attended with a great saving of fuel.

Hence it is found that, by the use of the hot blast, the consumption of coal per ton of iron made is very much less than when cold blast is used. Instead of two or tbree tons of fuel per ton of iron, the consumption with hot blast is only from 23 cwt. to 2 tons per ton of iron made. The apparently paradoxical character of this result has often led to a disbelief in the economy of hot blast; but the fact that a greater result is produced with a smaller consumption of fuel seems paradoxical only when the disposition of the heat generated by combustion, and the quantity of material to be heated, are left out of consideration. In the use of fuel for smelting, the most important condition is the intensity of the thermal effect rather than the quantity of heat generated, and in this respect there is a wide difference between the use of fuel for smelting and its use for generating steam, or for any similar operation requiring quantity of heat.

One of the most important improvements in the use of fuel for producing high temperatures, consists in a means of turning to useful account the waste heat which escapes in the combustion product from furnaces. This result is attained in connection with the use of fuel in the gaseous condition, and, with that object, the conversion of the fuel into combustible gas is conducted in a separate furnace, where the combustion takes place, so that only carbonic oxide is produced. This gas, resulting from partial combustion, is the fuel used, and before being burnt it is heated to such an extent that the temperature produced in burning it is much greater than it would otherwise be. The heated product of the combustion leaving the furnace is made to pass through a cellular mass of brickwork, to which it communicates its heat so far that it escapes eventually at a temperature of about 300° C, instead of 1,600° or upwards. When the brickwork has thus become heated as far as possible, the hot combustion product is made to pass through another brickwork chamber, and at the same time the combustible gas and air supplied to the furnace are made to pass through the heated mass of brickwork, so that before reaching the furnace they take up heat from it, and acquire a high temperation before burning.

This arrangement is termed a regenerator, and the furnaces in which this method of turning waste heat to account are termed regenerative furnaces. They have been applied by the inventor, Mr. Siemens, to several of the purposes for which high temperatures are required, such as glass-making, iron-working, &c., with results that show a very great economy of fuel due to their use. In steel melting, for instance, the saving effected amounts to as much as 50 per cent., and this is due, as in other cases already mentioned, to the disposition of the heat generated in such a manner as to give an effect of intensity in place of one of mere quantity.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

List of foreign countries which have already appointed Commissioners for the Exhibition of 1871:—

Argentine Confederation.—Senor Constant Santa Maria, Buenos Ayres.

Baden.—Dr. Dietz, President of the Commission, Baden; Ministerial Rath Turban; Professor Dr. Meidinger, manager of the Landes-Gewerb Halle in Carlsruhe.

Belgium.—Honorary President—Le Comte de Flandre. President—M. T'Kint de Naeyer, senator. Vice-presidents—MM. de Cannart d'Hamale, sénateur; Sainctelette, membre de la Chambre des Représentants; et De Keyser, directeur de l'Académie Royale des Beaux Arts d'Anvers. Secretary—M. J. Clerfeyt, secrétaire du Conseil Supérieur de l'Industrie et du Commerce, Brussels.

Colombia.—James L. Hart, Esq., F.R.G.S., Consul for the United States of Colombia, 3, St. Helen's-place, London.

France.—M. Ozenne, Councillor of State, Secretary-General to the Ministry of Agriculture and Commerce, Paris.

Hesse.—Herr Schleicrmacher, Councillor of the Ministry of Finance, President of the Central Office for Commerce and Industry, Darmstadt.

Norway.—M. O. Pihl, Frognerrien, Christiania.

Russia.—M. Boutowski, Privy Councillor, Director of the Department of Commerce and Manufactures, St. Petersburg.

Sweden.—M. Fahnehjelm, of the Office for Ecclesiastical Affairs, Stockholm.

Switzerland.—Albert Streckeisen, Esq., Consul-General for the Swiss Confederation, 7, Great Winchester-street-buildings, London.

United States.—N. M. Beckwith, Esq., New York.

Wurtemberg.—Dr. von Steinbeis, President of the Board of Trade and Commerce, President of the Exhibition Commission, Stuttgart.

EDUCATIONAL NOTES.

Since the last notes appeared the religious difficulty has been the principal subject of discussion in connexion with the Education Bill. Lord Russell's contribution towards its solution has called forth many comments, not generally favourable. It will be remembered that, besides the reading of the Bible, his lordship suggests that a hymn should be regularly sung, but the difficulties that would be thus created are obvious to all acquainted with the hymn-books generally in use, which usually contain hymns putting forth dogma in the strongest and most definite form.

Setting aside this portion of Lord Russell's proposal, however, it is evident that the framing of regulations with regard to the reading of the Bible would not be an easy task. The question naturally arises whether it is to be read through in order, beginning at Genesis and ending at Revelations, or should the reading consist of selections prescribed hy the master or by the school board? If the former course is taken, the *Saturday Review* urges that it would he an extremely unprofitable exercise, for few books probahly lend themselves so little to such a mode of perusal. If the latter course is preferred, we are at once met by a difficulty which is clearly stated in a letter from "A Hertfordshire Incumbent," in the *Times*. He points out, that, "children might thus have read to them, day after day, the driest, and, taken hy themselves, the most unprofitable, chapters of the Bible (let us say the first three of Chronicles, or parts of Ezra, or Nehemiah), or the proceedings might be even worse, for by a skilful selection of different parts of Scripture, such as, unhappily, is by no means unknown to the compilers of cheap infidel publications, the whole gist of Revelation might he perverted," and, "by a similar process, *mutatis mutandis*, a boy might be prepared for the reception of the extremest ecclesiastical theories, and, indeed, for a transition to the Church of Rome."

A "Shropshire Rector" goes so far as to say that, "no more pernicious comment can be made upon the Bible than to read it without comment. It is virtually telling the child, 'Here is a book we are all afraid of. It contains truths and doctrines which we dare not bring out into the light of day, for fear of stirring up strife and animosity among people calling themselves Christians;'" and, he adds "that if the Bible is to be treated as literally nothing but a mere reading book, or, if only such selections from it were read as to reduce the possibility of any dogmatic or theological interpretation to the lowest minimum, then I think we may say the secularist has gained the day, and all religious teaching is to be banished from our schools."

The Dean of Durham holds nearly similar views as to the uselessness of merely reading the Bible. He allows that "the reading of some verses may, no doubt, have a certain serious effect in a school, as at family prayers;" but regarded as the only or the chief religious teaching of children, he cannot consent to make it the substitute for that real teaching of the Bible which he believes to exercise a powerful influence both on their moral and intellectual character.

On the other hand, Mr. Vernon Harcourt expresses his "surprise and regret that the daily reading of a hook which contains the Lord's Prayer, the Ten Commandments, the Psalms, the Parables, the Sermon on the Mount, and the history of the life and death of Christ, should be rejected by religious men with so much bitterness and scorn. It is a painful revelation of the true nature of the sectarian spirit to learn that men should openly declare that the Divine text of the Bible, of which they are not the authors, is nothing, and that the human commentary, which is all their own, is everything; that they should care as little for what the Scriptures say, and so much for what each man may think fit to make them mean."

The Dean of Durham proposes that formularies should be relegated to the Sunday-school, and a certain time every day devoted to the *teaching* of the Bible, which, he believes, the children of Dissenters would attend almost as much as others.

On this question Mr. Edward Baines writes:—"I believe all religious bodies will agree to exclude catechisms and creeds from the rate-supported schools; and, if so, the schools will be undenominational Bible schools, in which the grand and simple elements of Scripture truth may be taught by the schoolmaster in a way suited to impress the hearts and consciences of young children, without any notion of attaching them to particular sects. I am confident that such schools would work to the general satisfaction of the country."

The *Saturday Review*, however, thinks that this Bible teaching, which would be a form of denominationalism, would be specially liable to be turned to proselytising purposes. "A lesson in a catechism proclaims itself, and supposing the conscience clause to do its work properly, a parent has only himself to thank if he allows his child to attend it. But a lesson in the Bihle does not bear its character on its forehead; and it is quite possible that a parent may only discover that his child has heen suhjected to denominational teaching, of which he disapproves, after the impression has been already made." This difficulty does not really appear worthy of much consideration, and surely parents may be trusted to guard their children from such influences, in the few cases in which such attempts at proselytising might be made. Mr. Bryce, formerly Assistant-Commissioner to the Schools Inquiry Commission, thinks "it is impossible to suppose that attempts would be made to inculcate distinctively Anglican views under the colour of teaching Scripture;" and his proposal is "to insert in the Bill a proviso forbidding the teaching, during the regular school hours, of the Church Catechism, or any other distinctively denominational formulary, and leaving the other religious teaching to be determined by the wishes of the locality, in the manner provided by the Bill."

The Rev. Archer Gurney, in a letter to the *John Bull*, advocates the secular system as the only practical one, and thinks it is far better to separate secular and doctrinal teaching than to set about devising a system of unsectarian religious instruction, which would he dry and "colourless." He thinks that to exclude dogma in the study of the Gospels is impossible.

It may be noticed that at most of the provincial meetings held to discuss the Bill, the religious difficulty forms the prominent feature. At a meeting of the Canterbury Town Council, it was resolved that Parliament be memorialised to strike out the clause in the measure referring to religious teaching, and substitute in its stead the one prepared under the auspices of the Education League, "as no system of education could be regarded as national if it was not thoroughly unsectarian." The General Purposes Committee of the Manchester Town Council object to the question of religious instruction being remitted to School Boards; and at a meeting of Nonconformists held in the same place strong resolutions were passed, protesting against the proposal of the Bill to give to Local Boards power to determine the religion to be taught in schools to be supported by public taxation, "because such proposal would be a practical adoption of the unjust and irreligious principle of concurrent endowment;" and also against power being conferred upon Local Boards to enforce the attendance of children at denominational schools, "under the ineffective protection of a conscience clause;" and finally insisting "that in all schools established or supported

by local rates, the instruction given should be absolutely unsectarian." At the annual meeting of the Exeter Board of Education, the Bishop of Exeter said that he had no objection to religious instruction being given at the beginning or at the end of school—in other words, he had no objection to the time-table conscience clause.

A numerously-attended and influential meeting of the supporters of the Education Union and others was held on the 8th inst., in St. James's-hall. The Earl of Shaftesbury presided, supported by the Duke of Northumberland, the Duke of Norfolk, the Marquis of Salisbury, the Earl of Harrowby, Lord Howard of Glossop, Lord Eustace Cecil, M.P., Earl Percy, M.P., Lord Sandon, M.P., Mr. W. H. Smith, M.P., Colonel Akroyd, M.P., Mr. Beresford Hope, M.P., the Rev. Dr. Barry, &c. Mr. Cowper-Temple, M.P., proposed, and Mr. Thomas Hughes, M.P., seconded a resolution, which was carried, against excluding religious teaching from schools. The Marquis of Salisbury moved, and Mr. C. Buxton, M.P., seconded, the adoption of a petition to Parliament, expressing great alarm at "the attempts now being made to introduce a purely secular system of elementary education, and to exclude the Bible and all definite religious teaching from primary schools," and stating it to be the belief of the petitioners "that exclusively secular teaching is opposed to the desires and convictions of the great bulk of the people of this country, who are in favour of Christian teaching for a Christian nation." The petitioners pray that the House will adopt "those principles of the Education Bill which provides for liberty of religious instruction in all public schools."

A very important conference took place on the 9th inst., at the Westminster Palace Hotel, between a number of Liberal members of Parliament and a body of school teachers, numbering about a hundred, belonging to the British, Church, and Wesleyan schools in the metropolis. Amongst the members of Parliament present were—Mr. Dixon, Mr. S. Morley, Mr. Mundella, Mr. Whitwell, Lord F. Cavendish, Mr. Acland, Colonel Akroyd, Mr. Dent, Mr. Jacob Bright, Mr. M'Arthur, Mr. J. Pease, Mr. Kay-Shuttleworth, and Mr. Cowper-Temple. Mr. S. Morley was unanimously voted into the chair. He gave the following as the questions to be discussed:—First—How far does the present system of Bible teaching in the metropolitan schools prevent parents sending their children to school? Second—Should a time-table for religious instruction be adopted in school? and if so, in what way would it best work in harmony with the due management of the school? Third—Is it practicable to inculcate the moral precepts contained in the Bible used as a school-book without making any reference to sectarian things, so that the school should remain utterly unsectarian?

A long discussion ensued, in which the experience of many of the teachers was given, and most of them agreed in saying that the "religious difficulty" was little more than a platform difficulty, which in practice they had found to vanish. In the case of 5,000 children, Mr. Ives, for example, found that only two parents had objected to the teaching of the Bible and the catechism. Mr. Ryder, who had been a British school teacher during forty years, said that, although his was a Dissenting school, 9 per cent. of Catholics, and 29 per cent. of Church scholars had passed through his hands; and he had given religious knowledge to the children of a working-man infidel lecturer, with the father's consent. Mr. Langton, who had passed through his school no fewer than 20,000 children, had met with only four cases of objection to religious teaching. The adoption of a time-table conscience clause was supported by Lord Frederick Cavendish and Mr. Pease, but on this point there was not so much unanimity amongst the teachers. However, the chairman, in bringing the proceedings to a close, said that he understood the meeting to have arrived at this decision: That, while they did not see their way to confining religious teaching to the beginning or the end of school hours, they agreed that it was practicable to work a conscience clause in such a way that the period for such religious instruction should be so known and regulated that any child might be put to other lessons while that was going on, if its parents desired.

A protest, signed by five thousand Nonconformist ministers in England and Wales, setting forth their objections to the Bill, has been presented to Mr. Gladstone. It protests,—1. Against the power given to local boards to levy a rate for the support of schools in which they may determine that the religious teaching shall be denominational, under whatever conditions the denominational teaching may be given. 2. Against the "Conscience Clause," which requires a Nonconformist British citizen to claim religious toleration in schools supported by national money. 3. Against the permissive arrangement for religious inspection, which it is believed will lead to the re-establishment of the very denominational inspection which the Bill professes to remove.

While upon this subject, it may be interesting to give the terms of the amendments to be proposed in committee by Mr. Winterbotham and Mr. Dixon. The former has given notice as follows:—

"Clause 7, page 3, leave out sub-section 3, and insert:—

"3. No scholar shall be required to attend or to abstain from attending any Sunday-school or any place of religious worship.

"4. No scholar shall be required to be present at any religious instruction or observance.

"5. In any school where religious instruction is given or religious observances are practised, such instruction and observances may take place before and after the school business, but not at any intermediate time. A public notification of the times for religious instruction and religious observances must be inserted in a time-table, to be supplied by the Education Department, and to be permanently hung up in a conspicuous place in the schoolrooms.

"6. In any school maintained wholly or in part out of local rates under this Act, no religious instruction shall be given, or religious observances practised, other than the reading of the Scriptures."

It will be observed that Nos. 3, 4, and 5 of these amendments are, in fact, neither more nor less than the time-table conscience clause, to which the government expressed their assent.

Mr. Dixon's amendments are as follows:—

"Clause 14, at end add 'no creed, catechism, or tenet peculiar to any sect shall be taught in any such school during school hours, but the school board may permit the reading of the Bible on the following conditions:—

"'1. That no child shall be obliged to be present at such reading;

"'2. That the time for such reading shall be immediately before or immediately after the ordinary school business. A school board may grant the use of the building for the giving of religious instruction out of school hours, provided that no preference be shown to any sect; but a school board shall not grant the use of the building for the purposes of religious worship.'"

Such is the position of the "religious difficulty" at the present moment.

SCHOOLS FOR IDIOTS AND IMBECILES.

THE EARLSWOOD ASYLUM, REDHILL, SURREY.

By George C. T. Bartley.

(*Continued from page* 337.)

The period usually spent in the institution, as before stated, is five years, at which time the idiot returns to his home, unless he has the good fortune to be one of the few who are re-elected for another term or for life. Those who leave are generally lost sight of, and this

appears to be a weak point in the administration of the institution. The result of the working of the charity should be such that, in some way, permanent benefit is conferred on the pupil. During their stay there can be no doubt but that they are very happy, and it seems to be a providential arrangement that these poor creatures are rendered happy with very little, if that little be accompanied with kindness.

The five years, therefore, to those who fall back either on the parish or their friends, is really of little permanent benefit. They may be able to work, to a certain extent, at a trade, but their infirmity is such that but few employers could make use of their services, and, consequently, when they are living at home a large part of their training is lost.

As regards their mental improvement in the various branches of ordinary education, it would seem that an expensive staff of teaching power is, to a great extent, thrown away, more particularly if the pupil, on leaving, sinks into his former state.

The following examples of cases of individual improvement are taken from the last year's report:—

1. A boy, admitted in May, 1860, aged 8. Could speak imperfectly, knew no letters, could only make strokes irregularly on the slate, could not count, knew no figures, coins, weights, or colours. Discontinued attending school in July 1868. He could then read fairly, could write words in a copybook, count to 12, and add a little, knew the figures, writing letters, coins, weights, colours, and could tell the hours by the clock; is now at work all day as a tailor.

2. A boy, admitted January, 1864, aged 18. Speech very imperfect, knew no letters, could only make a letter or two on the slate, not count, or add, knew no writing letters, coins, weights, or colours. Discontinued attending school in January, 1869, to devote the whole of his time to shoemaking. Knew all the letters, and could read slowly, wrote words in copybook, knew all the coins, weights, and colours, and could tell the hours by the clock.

3. A boy, admitted May, 1864, aged 9. Speech indistinct, could make strokes and letter O on slate, count to 7, not spell, knew no coins, weights, or colours. Now reads fairly in Testament, spells most words, writes sentences neatly in copybook, counts to 63, and does easy sums from board; can tell the hours by the clock, knows all the coins, weights, and primitive colours, draws outlines correctly; used to tear his clothes, but is improved also in this respect.

4. A girl, admitted in November, 1862. Knew a few letters, had no idea of counting or writing, and could only use a spoon. She now can read an easy narrative, count to 100, write words of two syllables, knows five colours, can use knife and fork well, and has much improved in conduct.

5. A girl, admitted in May, 1863. Could not speak or write. She now says many words distinctly, and tries to speak; exercises nicely, forms several letters on slate, and has a very good idea of hemming.

6. A girl, admitted in May, 1865. Speech very imperfect; could only make strokes, count to five, and could not use a thimble. She now can read simple words, write the same in a copybook, knows some figures, and can hem neatly.

These cases, which are the only ones given in the report, are, no doubt, favourable specimens, and they show the enormous difficulty in teaching the pupils theoretical knowledge; and great difficulty implies great cost. Case 1, for example, who was in the school eight years, was only taught to read fairly, write words in copybooks, count to 12, &c.; but, in the same time, and probably much sooner, he was taught to be a tailor. Similarly with Nos. 5 and 6.

A person who can only count up to 12 after eight years' instruction, can never make any practical use of arithmetic, and this deficiency in grasping any theoretical idea, which must be apparent after a trial of a few months, would seem to show that in such a case so much mental training is really thrown away. It may be said that the training has a good effect on the patient, and no doubt this may be true; but as the pupils are quite happy without this education, which sometimes even irritates them, they are really none the better permanently for it. In most cases they may be taught to do useful industrial work, which really interests and amuses them, at a very much smaller cost, and it would seem better to devote the amount now expended in a futile attempt to advance a comparatively small number, in increasing the advantages of an industrial training to a greater number of the afflicted.

The industrial training being very successful, and much more so than the theoretical education, were this magnificent charity increased as a scholastic training institution, a considerable saving might be effected, without any detriment to the pupils, if the theoretical education in subjects such as arithmetic and others, which are not important in assisting in discipline or physical training, were dispensed with, except for those few who appear likely to profit by such instruction. The whole time after teaching them to speak, dress, &c., might then be given to industrial work, which is more easily and economically taught. Under the excellent management at present existing, this work is to a considerable extent remunerative, and might be made more so by the plan proposed. Instead of pupils leaving the institution at the end of five years, this or a shorter period might suffice to serve as a time for training and learning some trade, after which they might be drafted into a separate or branch institution for industrial pursuits, such as rug and basket-making, sieve-making, and tailoring for our soldiers and police, and other occupations, now carried on on a smaller scale.

By such a system, instead of falling on the parish in spite of their training, as more than five-sixths of the idiots do, they would be permanently engaged in some occupation; earning, under the superintendence of the authorities, as much as possible towards their own support. The deficit might be supplied by private or public charity, which in this case would really be doing a good work.

The cost per head for training during the time necessary for teaching some occupation, would not be much higher under this arrangement than that of an ordinary industrial school, and the saving effected would assist towards keeping them permanently, when qualified, to do something to assist themselves. Many of them, in time, can at least be useful with their fingers, and some can really earn more than a living, so expert do they become; while they often require years of the most patient teaching to enable them to get through the simplest addition sum. With these two classes, and under careful management, it is to be hoped that ultimately such an institution would be almost self-supporting.

The officers of the Earlswood asylum appear to feel that at present the five years' plan with idiots is not altogether satisfactory. The training should effect a permanent benefit on the patients, or it would be sufficient to keep them happily and well while they are at the institution. Indeed, it even becomes a source of unhappiness to them if, on leaving Earlswood, they sink into want or the workhouse, when they acutely miss their accustomed advantages.

If the public were aware that, by some judicious training such as that proposed, the thousands of idiots could be converted into useful beings, their labour being of a remunerative character, even if not quite sufficient to render them self-supporting, the funds would not long be wanting for enlarging the institution now under consideration, and probably for erecting other establishments sufficient for training all our idiot and imbecile population.

THE CORPS DES PONTS-ET-CHAUSSÉES.

The following interesting account of the use and organisation of this corps is taken from the presidental address of C. B. Vignoles, Esq., F.R.S., to the Institution of Civil Engineers :—

The 1st February, 1716, marked the date of the actual establishment and definite organisation of the *Corps des Ponts-et-Chaussées*. A hierarchy of engineers was then created, which, though the duties first attributed to them have since been vastly extended, still exists in its leading features, on a system perfectly adapted to fulfil the purpose of keeping everything in the shape of what we call, in the present day, "public works" strictly bound under governmental control.

As now constituted, this *Corps des Ponts-et-Chausées* forms the most important branch of the government department in France designated as the "Ministry of Agriculture, Commerce, and Public Works." It is impossible in a brief sketch, such as I am attempting, to give more than a faint idea of the importance and many ramifications of this ministry, which includes the direction, inspection, and in many cases the carrying out of what, in this country, are assigned to various and generally independent bodies, or are not looked after at all, at least systematically. The agricultural branch is charged with the details and statistics relating to cultivation, produce of crops, drainage, irrigation, &c., with the supervision of the numerous farm and veterinary schools, the chambers of agriculture, and various other similar establishments; with the inspection of the river fisheries, with the regulation of the sea-bathing places, and the mineral water springs, and with sanitary affairs, general and special.

The commercial branch attends to assurance companies and tontines, to internal and external commerce, the valuation of custom-house entries, to the regulation and management of every mercantile port on coast and river, from the grand emporiums of Marseilles and Bordeaux to small fishing villages; it guards the various museums of and all that relates to arts, trade, or manufactures generally, through associations and schools; to the inspeetion of weights and measures, to the tobacco and gunpowder manufactories, and the protection of children in factories; to the control of all exchange agents and brokers, and of the various chambers of commerce, established in every department and in the principal towns.

The engineering branch inspects and controls every railway, canal, and navigable river, whether completed and in operation, or only in progress. It brings every mill and manufacturing establishment, worked either by water or steam, under its direction; mines, sunk or open, beds of minerals, quarries, and collieries, come under its regulations, and, of course, all steam engines, stationary or locomotive. Also all establishments for electric telegraphs, water, or sewerage, and the streets and improvement of towns. A special office is devoted to the management of all the lighthouses, channels, and buoys on the coasts, estuaries, and harbours. The construction and repair of highways and carriageable roads of every class come under its control. The supervision of the various scholastic establishments connected with engineering; the especial school of the Ponts-et-Chaussées itself, established soon after the corps was organised; the School of Mines, the School of Arts and Manufactures, and the engineering course of the Ecole Polytechnique. Within the category of its duties come the topographical and geological surveys of the empire, the whole extensive system of levels and contouring, and the publication of maps and profiles; further, it establishes minute regulations for the preparation, on fixed scales, of every plan and section intended for the purpose of soliciting a concession, and for every stage of the works subsequently executed. Finally, it has to report upon every concession demanded for any object, previous to presentation through the Minister of State, to the Crown, for ratification or otherwise.

Thus this "ministry" combines in itself, and becomes, theoretically, responsible for many of the duties performed in this country by the "standing order," and other committees of both Houses of Parliament, by some department or other of the Board of Trade, the Custom-house, the Ordnance Survey office, the Hydrographical Branch of the Admiralty, the Trinity Board, the Woods and Forests, the Board of Health, and other public Boards and Commissioners; by the county, city, and borough surveyors, by the way-wardens, and by innumerable local officers throughout the United Kingdom; besides many other duties and functions which, in this country, we have had no thought of creating for the purpose of control, but which are vested in this ministry by their perfect system of centralisation.

To keep this enormous machine in good working order, the subdivision of labour and responsibility has been carried to an extent which is a striking proof of the organising faculties of the French. There are in Paris about thirty-two bureaux, each with its staff of chief, deputy, and clerks, of which one-half have their attention devoted exclusively to public works. So of the almost as many permanent commissions sitting in Paris, each with at least a dozen members, besides councils and chambers of agriculture and commerce for each of the eighty-nine departments of France and all the principal cities. Further, there is a staff of engineers for each department and every great town in the empire, and for every railway, canal, and other establishment in working, besides engineers detached on leave, to assist and profit by experience to be gained in the management of railways or any private undertaking, and not a few are similarly allowed to look after public works of various kinds in foreign countries.

For the public works, the corps has 877 engineers in eight classes, of which 134 belong to the division of mines, and 4,343 conductors, in six classes, of which 149 at the present time nominally available, and 150 officers are mining guards; in addition, there are 275 harbour and other port officers; in the whole, 5,495 employés, are invalided with retiring allowances, there being nearly 200 widows of deceased officers in receipt of pensions. The *Ecole des Ponts-et-Chaussées* has 15 professors, mostly from the corps, 8 teachers, and 30 other persons on the staff for regulation purposes; at present, however, there are only 55 pupils at the school. The *Ecole des Mines* has 16 professors (mostly engineers). 8 teachers, and a large staff besides. There are only 9 pupils. The two working schools at St. Etienne and at St. Alais have 13 professors and teachers. We have often heard of the admirable modern management of the streets of Paris. To effect this, there are specially appointed 16 engineers of all classes, and 152 conductors, who have charge of the public streets, roads, foot pavements, promenades, plantations, water supplies, and sewerage, all appointed by the minister, but paid for by the municipality of Paris. I am not now considering the cost, but merely the organisation, which is certainly most complete and effective in its results.

The late Mr. Hosking, Professor of Engineering and Architecture at King's College, laid it down as a maxim, that it is "the combination of the workman and the man of science that forms the civil engineer," and I adopt the definition, as we all must. But the engineer of the *Corps des Ponts-et-Chaussées* is a highly educated scientific gentleman, and, as our esteemed member, Mr. Callcott Reilly, said in a debate a few weeks since, and there can be no better judge, "These engineers are all mathematicians." No doubt; but very few probably are at first practical men. These are found in the class of *Conducteurs des Travaux et Gardes-Mines*, and the young engineers are usually wise enough, till they acquire their own experience, to rely on them, they being generally really workmen.

These conductors of the *Corps des Ponts-et-Chaussées*

are a most valuable and in the main trustworthy body. They are entered, first, into the lowest of the six classes into which they are divided, at the average age of about twenty-five, after having served an apprenticeship to some master workman. By the time they are fifty, they get to rank as principal conductors, and, after a further service in that position, varying from three to thirteen years, they obtain appointments as sub-engineers, but rise no further, from want of sufficient previous education; they may be considered as the corporals, sergeants, and sergeants-major of the corps.

Those of higher grade (the commissioned officers, as it were, of the corps) enter the *Ecole des Ponts-et-Chaussées* at about twenty-one, and at the end of three, four, or five years are usually qualified for, and pass their examination, being then appointed as ordinary engineers of the third class, at which period they are not far from five-and-twenty. They then rise through all the ranks of the hierarchy, until they attain the position of inspector-general of the first class (the highest grade), after a service of thirty-six years, on the average. I have not been able to ascertain the rules of promotion, but I find that three officers of the same age, who entered the school on the same day, and, after five years' tuition, also obtained their first appointments as junior engineers on the same day, served respectively thirty, thirty-three, and thirty-six years before attaining the highest rank—so I infer that the promotion is not altogether by seniority. Neither can I get any reliable information about their pay, except that the first forty engineers-in-chief of the first class, each having served about thirty-five years in the corps on the average, appear to be entitled to about (under what circumstances I know not) to a salary of £320 a-year.

Such are the arrangements in the celebrated *Corps des Ponts-et-Chaussées* of France, which manages everything relating to engineering in that country, binding every one, native as well as stranger, not belonging to the corps, who desires to act in that profession, with a thousand ties of what an Englishman calls red tape. In theory, the system is perfect, but it drags along very slowly according to our ideas—and we must come to the conclusion that, however powerful to control, it is ill adapted to originate; yet it must be confessed that they are intelligent learners, and, if tardy in following, the do follow and improve; and they do certainly, after the realisation of facts, generally establish with accuracy the right mathematical principles on which they should be based. At the same time, it would be doing great injustice not to state, that many practical engineers of historical celebrity belonged to the corps of the French *Ponts-et-Chaussées*. I mention only Riquet, of the Languedoc Canal; Romain, the monk before mentioned; Belidor, who was also a military engineer and artillery officer; Perronet, Gauthey; but there were, and are, many others both in former and in modern times,

CORRESPONDENCE.

THAT THE NATIONAL PRINCE CONSORT MEMORIAL SHOULD FRONT TOWARDS LONDON, AND LOOK OVER THE SITE OF THE FIRST GREAT INTERNATIONAL EXHIBITION OF 1851, WHICH DIRECTIONS COINCIDE.

Sir,—It is with due deference to the relations and circumstances of the national tribute at present in the course of erection in Hyde-park to the memory of the Prince Consort, that I seek a place for this subject in your pages, than which none can be more appropriate, as the good Prince was our President for many years—as such commenced and eventually achieved the first great International Exhibition—and the Society of Arts was among the first who responded to the national desire to raise to his memory a material memorial.

A situation was chosen in Hyde-park for this structure; not, however, on the site of the Exhibition of 1851, but somewhat beyond it, to the westward, towards Kensington, where the park is the narrowest. This situation has been the subject of much comment; but assuredly, under present circumstances, it is best to strive to make the best of what is. At any rate, this somewhat remote sit e affords the opportunity of a long vista and worthy approach from London, up to the front of the memorial, if it be fronted in the just direction, namely, if it face towards London, and look over the site of the Exhibition of 1851, of which the directions fortunately coincide. That this is not the present scheme as to the direction in which the memorial should front, is evident in regarding its progress, and that is why this letter is written.

The idea at present held may be gained by looking at the cross at the summit of the memorial, which cross, however, being fortunately of metal, can be easily turned. By the direction of this cross, it may be seen that it is contemplated to face the memorial across a narrow strip of the park, over the Kensington-road, to the Albert Hall. Now I hold that, in any case, irrespective of what might have been or has been done in its vicinity, the memorial of the good and wise Prince, whose beneficent regard was so wide and national, should front, not towards the Horticultural-gardens, but towards the heart of the empire, towards London, and over the site of his great and peaceful achievement, the first great International Exhibition, which directions precisely coincide.

Were, however, any further consideration wanting to make this conclusion unavoidable and its justice emphatic, such would be supplied by the late erection of the Albert Hall; the great proportion and close proximity of which completely block up the vista in the direction in which the front has been hitherto contemplated, and necessitate, very fortunately, I think, the facing the memorial in another and the just direction, namely, towards the metropolis.

Perhaps I have said enough to set forth my proposal; but with those who are inclined to pursue the theme, we may see what further advantages accrue from this change from the wrong to the right. The first International Exhibition was a great historic event, of which the memory will go down hand in hand with that of the Prince; yet, strangely enough, its site, during a lapse of eighteen years, has hitherto been left wholly unrecorded, which would scarcely have been the case in any other country, and in truth, people even begin to be ignorant of where it stood. By the curious, however, the centre of its site may be traced as being nearly midway between two trees still standing in the park, near Prince's-gate, and which were included under the transept of the building. This centre point of what was the Great Exhibition structure is nearly half a mile, or thereabouts, on the London side of the memorial, and is precisely in front of its east face; and from this spot might well commence a grand promenade up to the front of the memorial, which promenade would form its principal approach from London, flanked respectively on the left and right by the other approaches of the carriage drive and the ride in Rotten-row. To limit my occupation of your space, I do not enter on details in respect to groups of trees, &c., that might enhance the north and south of this promenade, which would represent the main avenue of the Exhibition, nor the marking of its centre and extent by some simple means that would not cut up the park.

Enough, however, I hope, has been made evident in these few sentences that, by the mode they propose, not only a sufficiently long and open, but also a worthy and æsthetically correct front approach would be ensured up to the memorial from the metropolis; and also that, by the same means, that which has been so long omitted would be effected, namely, a record of the site in Hyde-park of the first great International Exhibition, and

thus also that the material remembrance of that great historical event would be united with the Prince Consort Memorial in one dignified and artistic plan. And I would submit the question—What could form so fitting an introduction to the national memorial of the good Prince as a grand front approach from the metropolis, over the site of that great national and peaceful event with which he blazoned our annals?

In respect to the Royal Albert Hall, it would thus still remain a near adjunct, but it would be relieved from the charge of standing in the way of the memorial, and precluding its just vista and approach. I conceive the advantages of what is above proposed are so evident that a visit to the spot will be conclusive in this respect to every mind.—I am, &c., Epsilon.

April 4th, 1870.

CHANNEL COMMUNICATION.

Sir,—I was very much interested in the discussion on Mr. Page's paper on March 30th, but must confess I was rather disappointed in the paper itself. I certainly expected that Mr. Page would have gone into more particulars respecting the construction of his tube. He told us a great deal about the tides at various parts of the Channel, but what they had to do with the subject under consideration I am at a loss to find out. I am sorry I cannot agree with Mr. Page as to the practicability of his scheme, and certainly I think he has very much under-estimated it. Mr. Winton, who has advocated laying down a tube of wrought iron, with a double shell (the space between the shells being filled with concrete), has estimated it at £11,250,000, and as he has no ventilating towers, the cost of them is not estimated. Mr. Chalmers estimated his tube at £12,000,000, and had three ventilators; and how Mr. Page is going to lay down a tube and place eight air-shafts in the Channel for £8,000,000 I cannot imagine. I do not think the public would prefer going through a tube (with only a few inches of iron and concrete between them and the water) to a tunnel through the strata, which, when once completed, would be safe always. There would be a great difficulty in making and keeping the joints tight; and I doubt very much if an apparatus could be constructed to enable divers to work under such a pressure of water. With regard to the ferries alluded to by Mr. Page, they certainly can never fulfil the requirements of the present day. They cannot prevent sea-sickness; and I certainly cannot see the utility of carrying empty trains across, as no one would remain in the trains while being taken on or off the ships.

Allusion was made to Mr. Hawkshaw's tunnel. This, as well as all the tunnels hitherto brought before the public, have this disadvantage, that should there be a fissure in the chalk, the brickwork or masonry with which they are, one and all, to be lined, would never prevent water at such a pressure (viz., about 200 lbs. per square inch) finding its way into the tunnel. To avoid this, I have proposed a plan (which has already been published) which is to line the tunnel with cast-iron and concrete. The tunnel is to be 22 ft. wide, and 22 ft. from top of arch to centre of invert, which would be wide enough for a double line. I propose to dispense with shafts in the sea, and ventilate from either shore. I think if we are going to block up the Channel with ventilating shafts, we may as well increase their number, and build a bridge; or perhaps Mr. Page's project could be turned upside down, and converted into a bridge. I think everyone will agree with me that the subject of a better communication with France is one of very great importance, and it is one that the Society of Arts would do well to take up, and thoroughly investigate. We should not be induced to accept this, that, or any other plan, merely because an engineer's name of some reputation is attached to it (for they may err as much as any one), but should thoroughly consider which plan would confer the most lasting benefits to the public at large.

Will you allow me to suggest that the Society of Arts should appoint a committee of engineers and commercial gentlemen, for the purpose of examining the plans of the various schemes, and reporting upon them. This would confer a great benefit, not only to the two countries directly interested, but to the whole world,—I am, &c.,

T. W. Cowan, C.E., Ph.D.

4th April, 1870.

THE SUEZ CANAL.

Sir,—In the course of the discussion upon the paper of Sir Frederick Arrow on this subject, Mr. Trelawney Saunders, alluding to the sandbanks which may possibly obstruct the entrance to the canal from the Mediterranean, describes the silt brought down by the Nile as gradually filling up all the ports to the eastward. Such, indeed, is the natural consequence of that river having been allowed to diverge, near the city of Cairo, into two or three main channels, besides innumerable small streams, natural or artificial, but within and outside the delta. Under such circumstances, silting up is inevitable, unless the simple remedy be applied of forcing the whole body of the Nile waters to join the Mediterranean by one undivided channel, by which means the silting would be driven out into deep water, and the only result would be, that the mouth would in time be extended in that direction.

The Danube is nearly blocked, owing to the many channels by which it communicates with the Black Sea, whereas, if confined to one channel only, the entrance would be free to vessels of any size or draft of water. The Po, though a magnificent river, has now no practicable entrance at all from the Adriatic, but disembogues through hundreds of small streams, meandering amidst a perfect labyrinth of sand shoals, extending from Comachio and Ravenna to Rimini. In the case of the Nile, its periodical overflow, though an immense benefit to the land of Egypt, also contributes to the destruction of the entrance from the Mediterranean. For a gallon of water, so to speak, cannot be drawn off a river in flood without causing a proportionate silting up of its bed, and deposit of sand at the mouth.

Any number of examples might be selected from our own insignificant rivers, whose mouths are now becoming either totally or partially impracticable for free navigation; in the first place, because the natural overflows are not prevented by permanent embankments; secondly, from the universal practice of drawing off their waters for the supply of navigable canals, now nearly useless; and especially from the establishment of such impediments to a free run, as weirs, dams, and locks everywhere, upon all our rivers and their tributaries, from the reach of tide to their source.

If our rivers and tributaries had a free run, we should hear little of the pollution of rivers, about which so great an agitation is now taking place, as rivers form the main drainage of the countries through which they flow; and if we interfere so unguardedly with nature's laws, for the purpose of inland navigation, water-power, or irrigation, by natural overflow, we must be content with the destruction of free navigation at their confluence with the open sea.—I am, &c.,

Henry W. Reveley.

Reading.

Sir,—Though I was present at the very interesting discussion held on the subject of the Suez Canal, on the 4th inst., the lateness of the hour deterred me from prolonging the meeting by any remarks of my own.

The mention of the name of Mr. Robert Stephenson reminded me, however, that I had lately seen and heard it coupled with a prediction of the impracticability of the canal as an engineering achievement. Now, any one who attended the debate which took place at the Hall of the Royal Geographical Society, about eight or nine years ago, may remember, as I do most distinctly,

that Mr. Stephenson, so far from asserting the construction of the canal to be impossible, admitted that the work might be completed, but stated that the great difficulty would lie in the maintenance of a free entrance, especially at the northern extremity. He added, with a touch of humour most reassuring to shareholders, that they might trust to the perseverance of M. de Lesseps for the undertaking not being abandoned until at least every shilling subscribed had been expended.

I certainly thought that the current of felicitation on the completion of the canal ran too much on its superiority over the Cape route, and that, but for one or two remarks at the close of the Conference, an uninitiated auditor might have been led to imagine that no more expeditious route had hitherto existed. Without wishing to detract from the merits of the canal, I cannot help thinking its effect upon commerce hitherto is overrated, and that, for some time to come, it will act less as a revolutionary than as a subsidiary passage to the East. To become the grand road it is imagined to be, it must certainly be widened if not deepened, and for this I do not believe the funds are yet forthcoming. The solution of the difficulty seems to lie in the development of Indian railways. So soon as transport from the interior to the outports is facilitated, and increased by their means to something like the extent effected in other countries, there will be so great a pressure for the most direct and economical means of traffic, that the full importance of a wide and well-dredged canal will be fully felt, and a remunerative return assured on the capital required.

I may add that I have lately seen the canal in its every-day working aspect, and though myself less qualified to form a scientific opinion as to the merits than some of those gentlemen who viewed it in its gala attire, the difference of opportunity may in some degree compensate for inferior ability in judging its capabilities.

I am, &c., F.R.G.S.

London, 22nd March, 1870.

MEETINGS.

Conference on International Money, Weights, and Measures.—The Council of the International Decimal Association will hold a conference on international coinage, the introduction of metric weights and measures, and the abolition of troy weights, on Friday, May 6th, at 8 o'clock, in the rooms of the Society of Arts, Earl Fortescue in the chair. The Right Hon. Sir Charles Adderley, M.P.; J. B. Smith, J.P.; Thomas Bazley, M.P.; Edward Baines, M.P.; C. R. Graves, M.P.; Dr. Farr, F.R.S.; Sir John Bowring, F.R.S.; Samuel Mann, President of the Institute of Actuaries; Frederick Hendricks, James Yates, F.R.S., Professor Leone Levi, and others will take part in the proceedings. Members of the Society of Arts and others will be admitted on presentation of their cards.

Institution of Naval Architects.—The annual meetings of the institution were held on Wednesday, April 6th, in the lecture theatre of the South Kensington Museum (by permission of the Lords of the Committee of Council on Education); on Thursday, 7th, Friday, 8th, and Saturday, 9th April, in the hall of the Society of Arts, John-street, Adelphi. A report of the proceedings, which should have appeared in the *Journal* this week, is unavoidably delayed, and will appear in the next and following week's *Journal*.

NOTICES OF PUBLICATIONS.

Photographic Art Journal.—The second number was published on the 1st of April, and as the question of prints and their production has recently been brought under the notice of members, when many processes of production were referred to, it may interest members to learn that the illustrations issued in the present number are produced by some of the processes recently described. The "Stirrup Cup," after a painting by Verschure, has been photographed and printed in permanent pigments by M. Goupil, of Paris, by Mr. Walter Woodbury's process, and the artistic qualities of the print are in advance of any ordinary engraving. The second illustration, "Netley Abbey," is printed in printers' ink, at the ordinary printing-press, by a process recently perfected by Messrs. Edwards and Kidd, and assimilated in many respects with the Albert-type process, the prints being taken direct from the gelatine and bichromate matrix. The third example is produced by the autotype process, with which members are familiar; and the fourth is an example of Fraworth's phototypy, and illustrates the power of reproducing printing surfaces from engravings, drawings, and wood blocks, thus rendering the works of the great art masters of the past capable of reproduction for the instruction of students in our own times.

OBITUARY.

Joseph Payne, Deputy-Assistant Judge, died on Tuesday morning, March 29th, after two hours' illness, from effusien of blood to the brain. Mr. Payne, who was in his 73rd year, was a gentleman commoner of St. Edmund's-hall, Oxford. He was called to the bar at Lincoln's-inn in June, 1825, and afterwards migrated to the Middle Temple. He practised as a barrister for a long period, and was subsequently appointed Deputy-Assistant Judge of the Middlesex Sessions, which position he has held for several years past. He had been long known for his efforts on behalf of the poor, and always took a warm interest in the various working men's clubs, and institutions of a like character. His connection with the Society of Arts commenced in the year 1832, and he was for many years one of the Society's treasurers; he was also one of the treasurers of the fund originally raised by the Society for carrying out the Exhibition of 1851, in consequence of which exhibition the shoe-black brigade was created.

GENERAL NOTES.

Agricultural Research at Nice.—A subscription is now opened at Nice, to establish there a laboratory for agricultural research.

Alloy of Zinc and Iron.—M. Oudemons has succeeded in making an alloy of zinc and iron. The new metal, which contains 4·6 per cent. of iron, is remarkable for its whiteness and tenacity.

Exhibition at Forli (Romagna).—In October of the present year an exhibition of the fine arts and of objects relating to agriculture and manufactures, will be held at Forli, near Bologna. Products from all parts of Italy will be allowed to compete for the prizes offered.

American Kerosene Oil.—The specific gravity of the native petroleums varies from 0·773 to 0·910; and of 100 parts of crude Pennsylvanian petroleum, the average composition is—Gazoline (sp. gr. 0·744), 10 parts; naphtha (sp. gr. 0·752), 10 parts; oils fit for burning and lubrication, 76 parts, varying in specific gravity from 0·844 to 0·760. Some kinds of kerosene sold at New York appear to contain no less than 90 per cent. of the very volatile oils, whilst in other instances the quantity of the latter is nil.

Production of Heat.—M.M. Troost and Hautefeuille state that carbon, combining with oxygen, only gives out 8,000 caloric units; boron under the same conditions yields 14,400 caloric units; while, when boron combines with three equivalents of chlorine, 104,000 caloric units represents the heat set free.

Icicles in Plants.—M. Prillieux has shown that icicles exist in the interior of all frozen plants. These icicles form small columns perpendicular to the surface, and often penetrating the epidemis. The ice is formed from liquids derived from the cells; the cells, however, remain intact, so that there is no destruction.

Education.—Recent facts have given the following figures:—In Birmingham, where there are 83,000 children, varying from 3 to 13 years of age, only 16,000 frequent inspected schools, and 10,000 non-inspected schools. In Leeds, out of 58,000 children, 12,000 are being educated at inspected schools, and 7,000 at other schools. In Manchester, out of 60,000 children, 25,000 attend inspected schools. In Liverpool, the number is 30,000 out of 90,000.

Molecular Structure. — Sir William Thomson has established the conclusion that, in any ordinary liquid, transparent solid, or seemingly opaque solid, the mean distances between the centres of contiguous molecules is less than the hundred-millionth, and greater than the two thousand-millionth of a centimetre. He illustrates the degree of eoarse-grainedness indicated by this conclusion by stating that the structure of a rain-drop or a globe of glass, as big as a pea, magnified up to the size of the earth, would be coarser grained than a heap of small shot, but probably less coarse than a heap of cricket balls.

Fresh Butchers' Meat from America to Europe.—It is proposed by M. H. Yobes to protect fresh meat during the journey from Montevideo to Europe in the hot weather, by having the hold of vessels lined with metal, and then covering the bottom of the hold with clean straw, sawdust, or bran, or some non-conductor of heat, upon which the meat is to be laid, and upon it a layer of ice, and on the top of the ice more straw, or other of the substances just named, and then another layer of meat and ice, and so on, the hold to be thus filled, and then hermetically closed.

Exhibitions at Naples, Turin, and Florence.—Italy is making active preparations for three great shows. The International Maritime Exhibition, which is to take place at Naples; the National Industrial Exhibition, at Turin; and, finally, the Exhibition of Female Work, at Florence, next autumn, are all three of them events which will be of the utmost importance to the industry of the country. The Minister of Agriculture and Commerce has lately sanctioned the regulations for the Maritime Exhibition, and the common council of Naples unanimously resolved to give £4,000 towards it. The objects exhibited will be distributed into ten groups:—1. Naval architecture; 2. Steam engines; 3. Harbour and various marine establishments; 4. Timber, metals, and combustibles; 5. Various articles and materials used in rigging and fitting up ships and in navigation; 6. Nautical instruments, apparatus for saving life, and arms for the merchant service; 7. Provisions for ships, sailors' clothes; 8. Fishery department; 9. Scientific section; 10. Principal kinds of export merchandise of Italy. The exhibition will be opened on the 1st of September, and closed on the 30th of November. As the Syndic of Turin has been nominated to the presidency of the commission of the Turin exhibition, and as he has lately been called to Florence, it is clear that the undertaking is favourably received by the present government, in spite of the rigorous system of economy which it has introduced. It remains to be seen whether the exhibition can be carried out in 1872.—*L'Industriale Italiana.*

The Consumption of Tobacco.—The consumption of tobacco for the year just ended was at the rate of 1½ lb. per head. In 1867, the quantity consumed was 41,048,000 lbs.; in 1868, 41,280,000 lbs.; and in 1869, 41,719,000 lbs. The increase may be accounted for by the increased population. Some kinds of tobacco appear to be much more injurious than others, and shag, so much used by English working men, is perhaps the worst.

Testing of Alcohol and Spirits for Amylic Alcohol.—The internal use of amylic alcohol, even in small quantities, being very deleterious, it is important that its presence in spirits and alcohol should be rapidly tested. This is done by pouring the suspected alcohol into a burette, mixed with its own bulk of rectified and pure ether and also its own bulk of water, when, after the mixture is gently shaken, the ether will become separated from the rest of the fluid and float to the top, containing in solution the whole of the amylic alcohol present in the burette. The ether is removed by a pipette, and, on being left to evaporate spontaneously, will leave behind the amylic alcohol, readily detected by its offensive smell.

Phosphate of Lime.—The New York journals announce that, in the neighbourhood of Charleston (United States), a short time ago, a considerable deposit of phosphate of lime was discovered, stretching over an area of about seven hundred acres. The beds of this phosphate are from forty to sixty centimetres in thickness, and it is calculated that the entire deposit has a value of above 6,000,000 dollars. This phosphate, which is more fertilising than Peruvian guano, can be sold at Charleston for six dollars a ton; and for facilitating its sale, the proprietors have resolved to excavate a canal two miles in length, fifty feet wide, and three deep; which, starting from the deposit of phosphate, falls into the river Arkely, which passes the town of Charleston.

A Large Lens.—The largest photographic portrait lens ever made in this country is one of 10½ inches diameter, recently completed by Ross, and now in the possession of Mr. Mayall, of Regent-street. It is an achromatic lens of great power, capable of taking portraits from the smallest miniature up to very nearly life-size. It is made of the whitest glass, and is large enough to admit a volume of light sufficient for the execution of photographs covering a space of 10 inches by 12 inches in eight seconds. The lens renders in the photograph all that is seen in the optical image, and this so truthfully that the coarseness and exaggeration belonging to large photographs, taken with inferior lenses, are altogether absent. In the open air, groups of 15 to 20 persons (each face about the size of a sovereign, and the whole picture 29 inches square) can be taken in ten seconds. The cost of manufacturing the lens was more than £200, but it is decribed as being worth its weight in gold.

Deposit of Sulphur.—Several of these deposits have been discovered in California, where, in one establishlishment some ten tons are now refined daily. The most recent report is from the Suez Canal, where, on the shores of the Red Sea, at the entrance of the Gulf of Suez, two inexhaustible deposits have been found. One at Djemsah, is situated in a perfectly rainless desert on the African coast, very near the sea, and consists of a hill 600 feet high, composed entirely of sulphur. In order to obtain the sulphur, it is blasted like the rock in a common stone quarry. Two hundred Arab labourers are occupied, under the supervision of French engineers, and produce some ten tons of sulphur a day. A railway is in course of construction, for the purpose of transporting the sulphur rapidly and in large quantities to the furnaces in which it is refined, and thence to the coast to be shipped. The Viceroy of Egypt buys from the French

company all the sulphur at eighteen dollars per ton. The other locality is Ranga, 500 miles from Suez, and also near the coast of the African continent. In this case also the sulphur appears in the form of rocks, much purer than the former, of a bright lemon-yellow colour, but covered under the earth, so that it must be obtained by tunnelling. This sulphur mine has not yet been worked to any extent.

The Projected State Railways in India.—The Under-Secretary of State for India has stated, in the House of Commons, that the Public Works Department would undertake the duty of constructing these railways; that the officers of the engineer corps were thought to be incompetent; and that the Indian government had a heavy stake in the completion of the works in the most perfect manner. It was under consideration whether the materials would be transmitted through the Store Department. Mr. Duff also said that not more than $3\frac{3}{4}$ millions would be expended in any one year, but that the government had not been informed as to the amount to be spent this year, nor could he say what number of miles of railway it was proposed to construct in India.

Plants as Sanitary Agents.—In the museum at Leicester, Mr. Ingram recently delivered an address on this subject, and explained how plants and trees absorb the moisture from the earth, which would otherwise appear in miasmatic exhalations. Vegetable action produces oxygen and liberates the air from taint, so that the multiplication of trees, shrubs, and plants increases the vital principle of the air, and helps to get rid of its impurities. All trees are, of course, not alike in taste and constitution. Those which are deciduous, with large woolly or hairy leaves, are not suited for towns; the particles of carbon that float on the air resting on the leaves often destroy them. Pines and firs require a pure air. The lime, the plane, the sycamore, the elm, and the chesnut, are amongst the trees that will thrive in towns. Low, marshy lands are greatly improved by heavy cropping. London sewage has made the poor, sandy wastes of Barking Creek wonderfully fruitful. Vegetation seeks support, and seizes upon the pabulum within its reach; nothing, for instance, is too gross for a hungry and healthy vine. The lecturer also mentioned a singular fact in proof of the power which plants possess to divert noxious exhalations. Washington Observatory, United States, is situated in a deadly marsh, the result of which was, that the astronomers' assistants were killed off wholesale. Sunflowers were sown all round, and they reached their greatest luxuriance at the time when the fever was most rife; but the happy result was, that the fever disappeared, whilst the plants luxuriated on the very poison that had committed such havoc. Mr. Ingram further suggested that trees or their roots might be employed as filterers around wells suspected of impurity by the percolation of foul matters into the water within them.

Poor Relief in Paris.—The reports of the Assistance Publique give the following information relative to poor relief in Paris:—It appears that there are rather more than 100,000 persons in the habit of receiving charity, of whom 40,000 are heads of families, and that the amount distributed is about £168,510. Amongst the recipients appear 10 men of letters, 10 teachers, 2 interpreters, 1 doctor, and, strangely enough, 3 drummers of the National Guard, and 8 soldiers of the municipal corps, the Gardes de Paris. Amongst the most numerous classes of indigent are 588 concierges, 422 commissionaires, 120 newsvendors and porters of journals, 50 frotteurs, polishers of oak flooring, 29 shoeblacks, 26 sewer men, 326 chiffonniers, 227 street-sweepers, 121 bargemen, and 190 persons who have never followed any calling. The afflicted include 172 blind persons, and 50 idiots and deaf and dumb persons. The females include 43 employed in the tobacco factories, 33 dress-makers, 2,909 needlewomen, 58 dealers in cast-off clothing, 457 dealers in sweetmeats, &c., 34 hawkers of vegetables, 1,917 servants and portresses, 175 nurses, 240 chiffonnières, 108 street-sweepers, and 2 newspaper folders. Amongst women of the more or less educated classes are 1 painter, 6 artistes, 2 actresses, 10 midwives, 1 hairworker, 23 school mistresses, 4 teachers, and 1 professor. There are also 221 females who have never had any employment. The afflicted class is composed of 194 blind, 83 idiots, 67 epileptics, 16 paralytics, and 7 deformed. The total amount of charity dispensed, when divided by the number of recipients, only gives an average of a centime per person per diem. Of course, the above account does not include the sums dispensed by charitable societies and private individuals.

Bread-making.—An interesting article appeared in the February number of the *Bulletin du Musée de l'Industrie de Belgique* on this subject. It relates to the substitution of certain powders (Horsford-Liebig) for the ordinary yeast, and mentions some experiments which have been made at the bakery of Dornach. These powders consist of two substances, which are mixed at the time of making the dough. One of them, formed principally of bicarbonate of soda, is decomposed when brought into contact with the phosphoric acid, or rather the triphosphate of lime contained in the other powder, thus causing carbonic acid gas to be disengaged. The disengagement of gas thus produced takes the place of that arising from the usual fermentation by yeast, which requires careful attention to ensure a perfect result. The two powders are sifted over the flour, which is first spread out in a thin layer, and the whole stirred together dry. Cold water, with a due admixture of salt, is then added, and the dough made up quickly. After standing fifteen minutes, the bread is formed and put into the oven. For very light bread, the flour is divided equally, and each of the parts separately mixed with one of the powders, which has already been dissolved in the proper quantity of water. The two portions of dough thus formed stand for thirty to forty-five minutes, and are then mixed together. This must be done carefully, and the salts thoroughly dissolved, otherwise brown lines are left in the bread, which, however, does not affect its taste. The advantages which attend this mode of making bread are stated to be, first, that a larger quantity is produced in proportion to the flour used, that it never becomes mouldy nor turns sour, that it is more quickly made, and, last of all, that it is more nutritious and easy of digestion. It is also thought to have a better taste. Its consistency, however, makes it unsuitable for soaking or use in soup.

MEETINGS FOR THE ENSUING WEEK.

Mon......Asiatic, 3.
Victoria Inst., 8. Dr. W. Hitchman, "On True Anthropology; or, the Spiritual, Mental, and Physical Constitution of Man."

Tues ...Civil Engineers, 8.
Statistical, 8.
Pathological, 8.
Anthropological, 8.

Wed ...Society of Arts, 8. Mr. A. J. Ellis, F.R.S., "On a Practical Method of meeting the Spelling Difficulty in School and in Life."
R. Society of Literature, $4\frac{1}{2}$. Annual Meeting.

Thur ...Society for the Encouragement of the Fine Arts, 8. Mr. Henry O'Neil, "The Influence of Art on Civilisation—Music and the Drama—and the Influence of Fashion on Art."
Zoological, 4.
Linnæan, 8. Mr. St. George J. Mivart, "On the Vertebrate Skeleton."
Chemical, 8.
Numismatic, 7.

Fri ......Quekett Club, 8.

Sat ......R. Botanic, $3\frac{3}{4}$.

Journal of the Society of Arts.

FRIDAY, APRIL 22, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock :—

April 27.—"A Narrative of the Works of the Suez Canal." By Daniel Adolphus Lange, Esq. On this evening J. F. Bateman, Esq., F.R.S., will preside.

May 4.—The Society's Conversazione at South Kensington Museum.

May 11.—"On Railways for India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

May 18.—"On International Money of Account, independently of International Coinage." By Jacob A. Franklin, Auditor of the Society; in sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1854.

May 25 (At Three o'clock).—"On the New Organ in the Albert Hall of Arts and Sciences, South Kensington." By I. Willis, Esq. At this meeting Sir Michael Costa will preside.

CANTOR LECTURES.

The third course of Cantor Lectures for the present Session will be given by Professor A. W. Williamson, F.R.S. The course will consist of four lectures, "On Fermentation," to be delivered on Monday evenings, the 25th of April, and the 2nd, 9th, and 16th of May, at 8 o'clock.

Lecture I.—Monday, 25th April.

Chief varieties of fermentation.—Chemical processes which take place in the best known processes of fermentation.—Other chemical processes analogous to them.—How these cyclical processes are distinguished from ordinary processes of chemical action.

Lecture II.—Monday, 2nd May.

Cyclical action analysed: 1. In known cases; 2. In less known cases.—Theory of "contagiousness" of chemical action.—Composition of yeast, and changes which it undergoes.—Assimilation of food by yeast plants during life.—Decomposition of yeast plants during life.

Lecture III.—Monday, 9th May.

Propagation of ferments.—Prevention of fermentation.—Germs in air: how removed; how destroyed.—Processes for arresting fermentation.

Lecture IV.—Monday, 16th May.

Wine-making and wine-keeping.—Chemical changes which improve the quality of wine.—Chemical changes which deteriorate the quality of wine.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture. Tickets for this course are issued with this number of the *Journal.*

CONVERSAZIONE.

The Society's Conversazione is fixed to take place at the South Kensington Museum, on Wednesday evening, the 4th of May. Cards of invitation have been issued.

ALBERT MEDAL.

The Council will proceed to consider the award of the Albert Medal early in May next. This medal was instituted to reward "distinguished merit in promoting Arts, Manufactures, or Commerce," and has been awarded as follows :—

In 1864, to Sir Rowland Hill, K.C.B., "for his great services to Arts, Manufactures, and Commerce in the creation of the penny postage, and for his other reforms in the postal system of this country, the benefits of which have, however, not been confined to this country, but have extended over the civilised world."

In 1865, to his Imperial Majesty the Emperor of the French, "for distinguished merit in promoting, in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects."

In 1866, to Professor Faraday, D.C.L., F.R.S., for "discoveries in electricity, magnetism, and chemistry, which in their relation to the industries of the world, have so largely promoted Arts, Manufactures, and Commerce."

In 1867, to Mr. W. Fothergill Cooke and Professor Charles Wheatstone, F.R.S., in recognition of their joint labours in establishing the first electric telegraph."

In 1868, to Mr. Joseph Whitworth, F.R.S., LL.D., "for the invention and manufacture of instruments of measurement and uniform standards, by which the production of machinery has been brought to a degree of perfection hitherto unapproached, to the great advancement of Arts, Manufactures, and Commerce."

In 1869, to Baron Justus von Liebig, Associate of the Institute of France, Foreign Member of the Royal Society, Chevalier of the Legion of Honour," &c., "for his numerous valuable researches and writings, which have contributed most importantly to the development of food-economy and agriculture, to the advancement of chemical science, and to the benefits derived from that science by Arts, Manufactures, and Commerce."

The Council invite Members of the Society to forward to the Secretary, on or before the 25th of April, the names of such men of high distinction as they may think worthy of this honour.

INDIA COMMITTEE.

It will be remembered that on the 13th of July last a deputation from the Council and India Committee of the Society waited on the Duke of Argyll, for the purpose of urging the government of India to take steps for providing a Department of Agriculture for India. The Council have great pleasure in announcing that a Department of Agriculture and Commerce for India has now been established, and that Mr. Rivett Carnac has been appointed the Secretary.

PROCEEDINGS OF THE SOCIETY.

NINETEENTH ORDINARY MEETING.

Wednesday, April 20th, 1870; Edwin Chadwick, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society :—

Bullock, William (Mayor of Macclesfield), Cumberland-house, Macclesfield.
Carreras, J. Joaquin, 61, Princes-st., Leicester-sq., W.C.
Downes, Charles, 29, Coleshill-street, Eaton-square, S.W.
Dupré, Dr. Auguste, Westminster-hospital, S.W.
Hanson, Edward, 15, Langham-place, W.
Orr, Peter, 26, Compton-terrace, Edinburgh.
Peters, George Donaldson, 9, Bow-lane, E.C.
Pritchit, John, 2, Chilworth-st., Westbourne-terrace, W.
Rolfe, W. F., Upper Barchester-st., Poplar New-town, E.

The following candidates were balloted for, and duly elected members of the Society :—

Collett, Richard, 25, Burleigh-road, Highgate-road, N.
Haden, George Nelson, Trowbridge, Wilts.
Thorpe, Alfred West, 31, Henrietta-street, W., and Stock Exchange, E.C.

The Paper read was—

ON A PRACTICAL METHOD OF MEETING THE SPELLING DIFFICULTY IN SCHOOL AND IN LIFE.

By Alexander J. Ellis, F.R.S., F.S.A.

It would be sheer waste of time to demonstrate the reality of an English spelling difficulty to an audience which, admitting its existence, has come to hear an account of some practical method of meeting it. To listen to the long and ingeniously humorous accounts of the world-known vagaries of our orthography, one would imagine that no one could learn to read at all. On the other hand, when all of us present are perfectly well aware of having learned to read, we are apt to consider such statements as purely chimerical. It is quite certain that the inconsistencies usually cited, such as the never-failing *o-u-g-h*, do not produce the same impression on the mind of a child who is learning to read as on the mind of an adult, who, having learned to read, wonders at his own prowess. Nor are statistics of much greater value, for when we find the state of education so different in Holland and Spain, two countries which possess excellent systems of writing, we must be cautious in attributing too great an influence to an erratic or systematic orthography. Yet, if we confine ourselves to the recent report on the state of education in the four largest provincial towns in the country, and find that in Birmingham, out of 16,000 pupils in inspected schools, only 256, or less than 1 in 60, could read a simple narrative or write a simple paragraph from dictation with the necessary correctness, we cannot but feel that, however much weight we must attach to bad attendance, bad teaching, and bad brains, there must be something due to bad material. We may assume, then, as universally admitted, that there is a spelling difficulty, which so seriously interferes with the work of education, that it is of social importance to meet it in schools. It is not so generally admitted that there is also a spelling difficulty in life. Our newspapers have sometimes revenged themselves on a literary man by printing a letter of complaint in his exact orthography and punctuation. Our humorists have revelled in supposititious spelling ignorance. Any one who receives letters from servants, working men, or even small tradesmen, knows how much truth there is as a groundwork for this comedy. But what is meant by the spelling difficulty in life may be best illustrated by an example. I have been able to read and write, in the ordinary acceptation of the terms, for fifty years. For forty years out of that time I have been a diligent student, reading and writing extensively. More than that, I have for the last five and twenty years paid particular attention to the value of our letters and the mode of using them. If, then, any one with ordinary capacity can learn to read and write English perfectly, I ought to do so. What is the actual state of the case? I cannot read out a single page of the "Post-office London Directory" with certainty. I cannot read out any technological work, any chemical, physical, physiological, anatomical, medical, geological, zoological, botanical, or similar treatise with certainty—nay, I am often at a loss in subjects with which I am more familiar, such as philology, astronomy, and mathematics. I am not surprised at this, for I find that men of science, who are apt to imbibe words by the eye rather than the ear, are very much at issue when they come to pronounce. As for the names of history and geography, and the foreign correspondence of the daily press, they are hopeless. Most of them resemble the name of Southey's celebrated admiral in his "March to Moscow"—

> Last of all an admiral came,
> A terrible man with a terrible name,
> What it was you all know well,
> No one can read it, and no one can spell!

The newspapers have lately been full of a word which I cannot trust myself to pronounce. They spell it *p-l-e-b-i-s-c-i-t-e*. I find it in the 8vo. Worcester, without the final *e*, but he has wisely abstained from giving the sound! I have no conception whether the writers call it *pleb·isit*, *pleb·iscit*, *plee·bisit*, *plee·biscit*, *plebis·it*, *plebis·eit*, *plibis·it*, *plibis·cit*, or even *plaibeesee·t* from the French, or *plibis·iti* from the Latin word, which we miscall *plibis·itum*. So there it remains, like a Chinese ideograph, very expressive, but quite inexpressible. Now, if I have this trouble in reading, what must I have in spelling? Unable to guess the arbitrary sounds from the visible forms, how can I hope to divine the arbitrary characters from the audible sounds?

This difficulty is not merely felt in names, which no wise man attempts to write unless the letters are called out to him. I always find it necessary to spell out my own, simple as it is, for the very simplicity of the orthography makes it avoided; and such forms as Elliee, or Eliss, are generally preferred by tradesmen. It is also not merely felt in technical words, where it is rampant. Few who merely heard the words would hit upon the correct orthography of *feuzee*, *ruluk*, *bifin*, *baumen*, *berjois·*, *feuglmen*, *neis rok* (=fusil, rowlock, beaufin, batman, burgeois, flugelman, gneiss rock). Some, even here, may be more or less puzzled. But the difficulty is felt in the commonest words. I must own to not being always independent of a dictionary, even now, leaving out of consideration all such technical words, together with the 2,000 words of doubtful orthography which Worcester has enumerated.

This is the difficulty which haunts us in school and in life. We can never tell with certainty how to pronounce any word we see, but have not heard. We can never tell with certainty how to spell a word we hear, but have not seen. All methods of teaching reading, and writing which do not proceed on the absolutely impossible conditions of seeing, hearing, and memorising every word in the language, can only lead us to guess more or less correctly at the sound and form of a word; and that method is best which teaches most expeditiously the simplest rules for guessing.

Now, then, for the method of meeting this difficulty, for it must be met, not shirked. It is absolutely necessary that every person born or brought into the sphere of English should learn to read with fluency in the present spelling, to the extent at least of the few thousand words which he requires; that he should have a means of mastering the sound of every even unusual word; and that he should be able to express himself readily and systematically in writing in such a manner that all present readers should immediately understand him. If this is accomplished, the difficulty is met. This, then, is the problem before us. But to educationalists it is by no means the whole of the problem. They know that much more is required than merely giving an intelligible sound to each word. They have to train the child's mind. They have to teach him a received pronounciation, to correct provincialisms and congenital or acquired defects of speech, to lead him to read intelligently as well as intelligibly. And yet these points are utterly

neglected where most needed, in elementary schools. The teachers cannot teach what they do not know, and what they do know they must be taught how to teach. Methods of communicating knowledge, and of communicating those very methods, are among the most pressing school requisites of the day. The problem of the spelling difficulty is not solved unless this important scholastic aspect of it is duly provided for.

Again, philologists, travellers, and missionaries are also aware of the pressing need of being able to note down unwritten languages, such as our own dialects, intelligibly to others, and of the helplessness of our present spelling for that purpose. I may mention that the instrument which I shall shortly explain arose from this very source, is the outcome of an extended examination into the relations between signs and speech in our own language from Anglo-Saxon adoption of Roman letters to the present day, and was forced upon me by the necessity, for my own investigations, of having an orthography which would embrace the whole of the British dialects, and yet be readily intelligible to the whole community.

The following three considerations have mainly influenced me in bringing my remedy for these difficulties before such a body as the Society of Arts. First, the problems of reading and writing are entirely distinct, especially with reference to a native who is necessarily more or less familiar with the words and sounds of a language before he is taught to read. There is the same difference between reading and writing as between hearing a speech and making a speech, between translating from a foreign into a native, and translating from a native into a foreign tongue. In the first case, we appreciate attempts to represent what we know, and are essentially passive. In the second we endeavour to represent to others, by means of their own instrument, what we know ourselves, and are essentially active. Practically, among ten persons who read decently, you will hardly find more than one who writes decently. It is only when sign and sound exactly correspond that there is a chance of writing being as easy as reading, and even then the chance is opposed by the difficulties of appreciating sounds and manipulating symbols. In French, there is such a near correspondence of one sound with one combination of letters, that it is tolerably easy for a foreigner, very easy for a native, to read any given French word. But there is such a multiplicity of written signs corresponding with each single spoken sound, that scarcely any Frenchman spells decently. In the *Athenæum* of last Saturday (16th April) it is stated that 30 per cent. of Frenchmen cannot read, and 70 per cent. cannot write their own language. Modern Greek is a still more striking example, for it is extremely easy to read, but incomprehensibly difficult to write. Other languages show the opposite condition. In Italian, each sound has practically one sign, so that it is very easy to spell. But the vowels *e*, *o*, and the consonant *z*, have each two sounds, and the place of the accent is only rarely marked, so that reading is much more difficult. In Arabic this difficulty becomes extreme, for only the consonants are generally written, and when the vowels are inserted each is allowed to have several meanings, so that reading is difficult even to a native, and almost impossible to a foreigner. In Turkish, the acme of absurdity is reached, by having three different methods of reading in use, Turkish, Persian, and Arabic, with nothing to point out which method is to be employed for a given word, a complicated vowel system, and no vowels inserted. On the other hand, Hungarian, Bohemian, Polish, and Spanish, are almost as easy to write as to read; and Dutch orthography is only marred by some etymological fancies. German is by no means perfect, Swedish is very bad, Russian ought to be perfect, but has been allowed to deteriorate, and also does not mark the position of a very variable accent. We must therefore bear in mind that the problem may admit of a double solution, and that many schemes might solve the easier portion of teaching reading, without touching the more difficult task of teaching writing.

Secondly, those who have had occasion to consult old books find that they have not any difficulty in reading works of the seventeenth century, or even the higgledy-piggledy spelling of the sixteenth. Chaucer, perhaps, occasions more difficulty, but rather from idiom and obselete words than spelling. Our knowledge of the present spelling enables us to read with our present pronunciation—which of course is wrong, but that is here immaterial—the very different orthography of our older writers. We also read without much difficulty the illiterate attempts of ignorant writers, or the purposely picturesque orthographies of a Thackeray or a Hood. It is therefore evident that it is not necessary, in order to communicate freely with those who can now read, to use the identical orthography which they employ, provided we use one which consists of the same letters used in the same general senses. And just as we read old and bad spelling without attempting to write it, so we might be able to read our present spelling without having the drudgery of writing it. In other words, it is clearly possible to imagine a future spelling which shall bear to the present a relation similar to that which the present bears to the past. The present and past spellers may be intelligible to the future, and the future to the present, without any more necessity for the future to write like the present, than the present now find for writing like the past.

The third consideration is derived from what has actually happened to musical notation in this country. The established musical notation, which every one recognises as necessary to be learned, was invented for a system of temperament now known as the unequal or old organ tuning, which is practically obsolete. It is ill-adapted even to the present fingerboard and tuning of the piano and organ. But for singing it presents such difficulties that amateur singers at sight were practically unknown. It also presents great difficulties in the theory of harmony, while it is helpless in representing just intonation. To obviate these difficulties Miss Glover invented, and Mr. John Curwen, with extraordinary perseverance and success, has worked out an entirely different system, known as the tonic sol-fa notation, which enables the pupil to understand the thing music and the thing harmony, and has made sight-singers and practical harmonists plentiful. More than this, owing to the common relations of the scale, it was found that those who had thoroughly mastered the tonic sol-fa notation were able, with a few weeks' instruction, to read the old notation in their own sense, and hence to sing at sight in any key or clef, a feat thought to be impossible on a large scale. The success of this system has been so great, that the Society of Arts, which I have now the honour to address, and which for this very reason I have been anxious to address, has allowed answers to their musical examinations to be given either in the established or the tonic sol-fa notation. The Committee of Council on Education have also allowed teachers in subsidised schools to draw their fees for teaching singing either in the established or the tonic sol-fa notation. That is to say, the Society of Arts and the Committee of Council on Education have recognised the existence of the tonic sol-fa notation concurrently with the established, and have, so to speak, accorded it belligerent rights as a *de facto* power.

Now these three considerations—first, that reading and writing are different problems; secondly, that we actually write one English orthography and read several English orthographies; and, thirdly, that there are two concurrent and acknowledged systems of musical notation—taken in conjunction with my own long-continued historical researches into the nature and meaning of English orthography, have suggested the following remedy for the difficulties we all feel and desire to remove:—

In the first place, I have invented a system of writing which appears to satisfy the following conditions:—

1. It is intelligible at sight to readers of our present spelling, giving them no more difficulty at first than the orthography of Spenser, and much less difficulty after five minutes' use.

2. It consists of absolutely the same letters as our present alphabet, without any superscribed accents or diacritics, and without any modification of form, each letter and combination of letters having its best known English signification.

3. It occupies as nearly as possible the same space as the present spelling for the representation of the same words.

4. It is very easy for a child to learn to read.

5. It is nearly equally easy for a child to learn to write.

6. It would render the whole labour of learning to read—first, in accordance with its own system, and, secondly, in the usual spelling, much less—less than half that which is now necessary under the best methods for learning to read in the usual spelling alone.

7. It would not increase the difficulty of learning to write and spell in the present way, when considered desirable.

8. It presents peculiar advantages in giving the received or any required pronunciation of a word with exactness, pointing out the precise position of the accent.

9. It is not merely confined to the English language, but can be, and in fact has been, extended so as to represent the sounds of all words occurring in the British Empire, and all words and names introduced from countries with which England comes into commercial or political relation, intelligibly, upon an English basis.

This system of writing I term *Glossic*, from γλῶσσα, the tongue; and, as it is convenient to have also a brief name for the customary spelling, I venture to style it *Nomic*, from νόμος, custom.

This system of writing, the construction and application of which I shall immediately explain, I propose for concurrent use. That is, I would not interfere in the slightest degree with the old spelling, the existence and value of which I fully recognise. I would not alter or modify it in any respect whatever, believing that such attempted alterations and modifications would seriously detract from its value, without in any commensurable degree removing the difficulties it creates. I insist even on the necessity of every British subject being able to read it, as the indispensable condition of benefiting by the stores of knowledge and literature which it possesses. And I therefore lay down, as a most important property of any proposed system of orthography that it should facilitate the acquisition of reading all that is now printed, or will hereafter be printed, in the customary spelling.

But I do not see that this object, which I keep steadily in view, is in any wise opposed to the use of another system of spelling for a different purpose, one which will teach the thing reading and the thing pronunciation, and will give to every Englishman a means of communication on paper, even with those who only write in the present spelling, without previously undergoing the labour necessary to acquire the habit of writing in the customary orthography. That is, I do not see why we should not recognise the distinction between reading and writing, and allow those who choose, while they read the present erratic print, to write in a future systematic spelling. A great objection lies against the present wild attempts to indicate the sounds of words which every ignorant writer practises. Bad spelling is unendurable. But the systematic representation of pronunciation is not bad spelling. It implies an education at least as high as that possessed by those who mechanically trace the letters they have mechanically learned to use. It really implies a much higher special education, a knowledge of the nature of speech, an habitual power over the analysis and synthesis of speech sounds which is now extremely uncommon, even in those who have received a so-called first-class education, but which, as I know by experience, can, by judicious training, be readily, pleasantly, and effectively communicated to children of the most ordinary intellectual capacity. The man who deliberately writes glossic can no more be laughed at than the man who deliberately composes music in the tonic sol-fa notation. He is, in fact, exercising a liberal art, which gives him an actual advantage over the man who cannot exercise it. He is replacing mechanical routine by intellectual method.

The process by which I conceive such a concurrence of two orthographies might be established is as follows:—

1. The proof that the nine conditions already stated are practically fulfilled. This must of course be the work of considerable time and labour. It is only from my former experience of the results obtained by working a cognate system that I am able to speak now with perfect confidence of the success of the present plan, which avoids altogether the rock on which the other split, namely the introduction of new letters. The experience and researches of more than a quarter of a century have also put me in a better position than my predecessors, and have enabled me to produce a system surpassing my most sanguine hopes. But in order to prove that my anticipations are well founded, it will be necessary to work the system in schools, and therefore to construct school apparatus and teaching manuals. And for use in subsequent life, a double vocabulary must be prepared, far exceeding in extent our present pronouncing dictionaries. One part should give every word in our language, direct or inflected, current or technical, literary or slang, written in nomic, with the prevalent varieties of pronunciation in glossic, but without meanings, unless the sound varies with the meaning while the nomic form remains unchanged. The second part would give the glossic forms first, and the nomic afterwards, subjoining meanings only when the nomic varied with the sense, while the sound remained unaltered. The first part would be a pronouncing instructor, such as we do not at present possess. The second would be an invaluable spelling instructor, such as could not have been hitherto constructed. A third part would be advisable, containing personal and geographical names, with their English and native pronunciation.

2. The next step would be the general use of glossic as an introduction to nomic in home-teaching, and in primary schools, under permission of local and government school boards. At the same time, it might be introduced into higher schools, as a means of teaching pronounciation and correcting those errors of utterance, congenital or acquired, which are, unfortunately, far from uncommon.

3. The general use of glossic to indicate pronunciation might be looked for at an early period. Nothing would be easier than, in a parenthesis or foot-note, to assign the pronunciation of an unusual or foreign word, when no new types or accented letters whatever are required; and, indeed, such a practice is even now not unfrequent, though the results are often ludicrous and inefficient, from the writer having to invent his orthography on the spur of the moment, instead of employing a well-considered system.

4. The occasional or habitual use of glossic, either by those who have been taught to read by its means, or those who deliberately adopt it through a conviction of its superiority to nomic.

5. The introduction of special papers on orthoepy in public examinations, requiring answers in glossic.

6. The acceptance of answers written in glossic to general questions in public examinations. This admits of two grades. First, when the examination does not turn on a knowledge of spelling or orthoepy, but might have been conducted *vivâ voce* without any writing at all, such as examinations in science, ancient and modern

languages, and general information; as, for example, collegiate, university, public school, or middle-class examinations. The second grade consists of such examinations as require a knowledge of nomic spelling; as, for example, those of the Civil Service Commissioners, the Society of Arts, and the College of Preceptors. The acceptance of glossic in place of nomic would imply the recognition of a knowledge of good pronunciation as equivalent to a knowledge of customary spelling. But the habits and traditions of the civil service and commercial life would, for some time to come, necessitate the setting of at least one paper in nomic spelling. Just as we might begin by having a single paper in glossic to test orthoepy, so we might end in having a single paper in nomic to test orthography. Until the Speaker of the House of Commons and the Lord Chancellor throw off their wigs, we can hardly look forward to the "native worth" of glossic being recognised as entirely equivalent to the artificial ignorance of nomic.

7. Even before that good time coming, some literary or even political journals might adopt glossic, either in whole or in part, to meet the preference of those who had learned glossic in youth, just as some music publishers already produce popular music in the tonic sol-fa as well as in the established notation.

Such is the meaning which I attach to the concurrent use of glossic and nomic, and the steps by which I hope it may be accomplished. And by this concurrence the spelling difficulty would be entirely obviated. If glossic is rightly constructed, reading would become an easy, intelligent process, and writing a pleasurable means of communicating thought and pronunciation. It remains to see if glossic is so constructed, and especially if it furnishes teachers with an instrument and a method for greatly improving school processes. It is in this last aspect that glossic will probably possess most interest for the Society of Arts, and it is therefore one ou which I am particularly anxious to have the expression of your opinion.

First, as to the construction of English glossic. The key and example given at the end of this paper will give the general conception immediately; and if the reader will try to read the example without referring to the key, he will readily convince himself of the practical fulfilment of the first condition, that glossic should be intelligible to nomic readers without explanation. But a few words are needed to explain the choice of the symbols.

aa, as in *baa*, has been in use from at least the fourteenth century to the present day. The only other forms for the sound are *ah*, which is unsightly; *au* in *aunt*, which more readily suggests another sound; and simple *a*, in *father*, *rather*, or, as many pronounce, iu *path*, *staff*, *pass*, *command*, and almost all pronounce before *r*, as in *part*. But this simple *a* has another much more frequent use, to which it must be applied.

ee, *oo*, *oa*, as in *beet*, *cool*, *coal*, date from the latter part of the sixteenth century, and cannot suggest any other sounds.

ai, *au*, as in *bait*, *caul*, were partially in use in the sixteenth century, but have practically had no other meaning since the latter part of the seventeenth century.

i, *e*, as in *knit*, *net*, have had these meanings from the earliest times to the present day.

a, *o*, *u*, as in *gnat*, *not*, *nut*, have had these significations from the middle of the seventeenth century. It is true that *i*, *e*, *a*, *o*, *u*, also occasionally represent other sounds in accented open syllables, but these must be otherwise symbolised.

The short sound of *u* in *full*, *o* in *woman*, *ou* in *could*, used to be generally represented by *u*, and occasionally by *o* or *ou*, as early as the beginning of the fourteenth century, and since the end of the sixteenth century it has also been sometimes represented by *oo*, as in *foot*, *good*. But all these combinations more readily suggest other sounds, as in *nut*, *not*, *foul*, *cool*, and none of them could be employed for this sound. Here, then, for the first time, a new symbol became necessary, and I have selected *uo* as combining all the old representatives *u*, *o*, *ou*, and as having no associations of any kind which could lead the nomic reader astray. The context will always enable him to determine the value of this very rare combination without instruction.

The diphthongs have so many little varieties of sound that I have found it necessary to represent them in two ways; conventionally, for common use; analytically, for systematic purposes.

ei was used in the fourteenth century as one of the sounds now given to it by many speakers in *height*, *sleight*, *either*, *neither*, and although this combination has in several words received the modern sounds, first of *ai*, as in *their*, *veil*, and next of *ee*, as in *conceive*, *seize*, yet it undoubtedly most naturally suggests the diphthongal sound in any new words. Our pronunciation of the Greek diphthong ει, and the German use of *ei*, also renders this employment of *ei* familiar.

oi has been, at least from the seventeenth century if not earlier, consistently used for its present sound in *foil*.

ou has also been used from the sixteenth century, as a diphthong, closely resembling its present sound in *foul*, and from the seventeenth century for that sound exactly.

For systematic diphthongs I suggest the use of a final *y* and *w* in place of the *i* and *u*, with which the conventional terminate. Thus the common and increasingly-prevalent diphthongal pronunciation of *ai*, *oa*, in the south of England, by making them terminate in a faintly-audible *ee* and *oo*, would be properly represented be *aiy*, *oaw*. Such distinctions, however, would only be necessary in orthoepical discussions. Glossic, therefore, represents eleven vowels and four diphthongs, by long-established notations, and only employs an entirely new symbol for one rare sound. There is, however, another set of English diphthongs, quite peculiar, of frequent occurrence and great importance to represent, which have not been hitherto properly regarded by phonetic writers. These consist in subjoining an indistinct murmur of a previous vowel, which is modified in sound by the connection. They arise whenever the letter *r*, following a vowel, has ceased to be trilled, or, as we may say, has become vocal. Compare *peel*, *peer*; *pail*, *pair*; *mole*, *more*; *pool*, *poor*; *fell*, *fir*; *cull*, *cur*. These diphthongs must continue to be represented by subjoining *r* to the preceding vowel; and great facility of spelling will be introduced by not recognising a distinction asserted by some orthoepists, but certainly little observed in life, between *serf*, *surf*; *fir*, *fur*, &c. The trilled *r*, which never occurs except before a vowel, but is always found before a vowel in the south of England, although it is constantly heard when final, or before consonants in Scotland and in foreign languages, is sufficiently indicated by position, but in elementary books and dialectic writing must be distinguished by a following apostrophe, thus, *r'*. The difficulty of representing vocal *r* is, however, not yet fully surmounted. In *he rings*, the *r* is only trilled; in *hearings*, there is first the diphthong *eer*, and then the same trill as in *rings*. The obvious method is to write both sounds, as *heerr'ingz*, or, omitting the apostrophe before the vowel, simply *heerringz*, which introduces a peculiar value for *rr*. In the same way we must distinguish *occurrence* and *occurring*. The first has only a trilled *r*, and is properly *okur'ens*, while the second is *okerr'ing*, so that, omitting the apostrophe before the following vowel, we have *okur'ens*, *okerring*. We thus, for the first time, satisfactorily represent a great peculiarity of received English pronunciation.

The use of *y*, *w*, *h*, *p b*, *t d*, *j*, *k*, *f*, *v*, *z*, *l*, *m*, *n* is indisputable. Having *j* for the so-called "soft sound" of *g*, we must use *g* for its so-called "hard sound" in *gape*. *s* must also always have its sharp hiss in *seal*. The combinations *wh*, *ch*, *sh*, *ng*, *nk*, must clearly have the sounds in *whey*, *chest*, *rush*, *sing*, *sink*. But as the letters *h*, *w*, *s*, *n*, *g*, *k*, have also received separate values, it is neces-

sary to show when the combinations are not used, by interposing a hyphen (-), as in *mis-hap*, *in-got*, *in-kum*. The combination *th* has two meanings, and it would seem at first that the usual sound in *the* should be assigned to *th*. It will be found, however, that in all new words, *th* suggests the sound in *thin*, and the relations of other languages point out that a new combination, *dh*, already in frequent use among orthoepists, should be introduced for the sound in *then*. This is the second new combination we had to introduce, and as it is of frequent occurrence, it is the greatest difficulty to a purely nomic reader, but he will be found to overcome it with great readiness. The unusual sound of *g* in *rouge*, *s* in *vision*, *z* in *azure*, has long been written *zh* by orthoepists, and no other sign is more suggestive to an Englishman.

English glossic is now complete, so far as the representation of monosyllables is concerned, and these are all that have been usually considered. But when we proceed to polysyllables, we find that the absence of accent materially modifies the sound of the vowels. To the English glossic reader this difficulty is completely overcome by marking the position of the accent. But more is required for the English glossic writer. The position of the accent is a matter of great difficulty. Many persons differ as to the accented syllables in whole classes of words, as *illus'trate*, *il'lustrate*. In other cases the accent alters the meaning, as *au'gust*, *augus't*. No system of writing would be worth introduction which did not mark the position of the accent. For reasons which I need not stay to particularise, I mark the accent in glossic by a turned period, placed immediately after the long vowel or diphthong in an accented syllable, or the first consonant following a short vowel, as in *au·gust*, *augus·t*, *risee·v*, *difer·ing*, *aspeir·ring*, and to diminish the number of accent marks in writing or printing, I adopt Mr. Melville Bell's rule, that the first syllable must be accented when no accent mark is used. The absence of stress will be found materially to modify the sounds of vowels in English. This is a mere local peculiarity, and does not occur in other languages. The modified sounds have each an accurate representative in the extension of glossic for orthoepical and linguistic purposes, but in English glossic I find it sufficient to use *i* for unaccented *ee* in open syllables, to leave *a*, *ai*, *aa*, *au*, *oa*, and *oo* unchanged in open syllables, and to sink the vowel of all obscure syllables ending in vocal *r*, *l*, *m*, *n*, *j* into *e*. This last is a practice borrowed from German, and is consonant with the old English custom of representing all final vowels by an *e*, which lost its meaning and value altogether in the fifteenth century. I find the habit practically of great value. On other orthoepical points I forbear to enter, as they would take up much time, and divert your attention from the main point. The particular orthoepy adopted by any theorist is of small importance, when we have an alphabet capable of expressing any required orthoepy. Hence, glossic must not be discredited on account of the pronunciation which any writer may choose to exhibit. I also refrain from dwelling upon the extension of glossic, which is absolutely necessary for imperial and orthoepical purposes. A brief account, with some examples, is, however, subjoined to this paper.

Now, you will observe that glossic fixes the most common old values of the nomic letters, and that it introduces no new letter whatever, and only three new combinations, of which two, *dh*, *zh*, are very well known, and the third, *uo*, is eminently suggestive. Hence, the immediate legibility of glossic to a nomic reader. Conversely, you will at once see in what a position the glossic reader is placed with regard to nomic. When he is familiar with glossic reading, he knows every usual nomic letter and combination, except *c*, *q*, *x*, in its most usual nomic sense. There is little doubt that most children will be able to read nomic long before they are put to it, from merely seeing the writings on shopboards and placards on their way to and from school. At least such was the case with those taught by the phonetic alphabet I tried several years ago, which was far from following the nomic analogies with the accuracy of glossic. A very few rules suffice to put the glossic reader into the position of a shrewd guesser. He will know, within two or three sounds, what a nomic word must represent, and, trying one after the other, mentally and as quick as thought, he hits at once on the right sound, provided he is previously acquainted with the word, either from having heard it in conversation, or seeing it in a glossic book; at the worst he has to ask, or turn it out in his vocabulary. I can do no more myself, I do not know how anybody can possibly do more. The glossic reader, therefore, becomes almost by intuition a nomic reader.

But how is a child to become a glossic reader? The ordinary process of teaching to read is rendered unnecessarily difficult by the strange way in which a child is set to work, partly owing to the ill-adaptation of our orthography to a rational method, and partly to the minds of teachers having been set upon overcoming an extraneous rather than an inherent, an artificial than a natural difficulty. If you think for a moment of the state of a child's mind at four years of age, when it is usually brought to the reading tablet, and especially of the kind of child's mind with which the elementary teacher has usually to deal, of its vagueness of perception and its difficulty of comprehension; and also weigh the fact that the child has seldom heard correct utterance, hardly knows what sounds it says, and has no notion that words are compound and capable of analysis, you will at once understand the difficulty of a teacher in striving to make him understand and use that divine thing, alphabetic writing. Such steps as *ai-bee*, *ab*; *see-ai-tee*, *eat*, are of course murderous. But great and very needless trouble is occasioned, even with the best alphabet, by teaching sign and thing together, instead of thing first and sign afterwards. This may be illustrated by a brief description of the process I recommend for teaching glossic reading. Of course, it can be taught otherwise; but with a good instrument it is inexcusable not to turn out good work, and that implies a good process.

The teacher must first make himself familiar with the symbols and sounds which they represent. This is best done by oral instruction, but can be conveyed sufficiently for rough purposes by written instruction, such as I should be prepared to furnish, and such as may be collected from Mr. Melville Bell's admirable treatise on "Visible Speech." The teacher should also practice for himself all the exercises which he gives the pupil, till he can execute them with certainty and ease to himself. In other words the teacher must first know what he has to teach. This is an indispensable, but not the only condition for rational instruction, for he must also know how to teach.

The first exercise begins in the nursery or infant school; if possible, as the child begins to speak, and certainly at two or three years old, long before any attempt is made at putting letters before him. It consists in repeating the six vowel sounds, *ee*, *ai*, *aa*, *au*, *oa*, *oo*, which form the key to all correct enunciation. They may be sung with a swing, in different times, in groups of three and two. When caught up by the child from mere imitation of sounds, they should be fixed by repetition. They should be repeated in different orders, with different stresses, at different pitches, and with different lengths. Then great attention should be paid to purity of utterance. In order that the teacher should thoroughly attend to the child, he should never allow him to speak at the same time with himself. As in the tonic sol-fa system, the pupils should speak by "pattern;" and whenever anyone is heard to be wrong, the whole should repeat till all are right. *ee* should be bright without any obscurity, and especially should not begin obscurely and end brightly; that is, it should not dwindle into the Derbyshire diphthong *i·y*, the first step on the road from *ee* to *ei*, which was travelled over in the fifteenth century. The same observations apply to *oo*, which must not be allowed to fall into *uo·w*, also a

Derbyshire diphthong. *ai*, *oa*, require still more care in this way. The London termination of these sounds in *ee*, *oo*, producing *ai·y*, *oa·w*, should not be tolerated. Still less must we allow the first element to be shortened, producing the uncouth dipthongs *aiy·*, *oaw·*, which are now so prevalent. Again, the *ai*, *oa*, must be kept quite close, and not approach to the open *e·*, *o·*, producing vowels which are prevalent provincially. As respects *aa*, *au*, we have chiefly to guard against an interchange of sounds in the provinces; against an inserted vocal *r*, and even trilled *r'*, in London, when another vowel follows, and against the extravagant thinning of *aa* in the direction of *a·*, which is becoming fashionable. These few indications will show the difficulty of the exercise, but once accomplished all the rest is easy. The sense of hearing and the obedience of the vocal organs has been established. Accuracy, certainty, and discrimination have been awakened in the child's mind, and he has made the first and most difficult step in the analysis of sounds. If six weeks, or even six months, are spent in this pastime, they will have been well spent in securing a perfect result. The vocal organs and the child's mind must not be fatigued. Five minutes is a long lesson at this work. Then the exercise may be varied by using the mute consonants *p*, *t*, *k*, before these vowels, as *pee*, *pai*, *paa*, *pau*, *poa*, *poo*; or *tee*, *tai*, *taa*, *tau*, *toa*, *too*, and so on. The next variation is to place the consonant after, as *eep aip*, *eet ait*, &c. Then both before and after, as *peep*, *teet*, &c. These words should be repeated with every degree of emphasis, prolongation, and rapidity. In the final consonants the effect of the "recoil," or whisper at the end, before a pause, and its absence in combination should be brought out. The difference between *peeppeep* and *peep peep* should be clearly felt. When this is secured, we may use consonants medially, as in *peepeep*, and the distinctions *peep peep*, *peeppeep*, *pee peep*, *peep eep*, should be made perceptible. In all these cases we must take great care not to indroduce an indistinct murmur between the vowel and the following consonants, nothing like *pee-up*, *pai-up*, *paa-up*, &c., should be tolerated.

We may now practise the use of different consonants, initial, final, and medial, such as *peet*, *teep*, *peek*, *keet*, *teek*; *peeteek*, *keepeet*, and so on, and bring out the effect of accent.

The step to the sonant consonants, *b*, *d*, *g*, is a great one, and exercises like *pee*, *bee*, *peeb*, *beep*, *peebpee*, *beep bee*, &c., are important and difficult.

Having secured these consonants, we may pass to the short vowels, *i*, *e*, *a*, *o*, *u*, *uo*. These must be taken both long and short, but being most familiar as short, should be first taken with a following consonant, as *ip*, *pip*, *tip*, *kip*, *bip*, *dip*, *gip*; *ib*, *pib*, *tib*, *kib*, *bib*, *dib*, *gib*, &c. The pupil, used to lengthen and abbreviate the first six vowels, soon learns to lengthen and abbreviate these also.

Then comes a very difficult task for the teacher, to distinguish, for example, *pi·p* with a long *i·* from *pee·p* with long *ee*. The teacher arrives at this by singing, *pip·*, *pi·p*, *pee·p*, *peep·*, *pip·* Much of the nicety of English speech depends upon such distinctions. They should be well practised upon all the vowel pairs, as *pai·t pe·t*, *paa·t pa·t*, *pau·t po·t*, *poa·t pu·t*, *poo·t puo·t*. This being done, the final consonants may be discarded, and *i*, *e*, *a*, *u*, *o*, *uo*, pronounced alone, long and short.

The next exercise may be the diphthongs, obtained from the vowels by such combinations as *aa-ee*, *aaee*, *aay*, gradually shortening the first element. All varieties of diphthongal sounds may thus be taught, and their strange multiplicity in the provinces accurately discriminated. Similarly, the vocal *r* diphthongs will result from *ee-u*, *eeu*, *eeu*, *eer*. The sounds of *y*, *w* must also be evolved in the same way as the diphthongs. The accurate pronunciation of *yee*, *yeeld*, *woo*, *wuod*, which is extremely difficult to many speakers, must be carefully inculcated.

The various methods of commencing vowels may now be taught, the aspirate *h* carefully evolved, and the catch, which is not uncommon, as carefully avoided.

The hisses *f*, *th*, *s*, *sh*, may be next taken, and afterwards the corresponding buzzes *v*, *dh*, *z*, *zh*, always first in connection with vowel diphthongs and mutes or sonants, and afterwards separately. Here there will be a variety of difficulties of speech to surmount, which I need not detail. When these difficulties are overcome, the true nature of *wh*, and its relation to *w*, may be brought out by the analogy of *wheel*, *weel*, to the known *feel*, *veel*. *m*, *n*, are easy, and might be taken before the above, but, in any case, must be worked with them, and then *ng* should be practised initially as well as finally.

Lastly, *l*, *r'*, have to be practised. They are the most difficult sounds for a child, and require the greatest care. They have especially to be studied in connection with mutes and sonants, and for separate enunciation.

In Mr. Melville Bell's "Principles of Speech and Dictionary of Sounds" will be found a variety of exercises, supplementary to those which I have suggested. A good manual for the teacher would contain a full but not complete enumeration of them, for the teacher should be able to introduce variations on the spur of the moment, from understanding the principles of their construction. Of course all these exercises are intended to be done without letters, without book, without tiring the organs, as a kind of pastime. I need hardly tell you their value. They will not only have created clearness and flexibility of utterance, and given a power for appreciating English which will make the subsequent acquisition of foreign sounds easy, but they will have initiated a child into the practice of analysis and synthesis, and have taught him in especial the speech elements of his own tongue, and the method of combining them. And now, at four years of age, you put a glossic book before him. All he has to do is to associate a sign with a familiar sound, to combine signs in the same way that he has familiarly combined sounds. The process of reading will be very swift indeed. In two or three months a previously well-trained child will be able to read any glossic book at sight, with an accuracy of pronunciation and intonation which has only been met with in rare cases of children twice his age. But care must be taken, in teaching the symbol, to fix it firmly in the mind. The child should draw every symbol as he learns it. He should be constantly exercised in writing down sounds by ear, quite independent of their being significant words or not, and then by the time he can read glossic he will also be able to write glossic, that is, to make himself intelligible in writing to any nomic reader in the kingdom by the time he is five years old.

Now comes a point of danger. It does not arise from the child, but from the parent or teacher. The parent is too anxious for the child to read nomic, and is impatient at glossic, which he looks upon as "bad" spelling. The teacher wants to push his child on to nomic reading and spelling for the sake of his own glorification. This danger can only be properly obviated by judicious school inspection. The inspector should insist upon children being kept to glossic for at least a twelvemonth after they are able to read and write with ease. They have only learnt a few hundred words, recollect; they have to acquire a large stock of unfamiliar words, which they never hear in conversation, and which they can best acquire in the only substitute for conversation, glossic spelling. They can be thus rendered familiar with the words they will afterwards have to guess systematically when presented to them in nomic, and which they cannot guess at correctly unless they know the sound first. By hurrying them too fast to the nomic you deprive them of more than half the educational value of the glossic initiation, and reduce them to the condition of foreigners for nine words in ten which they will meet with hereafter. You also deprive them of the habit of glossic writing, a habit which will be useful to them through life, and materially facilitate their acquisition of nomic spelling, where it is found necessary for them to learn it. Recollect that a child at ten years of age will not generally be in the

same condition with respect to nomic as a child of five years would be in respect to glossic, if trained in the manner I have suggested; for the glossic child will be able to read any glossic words which he sees, and to write accurately any glossic word which he hears. Give him time to let this habit of reading and writing work into his nature, and become a part of himself instead of a superficial acquirement, remembering that it is to be of use to him all his life, and not to be thrown away with school-books when he is driven out to scare crows —allow this, and the rest is easy enough.

The acquisition of nomic reading will thus become a trifle, hardly more difficult than the acquisition of glossic reading by a nomic reader. But how about nomic spelling? I can easily imagine that the whole system will be supposed to make shipwreck on this sandbank. But in the first place it is part of my theory that nomic spelling is, in the greatest number of cases, unnecessary to learn, because the glossic writer is intelligible to all his countrymen that can read at all. But I recognise the fact that, for some time to come, the arrangements of offices will not permit of clerks, shopmen, porters, civil servants, and others writing in any but nomic spelling for business purposes. Hence, many children must learn nomic spelling, and I can quite understand school inspectors insisting upon good nomic spelling at ten years of age. With the Birmingham statistics, which I quoted at the beginning of this paper, this is much to ask; but with a glossic foundation continued to six or seven years of age, and rendered thoroughly substantial, it will, I believe, not be much to give. My conviction is founded upon the results of experiments made in schools in Boston, Massachusetts, with my former phonetic system, which was in every respect an inferior instrument to glossic. These showed that classes taught phonetically spelled in the ordinary way better than those taught unphonetically. The cause was not far to seek; it was in many respects the same as that which makes a foreigner spell French better than a Frenchman. The English glossic reader knows all his letters, and their commonest uses, except *c*, *q*, *x*, which present little difficulty. In learning nomic, he is perpetually translating the false uses (as they appear to him), the queer outrageous combinations, the "funny forms," into regular, sensible, systematic glossic. The very oddness and irregularity of the form impress it on his mind and cling to his memory. Add to this a judicious method of teaching, bearing in mind that we write by the hand to the eye, and that the singularity of nomic form can be imitated by a singularity of pronunciation, the letters being assumed to have their glossic value. The three letters *c*, *q*, *x*, in extended glossic, represent Caffre clicks, of which the first and last are the common English *tut* and *cl'ck*, the *q* being formed by bringing the underpart of the tongue against the palate before clicking. They are conveniently considered in nomic as *k* or *s* for *c*, *kw* for *qu*, and *ks* for *x*, with a click of any sort, but by preference the right sort, before or after them, which will give them a decided character. Thus, the nomic for *nai·shen* is *nat-i-on;* for *nai·teur*, is *nat-ur-e;* for *nash·enel*, *nat-i-on-al;* for *prak·tis*, the verb is *prakc-tis-e;* for *prak·tis*, the noun is *prakc-tisc-e;* for *siti*, it is *csity;* for *kwei·et*, is *qkwi-et;* for *kweit*, is *qkwit-e;* for *axe*, is *aksx-e*. These sounds give a glossic meaning to nomic, and represent at once the difference and the mode of spelling. It is in this way that the question—How do you spell such a word? or rather, What is the nomic for such a word? must be answered vocally. But the principal source of nomic spelling is nomic transcription from glossic. This is altogether different from the old exercises of correcting bad spelling, because the original glossic is really a better spelling to this generation than the nomic. Hence, we do not impress incorrect forms on the mind, but draw attention to altogether different systems of writing. You must also not be misled by the effect of a little phonetic reading or writing upon an ordinary imperfect speller. Such a person, knowing neither phonetic nor ordinary spelling properly, readily mixes them up together, and produces a wonderful hodge-podge. I assume that, before the pupil begins to write in nomic, he is thoroughly used to glossic, and can write it with perfect correctness. There is then not the least chance of confusion, his one great rule being that nomic is not glossic, and that hence the actual coincidence of the two orthographies in any word is casual, and even suspicious. For myself, I find that I can sit down to write nomic or glossic with ease and fluency, and without thinking about either while I am writing, so that my flow of composition is in no respect changed. Occasionally, after a pause, I may forget which spelling I was using, and write a line in the wrong spelling, but this is precisely similar to beginning to speak in a wrong language, as has also happened to myself, and probably to many others. The analogy of various languages is the true one. When the mind is set into the train of any particular tongue, the vocal organs have no desire to fly off into another. The few correspondents I have hitherto had in glossic have betrayed no tendency to introduce words in nomic. My former experience of phonetic writing entirely confirms this view.

Allow me to say a few words on the practical value of extended glossic in school teaching. All advanced scholars, even in elementary schools, can be, and therefore should be, taught at least those sounds which are met with in the English dialects and the principal European languages. In elementary schools the dialectic sounds are of great importance, because, when thoroughly known, they can be thoroughly avoided, and when completely symbolised, errors of speech can be rendered visible, and hence permanently sensible. A boy in a class mispronounces. Another is called upon to correct him. Both error and correction are written on the blackboard by a third pupil, and acknowledged by the class. The value of such exercises can hardly be overrated. In superior schools, exact enunciation can thus be well taught, with the difference between the theoretic isolated pronunciation of words and their practical combined utterance, both of which can now be properly written. It is needless to insist on the value of the correct pronunciation of French, German, and Italian, which can thus be imparted. But I would note, as an advantage, what many theoreticians and linguists are inclined to consider a fault, that these foreign sounds are represented on an English basis. Of course, extended glossic is not intended as a universal system of writing for all nations. Some such scheme as Mr. Melville Bell's "Visible Speech" is far better adapted for that purpose. But extended glossic is intended to show the differences between English and foreign pronunciation to an English eye. Hence the use of letters in un-English senses would be ineffective and inappropriate. The extreme differences in the appearances of French, Italian, and German words, when spelled in their own nomic and in extended glossic, are therefore very valuable for the purposes of instruction, and for the mere indication of the pronunciation to Englishmen. I may perhaps be permitted to add, as the result of much examination and extensive trial, that I have found the English basis more suitable than the Latin or Italian for theoretic universal writing of sounds. It is the only basis on which I have succeeded in writing all languages, without introducing a single accented, italicised, inverted, modified, or foreign type; the only system yet produced which is adapted for use by the humblest printing-office, and can be exhibited in the most varied fancy forms of letters; the only system, therefore, which could be used immediately and universally, not only in England and its colonies, but throughout the world where Roman types are kept.

Such is a very imperfect and hurried account of my scheme for meeting the English spelling difficulty in school and in life. Notwithstanding the length of my communication, there are many points on which I have foreborne to touch, and others which I have scarcely named. My object in introducing glossic spelling con-

currently with nomic is manifold. The educational and orthoepical sides have been partially explained. Socially, glossic aims at diminishing the amount of existing ignorance, by saving the school-time now wasted over learning to read and spell. Politically, extended glossic would furnish an instrument for writing the languages of all British dependencies, English, Welsh, Gaelic, Irish, Canadian, French, Arabic, Hindostanee, Dravidan, Caffre, and American Indian, by one alphabet. Nationally, glossic hopes to supply an unchanging system of writing, capable of registering all changes of pronunciation, to introduce simultaneous uniformity of utterance into the provinces, and to render our speech more accessible, not only to foreigners, but our millions on millions of Indian subjects. Philologically, glossic for the first time gives a systematic means of writing all English varieties by one alphabet, which, having for its main function the representation of the received dialect, clearly and simply points out the provincial diversities. To this use, at any rate, for which glossic was specially prepared, I hope to have an opportunity in future years of applying my new system of writing. Ethnologically, glossic furnishes English travellers with a simple means of registering all varieties of speech, for in its extended form, glossic will be found to cover the same ground as Mr. Melville Bell's "Visible Speech," without which it could not have been inveuted.

But I do not ask your opinion upon these multifarious points; they are merely mentioned to show the wide bearing of my scheme, and guard against the probable error of conceiving it as a mere piece of school apparatus. I wish to elicit opinion principally on its educational value in learning to read, and its social value in saving learning to spell. I should feel much obliged if gentlemen present would confine the discussion as much as possible to these two points, and not raise collateral issues, which, though interesting in themselves, would absorb time that should be devoted to these two important considerations. Most especially I hope that no one will raise an etymological objection to phonetic spelling, because it would be entirely beside the present question. As I do not propose to alter the usual orthography at all, I do not in the slightest degree impair the etymological value it is, not very justly, assumed to possess. Again, I hope the question of any particular orthoepy will not be raised. My scheme holds good for any orthoepy. The questions are—Is glossic available now for saving labour in teaching to read ordinary print at school, and saving the tenfold more tedious labour of learning to write ordinary spelling in life? If a Society like the present should regard my scheme with favour, people may possibly be found to work it out. For myself, I am too old a man, and too worn out with previous labour in the same field, to hope to conduct such a work personally to a successful issue. But it would be exceedingly pleasant to me to help, and to see a chance of overcoming that great difficulty against which I have struggled so long.

APPENDIX.

Key to English Glossic.

Read the large capital letters always in the senses they have in the following words, which are all in the usual spelling, except the three underlined, meant for *foot*, *then*, *rouge*.

bEEt bAIt bAA cAUl cOAl cOOl
knIT nEt gnAt nOt nUt fUOt
hEIght fOIl fOUl fEUd
Yea Way Whey Hay
Pea Bee Toe Doe CHest Jest Keep Gape
Fie Vie THin DHen Seal Zeal ruSH rouZHe
eaR R'ing eaRR'ing Lay May Nay siNG siNK

R is vocal when no vowel follows, and modifies the preceding vowel, forming diphthongs, as in pEER, pAIR, bOAR, bOOR, hERb.

Use R for R' when a vowel follows, except in elementary books, where *r'* must be retained.

Use RR for RR' between two vowels, except in elementary books.

Separate *th*, *dh*, *sh*, *zh*, *ng*, *nk*, by a hyphen (-) when necessary.

Place a stress on the first syllable when not otherwise marked.

Mark stress by (·) after a long vowel or diphthong or vocal *r*, and the first consonant following a short vowel; emphasis by (·) before a word.

When three or more letters come together of which the two *first* may form a digraph, read them as such.

Letters retain their usual names and alphabetical arrangements.

Words in customary or *nomic* spelling occurring among *glossic*, and conversely, should be underlined with a wavy line ~~~, and printed with s p a i s t l e t e r z, or else in a *different type*.

Spesimen ov Inglish Glosik.

Objekts.

Too fasil·itait lerning too reed.

Too maik lerning too spel unnes·eseri.

Too asim·ilait reeding and reiting too heerring and speeking.

Too maik dhi risee·vd proanunsiai·shen ov Inglish akses·ibl too *aul* reederz, proavin·shel and foren.

Meenz.

Leev dhi oald speling untuch·t.

Introadeu·s along· seid ov dhi oald speling a neu aurthog·rafi, konsisting ov dhi oald leters euzd invair·riabli in dhair best noan sensez.

Emploi· dhi neu speling in skools too teech reeding in *boath* aurthog·rafiz.

Alou· eni reiter too reit in dhi neu speling *oanli* on aul okai·zhenz, widhou·t loozing kaast, proavei·ded hee cuzez a risee·vd proanunsiai·shen; dhat is—

Aknol·ej dhi neu speling kon-kur·entli widh dhi oald.

Key to Universal Glossic.

(Coextensive with Mr. Melville Bell's "Visible Speech").

Small Capitals throughout indicate English Glossic.

Mr. Melville Bell's Vowels.

	Back.	Mixed.	Front.	Back.	Mixed.	Front.
		Primary.			*Wide.*	
High	uu'	ea	EE	u'	i'	I
Mid	uu	U	AI	AA	a'	E
Low	ua	ua'	ae	ah	e'	A
		Round.			*Wide Round.*	
High	OO	ue'	ui	uo	uo'	ue
Mid	OA	oa'	eo	ao	ao'	oe
Low	AU	au'	eo'	o	o'	oe'

a as in English *gnat*.
a' (read *ai-huok*) fine southern English *ask*, between *aa* and *e*.
aa as in English *baa*.
ae usual provincial English *e*, French *ê*, German *ä*
ah broad German *ah*, between *aa* and *au*.
ai as in English *bait*, with no after-sound of *ee*.
ao open Italian *o*, between *o* and *oa*.
ao' closer sound of *ao*, not quite *oa*.
au as in English *caul*.
au' closer sound of *au*, as *i* in Irish *sir*.
e as in southern English *net*.
e' modification of *e* by vocal *r* in *herb*.
ea Russian and Polish variety of *ee*.

ee as in English *beet.*
eo close French *eu* in *peu, feu.*
eo' opener sound of *eo,* not quite *ee.*
i as in English kn*i*t.
i' opener sound of *i,* not quite *e,* as *e* in English *houses,* Welsh *u.*
o as in English n*o*t, opener than *au.*
o' a closer sound of *o.*
oa as in English *coal,* with no after-sound of *oo.*
oa' closer sound of *oa.*
oe open French *eu* in *veuf,* German *ö.*
oe' opener sound of *oe.*
oo as in English *cool.*
u as in English *nut.*
u' obscure *u,* as *o* in English *mention.*
ua open provincial variety of *u.*
ua' slightly closer *ua.*
ue French *u,* German *ü.*
ue' Swedish long *u.*
ui provincial German *ü,* nearly *ee.*
uo as in English *full, woman, book.*
uo' Swedish long *o.*
uu usual provincial variety of *u.*
uu' Gaelic sound of *ao* in *laogh;* try to pronounce *oo* with open lips.

Quantity of Vowels.

All vowels are to be read short, or medial, except otherwise marked.

The stress (·) placed immediately after a vowel shows it to be long and accented, as *au·gust;* placed immediately after a consonant, hyphen (-), gap (:), or stop (..), it shows that the preceding vowel is short and accented, as *augus·t, aamao:·, pa'pa'..·*

The holder (··) placed immediately after a vowel or consonant shows it to be long, as *au··gus·t, needl··*; the stress holder (···) shows that the consonant it follows is held, the preceding vowel being short and accented, compare *hap·i, hap···i, ha·pi, ha·p··i*; only in theoretical writing.

Stop (..) subjoined to any letter indicates a caught-up, imperfect utterance, as *ka.., kat..* for *kat*; great abruptness is marked by (...)

Accent marks may also be used when preferred, being first placed over the first letter of a combination, thus:—
long, *âu* accented, *āu* unaccented.
short, *ù* accented, *ŭ* unaccented.
medial, *áa* accented, *äa* unaccented.
Ex. âugŭst, āugùst, káazäa, It. *casa.*

Systematic Diphthongs.

Use *y, w, w', h'* for the *ee, oo, ue, u* element of a diphthong or triphthong which receives no stress. Consider the element which has the stress to be short unless it is marked as long.

The four English Glossic diphthongs *ei, oi, ou, eu* are unsystematic, and are variously pronounced thus:—

ei is *uy* in the South, sometimes *a'y, aay;* and is often broadened to *uuy, ahy, au'y,* in the provinces.

oi is *oy* in the South, and becomes *auy* provincially.

ou is *uw* in the South, sometimes *a'w, aaw,* and is often broadened to *uuw, ahw, oaw, aow;* it becomes *oew'* in Devonshire, and *aew* in Norfolk.

eu varies as *iw, eew, yoo, yiw, yeew.*

The Londoners often mispronounce *ai* as *ai·y, aiy, ey* or nearly *uy,* and *oa* as *oa·w, oaw, ow* or nearly *uw.*

Diphthongs with *h'* as *eeh', ih'* occur in Cumberland and Teviotdale.

English vocal R, is essentially the same as H', forming a diphthong with the preceding vowel. Thus *peer, pair, faar, faur, boar, boor, feir, flour, fer, difer·ring,* would be systematically written *pi·h', pe·h', fah·h', fau·h' bao·h', buo·h', fuyh', fluwh', fe'h',* or *fu·, dife'h'·ring* or *difu·ring.*

Consonants.

Many differences from the usual English consonants are marked by adding an *h* in the usual way, with *y* for palatals, *w* for labials. Miscellaneous varieties are produced by subjoining an apostrophe (') or prefixing a turned comma (‘), or turned apostrophe (‚), or a simple comma(,). Generally if these hooks are neglected, the resulting letter indicates the nearest English sound.

Simple consonants, and added G,K.

Y, W, H; P B, T D, J, K G, F V, S Z, R L M N, NG NK.

Added H.

WH, CH, TH DH, SH ZH.

KH, GH German *ch, g* in *Dach, Tage;* YH, R'H, LH, MH, NH, NGH the hissed voiceless forms of *y, r', l, m, n, ng.*

Added Y and YH.

TY, DY, KY, GY, LY, NY, NGY, the palatalised or *mouillé* varieties of *t, d, k, g, l, n, ng,* as in *virtue, verdure,* old *cart,* old *guard,* Italian *gl, gn,* French provincial, *il n'y a pas=ngyaa pah.*

KYH, GYH are palatal varieties of KH, GH as in German *ich, fliege.*

Added W and WH.

TW, DW, KW, GW, RW, R'W, LW, NW, &c., are labial varieties of *t, d, k, g, r, r', l, n,* &c., produced by rounding the lips at or during their utterance, French *toi, dois,* English *quiet, guano, our,* French *roi, loi, noix,* &c.

KWH, GWH are labial varieties of KH, GH as in German *auch, saugen,* and Scotch *quh.* HWH is a whistle.

Added apostrophe (') called "Hook."

H', W', called *aich-huok, dubl-eu-huok,* see diphthongs.

H' after consonants or signs, simplest emission of voice: H'W is *h'* with rounded lips; H'WH a voiced whistle.

T', D', called *tee-huok, dee-huok,* dental *t, d,* with tip of tongue nearly between teeth as for *th, dh.*

F', V', called *ef-huok, vee-huok,* toothless *f, v,* the lip not touching the teeth; *v'* is true German *w.*

R' read *aar-hook,* trilled *r.*

N' read *en-huok,* French nasal *n,* which nasalises the preceding vowel. To Englishmen the four French words *vent, vont, vin, un* sound *von', voan', van', un';* but Frenchmen take them as *vahn', voan', vaen', oen'.* In French Picard, in Portuguese and Hindoostaunee, other varieties occur. Sanscrit *unuosvau‚ru.*

KY', GY' peculiar Picard varieties of *ky, gy,* nearly approaching *ch, j.*

CH', J', TS', DZ' monophthongal Roman varieties of *ch, j, ts, dz.*

TH', DH' lisped varieties of *s, z,* imitating *th, dh;* occasional Spanish *z, d.*

S' not after *t,* Sanscrit *visu‚rgu.*

Prefixed comma (,) called "Comma."

,H read *koma-aich,* lax utterance, opposed to ‘H.

,T ,D read *koma-tee, koma-dee,* peculiar Sardinian varieties of *t, d,* the tongue being much retracted.

,L Polish barred *l,* with ,LH its voiceless, ,LW its labial, and ,LWH its voiceless labial forms.

; read *hamza,* check of the glottis.

Prefixed turned comma (‘), called "Hook."

‘ read *ein,* the Arabic ‘*aayn* resembling a bleat.

‘H, ‘T ‘D, ‘S ‘Z, ‘K, read *huok-aich, huok-tee,* &c; peculiar Arabic varieties of *h, t, d, s, z, k;* ‘G the voiced form of ‘K.

‘KH, ‘GH, called *huok-kai-aich, huok-jee-aich;* the Arabic *kh, gh* pronounced with a rattle of the uvula.

‘W, ‘PR, ‘BR, read *huok-dubl-eu,* &c.; lip trills, the first with tight and the others with loose lips; the first is the common English defective *w* for *r',* as *ve‘wi t‘woo,* the last is used for stopping horses in Germany.

‘F, ‘V, read *huok-ef* &c.; *f, v* with back of tongue raised as for *oo.*

‘LH, ‘L, read *huok-el-aich, huok-el,* Welsh *ll,* and its voiced Manx form.

'R read *huok-aar*, the French *r grasseyé*, and Northumberland burr or *k'ruop* ='*gh*⫰; 'RH its voiceless form.

Prefixed turned apostrophe (‚), *called " Curve."*

‚AA, read *kerv-aa*, an *aa* pronounced through the nose, as in many parts of Germany and America, different from *aan'*. The "curve" prefixed to any vowel, °*h*, or *h'*, indicates this peculiarity of utterance.

‚T ‚D, ‚SH, ‚R, ‚L, ‚N read *kerv-tee* &c., Sanscrit "cerebral" *t, d, sh, r', l, n;* produced by turning the under part of the tongue to the roof of the mouth and attempting to utter *t, d, sh, r', l, n.*

‚H read *kerv-aich*, a post aspiration, consisting of the emphatic utterance of the following vowel, in one syllable with the consonant, or an emphatically added final aspirate after a consonant. Common in Irish-English, Hindoostaunee, and Chinese. German provincial *k‚hoam* for *kaom*=komm.

Clicks, spoken with suction stopped.

C, tongue in ‚*t* position, English *tut!*

Q, tongue in '*t* position.

X, tongue in *ty* position, but unilateral, that is, with the left edge clinging to the palate, and the right free, as in English clicking to a horse. *C, q, x* are used in Appleyard's *Caffre*.

QC, tongue in *ty* position, but not unilateral; this sign is used in Boyce's *Hottentot*.

KC, tongue retracted to the '*k* position and clinging to the soft palate.

Whispers or Flats.

°H, called *serkl-aich*, simple whisper; °H' whisper and voice heard together, °'diphthongal form of °*h'*.

°AA, read *serkl-aa*, whispered *aa*, and so for all vowels.

°B, °D, read *serkl-bee*, &c., the sound of *b, d*, heard when whispering, as distinct from *p, t*, common in Saxony when initial, and sounding to Englishmen like *p, t* when standing for *b, d*, and like *b, d* when standing for *p, t*. °G, whispered *g*, does not occur in Saxony.

°V, °DH, °Z, °ZH, °L, °M, °N read *serkl-vee*, &c., similar theoretical English varieties, final, or interposed between voiced and voiceless letters.

Signs.

Hyphen (-), used to separate combinations, as in *mis-hap, in-got, in-kum.* In *whair-ev·er*, *r* is vocal; *elm, fauln* are monosyllables, *el-m, faul-n* are dissyllables; *fidler* has two syllables, *fidl-er* three syllables.

Divider), occasionally used to assist the reader by separating to the eye words not separated to the ear, as *tel)er dhat)l doo.*

Omission (₀), occasionally used to assist the reader by indicating the omission of some letters usually pronounced, as *hee)₀l doo)₀t.*

Gap (:) indicates an hiatus.

Closure (.) prefixed to any letter indicates a very emphatic utterance, as *.mei .hei* for *my eye.*

Emphasis (·) prefixed to a word shows that the whole word is more emphatically uttered, as *ei ·neu dhat ·dhat dhat ·dhat man sed woz rong; ·ei gaiv ·too thingz too ·too men, and ·hee gaiv ·too, ·too, too ·too, ·too.*

The following are subjoined to indicate, ⫯ emission, ⫰ suction, ¿ trill of the organs implicated, † inner and ⫰ outer position of the organs implicated, ‚‚ tongue protruded, § unilaterality, * linking of the two letters between which it stands to form a third sound.

Examples.

Received Pronunciation.—Whot doo eu wont? *Vulgar Cockney.*—Wau·chi wau·nt? *Devonshire.*—Wat .d)yue want? *Fifeshire.*—Whuu't u'r' yi' waan;n? *Teviotdale.*—Kwhaht er' ee wahntun?

Teviotdale.—Dhe)r' ti'wkwh sahkwhs graow·un e dhe Ri'wkwh Hi'wkwh Hahwkwh.—Kwhaht er' ee ahnd um? U')m ahnd um naokwht.—Yuuw un ·mey el gu'ng aowr' dhe deyk un puuw e pey e dhe muunth e Mai·y.—Hey)l bey aowr' dhe ·naow nuuw.

Aberdeen.—Faat foa·r' di'd dhe peer' si'n vreet tl)z mi'dher'?

Glasgow.—Wu)l ait wur' bred n buu;ur' doon dhu waa;ur'.

Lothian.—Mahh' koanshuns! hahng u' Be·yli!—Gaang u'wah·, laadi! gai tu dhu hoar's, sai xx! un shoo em ·baak ugi'n·!

Norfolk.—Wuuy dao·nt yu' paa·)mi dhaat dhur ·tue paewnd yu' ao·)mi, bo? Uuy dao·nt ao·)yu' nao ·tue paewnd. Yuuw ·due!

French.—Ai pw'ee uen vyaiy ka'raony ai un'n on'fon' bao'rny oan von'due deo moavae van' oa poeplh bae·t. Ee aet voo?

German.—Ahkh! aaynu' aayntseegyhu' ue·blu' foyreegyhu' mueku' koentu' v'oal ahwkwh meekyh boe·zu' mahkhu'n! Yhah szoa·! Es too·t meer' oon:en·dleekyh laayt!

Arabic Alphabet (substituting hamza for ;aalef).—; b t th j 'h 'kh d dh r' z s sh 's 'd 't 'z ! 'gh f 'k k l m n w y.

Arabic vowel system, after F. W. Newman.—
fine e ae, i ee, uo oo, aiy oaw.
coarse u au, ue uey, oe oew, aay aaw.

Sanscrit Alphabet (modern pronunciation, the vowels au, ee, oo, ai, oa *being always long).*—
u au, i ee, uo oo; ai ei, oa ou, n' s',
k k‚h g g‚h ng, ch ch‚h j j‚h ny, ‚t ‚t‚h ‚d ‚d‚h ‚n, t‚t‚h d d‚h n, p p‚h b b‚h m, y ‚r l v, sh ‚sh s h ‚l.

Hindoostaunee (after Monier Williams, where au *may be* aa).

Alphabet.—! ai au b ch d ‚d ee ei f g 'gh h 'h i j k 'k 'kh l m n n' oa oo ou p r' ‚r s sh t ‚t u uo v w y z.

Anecdote (the position of the accent is not marked, because not assigned by Monier Williams).—Aik shu'khs b‚hook‚hau 'Kauzee kai yuhaun' gu-yau kuhnai lugau: Mein' b‚hook‚hau huon', kuch‚h muoj‚h-ai doa; toa mein' k‚hauoon'! 'Kauzee nai kuhau ki yih 'Kauzee kau g‚hur' hei, 'kusum k'hau, our' chulau jau.

DISCUSSION.

Mr. **Edward Jones, B.A.**, Head Master of the Hibernian Schools, Liverpool, said that, as a teacher of 28 years' experience in elementary schools, he fully recognised the spelling difficulty as something far more formidable than the religious one, of which so much had been heard lately, for the practical effect of the present mode of spelling was, as regards the bulk of the scholars, to exclude from elementary schools almost every subject except the three R's. Not long ago, in that very room, the importance of teaching some of these other subjects, such as the science of health, and various other technical matters, was insisted upon, and their importance could not, in truth, be over-estimated, but, as a teacher himself, and as one who had mixed much with teachers, particularly those of inspected schools, he must say he saw no hope whatever of being able to do anything of the kind on a large scale, unless some improvement in spelling, such as had been recommended by Mr. Ellis, were adopted. A year ago he had had the honour of bringing before his fellow-townsmen in Liverpool the importance of this subject, and through the newspaper reports of that meeting he had been favoured with communications from all parts of England on the same subject, and had been astonished to find the number of schemes which had spontaneously suggested themselves to different persons for meeting this spelling difficulty, for he believed the number of different schemes he had received exceeded a dozen. For himself, he fully agreed in the main with Mr. Ellis's scheme, although in some few particulars he differed from him. He fully endorsed the idea that simplified orthography should be used for teaching, as a stepping stone to, or concurrently with, the present system, and also that some

new simplified system should be officially recognised. As to details, he agreed with Mr. Ellis's plan of representing the short vowels, *gnat*, *net*, *nit*, *not*, and *nut*, but excepted *fuot*. He also agreed that the digraphs *di*, *sh*, *ng*, *th*, should stand for the sounds which they at present most usually represented, and that the sounds *ing*, *caul*, *cool*, *foil*, and *foul*, *ee* for *feet*, *ai* for *bait*, and *oa* for *coal*, should be retained. He could not, however, agree with the *no* for the short sound of *u*, because there was no such combination in use, or with *ei* to represent long *i*, because, as far as he had been able to gather, there were only two instances, *height* and *sleight*, in which these letters represented that sound, and even there, he believed, an alternative pronunciation, *haite* and *slaite*, was allowable.

Mr. Ellis said that was the 17th and 18th century pronunciation.

Mr. Jones said he also objected to the combination *eu*, as in *feud*, that word and its derivatives, and *Europe*, being, he believed, the only examples of the sound. He believed there was more harmony in English spelling than it sometimes had credit for, and should have been glad if Mr. Ellis had recognised the principle which very extensively prevailed of indicating a long vowel by a final *e* after a single consonant, and a short vowel by a double consonant, as *hat*, *hate ; hatter*, *hater ; hop*, *hope ; hopping*, *hoping ; pin*, *pine ; pinning*, *pining ; tun*, *tunnel ; tune*, *tuning*, &c. This principle ran through the whole language, and it seemed to him an unnecessary complication not to recognise it. He found, on counting the words in "Walker's Rhyming Dictionary," that this rule applied to about 3,000 words against 400 exceptions, or from 80 to 90 per cent., and he certainly thought that if they were to have a stepping-stone to the ordinary orthography the transition should be as gentle and gradual as possible. Again, Mr. Ellis had not explained why he had adopted *k* to represent the hard sound of *c*, when the latter was far more common; indeed, next to *e* it was the most frequently used letter in the alphabet. In "Webster's Dictionary" there were at least 8,000 words containing *c* hard, whilst the number with *k* was comparatively very few, and a reference to "Macaulay's History" showed the same result, the proportion being about 18 to 1. In the short example at the end of the paper there were 118 words, only nine of which were unchanged in form, and if such an extensive alteration were attempted, he feared there would be no hope of success, and it must be recognised by Government authority before teachers could introduce it. He would rather that the change was made as slight as possible, and as much as could be in analogy with existing orthography. Further, in order to conciliate those who thought a great deal of the etymological and historical difficulty, of whom he was not one, he would fall back where it could be done on the old orthography before it was stereotyped by Johnson, who did a great part of the mischief. Before that time there was great latitude in spelling, and he would therefore select eligible forms from the writings of old authors, by which means almost every requisite could be obtained. In conclusion, he hoped that some committee or commission would be appointed to investigate this subject; the country was much indebted to Mr. Ellis for his long and self-sacrificing labour in this direction, but there were other schemes equally worthy of attention, and before government, or any great society, were asked to commit themselves to anything, a full inquiry ought to be made. Unfortunately, however, spelling was at present "Nobody's Child," and therefore he would suggest that the Society of Arts could do no greater service to education than to institute an inquiry into all the schemes for spelling reform now before the public, and if it were found that in many points they all agreed, which he believed was the case, the ground would be, to a certain extent, cleared; and if even those recommendations were adopted a great deal would have been done for the cause of education.

Mr. Danby Fry said this subject had attracted a great deal of attention at the Philological Society, of which he was a member, but, as it appeared to him, the proposal put forward by Mr. Ellis was very different to that which had been discussed by Mr. Jones, the subjects were distinct, and might be pursued separately. Mr. Ellis's scheme had special reference to the teaching of spoken language through the medium of a particular mode of spelling, but this was quite distinct from the improvement of English orthography as an actual means of writing, which had been more particularly referred to by Mr. Jones. If time allowed he should have been very glad to have entered on a discussion of this subject, but it would almost involve a separate discussion on each word in the language, for hardly any were spelt in a way that did not admit of improvement. He had no doubt that if Mr. Ellis's scheme were adopted it would be exceedingly valuable in an educational point of view; teaching the child first to speak it correctly, and then to write it correctly, by a faithful representation of speech itself, would undoubtedly familiarize the child with the proper sounds, and would enable him to learn the present mode of spelling with greater facility afterwards. He believed this had been already proved by the practice of a similar system to that now recommended, and its further adoption would no doubt be useful, but it would not at all affect the actual spelling of the English language, for even if glossic were used as a means of instruction, the other method must be learned by those who had to employ it in daily life. If a joint committee of various societies were appointed, or even a government commission, to inquire into the advantages of such a system for teaching reading and writing, the result would no doubt be very valuable, and if anything of the kind were to be introduced, it was of great importance that the best system should be selected before any definite step was taken. The alteration of the established orthography was perhaps even more important, and would form the subject of a separate inquiry, although the two might proceed together. He had not much hope of anything practical being effected unless some such inquiry were instituted, either by the government or by a joint committee of learned societies, such as the Society of Arts, the Philological Society, and the College of Preceptors.

Mr. Pagliardini said he regretted that Mr. Ellis, who began so bravely twenty-five years ago, should have allowed himself to be alarmed by a learned dean's diatribes against the introduction of any new letters, and had, therefore, discarded the few new letters he had formerly suggested, when some eight or ten would have enabled him to allot a single sign to every single sound in the language. He must say he had a great objection to digraphs to represent a single sound; first of all because he believed that before the next generation the united states of Europe would be fully constituted, and the human family was fast being constituted, so that a system adapted to all European languages should be kept in view. The elementary sounds of the human voice were limited to about forty-eight, and he did not see why all the clever heads in Europe should not meet, analyse the distinctive sounds of the human organ, and appropriate a distinctive sign to each, so that if a sound were common to English, French, German, Spanish, and any other language, the same sign should represent it, and each nation would merely discard from the general alphabet those signs for which it had no sounds. Then, in learning a new language, the pupil would not encounter the difficulty of finding half a dozen new powers given to the same signs that had the same number of different powers in his own, but would know at once the value of all the signs to which he was accustomed, and would merely have to acquire a few fresh ones. Most of those gentlemen who feared to make too many alterations in the English language forgot what writing ought to be—a photograph of spoken language. He did not understand

what writing was, unless it was a portrait which was to eternalise those thoughts which were passing in a man's mind, or the words which he had spoken, but the *sounds* ought to be represented, not any fancied etymologies or derivations, for he had found much more advantage from inspecting the sounds of a word when he knew how to pronounce it than he ever did from any false orthography based upon etymology. The Italian language abounded in vowels, but each one had a distinct, simple sound, and when three or four came together there were three or four distinct sounds. To spell such a sentence as *I miei amici* in Mr. Ellis's system would be very cumbrous, and would require something like eight vowels one after the other, which the eye could scarcely take in. Mr. Jones had proposed the addition of a final *e* to make the vowel long, as characteristic of English spelling; but there were so many exceptions to this rule, that it was by no means a sure guide, and he should much prefer doubling the vowels. He had no objection to *aa*, *oo*, and *ee*, but could not accept the Germanism *ei* to represent the English diphthongal sound of *i*. If a diphthong were used at all he should prefer *ăĕ*; but either of these methods would tend to lengthen the printing; and he had calculated that, by having a separate phonetic sign for each distinct sound, three volumes would contain as much as four in the ordinary system, and a man would save one-fourth of his time in writing. This saving was surely worth consideration; and when they heard that children spent seven years at school in learning nothing but how to read and write, it showed there was something decidedly wrong in the system which required such an immense waste of time and temper, and he could quite understand teacher and pupil being out of temper, when they had each to learn English on the present system of spelling. French was not much better. Three or four weeks, on the other hand, would be sufficient, with a correct system, to make a child read fluently anything printed phonetically; and as soon as they had learned the mechanical power of copying the letters, they would be able to write with equal facility. He should begin by teaching linear drawing before writing, and let the children copy chairs, tables, and other familiar objects, which would be both interesting and useful, and from that they would easily learn to copy letters, and would then be able to write any word they could pronounce. He had had some experience in higher class schools, and he must say that the manner in which lads of 17 or 18 wrote English was often astonishing; the girls, generally speaking, spelt better. Every infant was by nature a phonetician, but the pedantry of teachers (leaving etymologists on one side), forced this instinct into the corrupt present system. The same thing had nearly happened in Italy. There, the *savans* took to Latin and Greek, and despised their own language as being only fit for the market and shop, and unworthy to carry men's thoughts; the consequence was that they all wrote in Latin, more or less correct, and the Italian language was left to the mercy of the middle and lower classes. They spelt phonetically, but as Dante, Petrarch, and Boccacio had already written immortal works in that language, when Italian *savans* began to feel that their own language was one worthy of a great nation, and that modern thoughts could be better expressed in it than in a dead language, they tried what had been done in England and France, to bring back Italian to what they called an etymological spelling. For instance, they strove to write "*filosofia*" with two ph's, and *lutto*, meaning grief, "mourning," they attempted, following the Latin, to make *lucto*, and they got into *tucto;* in fact, they got into a mess, and found they had lost their opportunity, and the Italian was spelt phonetically, and so it remained to this day. There were only six alterations he should like in it to make it perfect; it had a double sound to the letters *c* and *g*, and no signs to represent *gli* and *gn*, the aspirates of *l* and *n*, and but one letter to represent the broad and close *e*, and one for the broad and close *o*. Those were the only differences in Italian orthography which prevented its being perfectly phonetic, and the consequence was, that when Italy had got rid of the priesthood and despotic governments, which had always fostered ignorance; as soon as she had time to look about her and attend to national education, Italian workmen would soon get the start of English and French, because their learning to read and write would be the work of two or three months at the utmost. *N o* spelt *no*, and *m i a*, *mia;* in fact, when you pronounced the letters of which any word was composed, you pronounced as nearly as possible the word itself, with the six alterations he had mentioned. Some people said that, if phoneticism were introduced, every one would be spelling as they pronounced, and we should have all sorts of dialects; that the Lancashire man would spell one way and the Devonshire man another, but that happened to a still greater extent in Italy, which, being divided into half-a-dozen different states, with different courts and academies, there were independent dialects. Still there was but one Italian language, and when a great author was writing for the nation he wrote in Italian, and everbody read it, but a local poet or author writing for his own locality would use his own dialect. He had books in perhaps a dozen different Italian dialects, and he could read in each the thoughts of the authors as they wrote them, because they were spelt as they were pronounced. He therefore should oppose any alteration in English or French orthography that did not keep an international end in view, and that was why he advocated an extension of Mr. Jones's idea of a congress of all persons who had orthographic crotchets. If they could agree upon anything, which he feared would not be the case, a great deal would have been effected; but he should like an international assembly in which all European nations at least should be represented. They did not want to go into variations of sound to the third degree; 48 or 50 distinct sounds would be sufficient, of which English had but 39, and French but 36; there would, therefore, not be many new characters required in any language; and if the nations would agree to make one change a-year, at the end of 20 or 30 years the thing would be accomplished. With regard to old books, it was astonishing how few there were in existence. He had a few, and was rather proud of them; and if anybody had a "Shakespeare" 200 years old they valued it more than half-a-dozen volumes of a later date. The fact was old books very rapidly disappeared, so that if a gradual change as he had suggested were introduced, booksellers would by no means be losers; to this he only wished to add that experience had proved to him that those persons who had begun by phonetics found far less difficulty in reading books printed in the present "heterography" than those did who had begun with it.

Mr. Hyde Clarke said the subject, no doubt, was one of the most important that could come before the Society, and affected a very large portion of the population of the globe, not only in Europe, but also in America. This question must not be regarded simply from an English point of view, but the whole body of the English speaking population should be taken into account. However willing he was to admit that there were difficulties in the present mode of spelling, he did not think they were sufficient to render it necessary to adopt a spelling reform, and particularly one of such a character as that evening had been proposed to them. The question really was, whether glossic ought to be used at all, because if it were introduced in such a way as Mr. Ellis proposed, it would certainly be for the purpose of superseding the present mode of spelling, and, under such circumstances, he should certainly be inclined to adopt Mr. Jones's practical reform instead of the more elaborate system suggested by Mr. Ellis. He believed, however, that the difficulties which attached to spelling, and the teaching of writing and spelling, were not such as had been represented, and were not to be removed in the way suggested. They arose, to a

considerable extent, from the extension of the English language amongst persons of different races and of different dialects, and likewise from the great copiousness of the language itself, which extended to more than one hundred thousand words, as well as to the very circumstance which had been alluded to of there being such a large number of personal and topographical names entering into its composition. Looking at circumstances of that kind, and their bearing upon other languages, not merely in the way Mr. Ellis had stated, but on a wider scale, he thought they should fail to obtain evidence which would justify them in displacing the present system of orthography which had been adopted by such a large portion of the human race, and which, as Mr. Ellis had acknowledged, had such an important influence in connection with our Indian empire. He believed the system which Mr. Ellis proposed was more cumbrous than that which he wished to displace, and, like many systems of mnemonics, entailed as great difficulties in its employment as the system which it proposed to abolish.

In answer to some expressions of dissent, **Mr. Hyde Clarke** said he did not speak without full consideration and some experience of the subject. They must look at the actual state of affairs, and the balance of good which could be obtained.

The Chairman, in moving that the thanks of the meeting be given to the writer of the paper, said—This question is a fundamental one for a national system of education. Your Council, in the instructions issued to their delegates to the Educational Congress, expressed their belief, on the testimony they have received, that the three R's might be taught in probably half the time now occupied in teaching them. That is to say, half of the half-time which, as I say, exhausts the capacity of profitable attention of children, would suffice for attaining, comparatively pleasurably, the instruction they now get only painfully. You have heard well described, by the writer of the paper, the difficulties which an apt and distinguished scholar, a person of evidently high abilities, has experienced in learning to spell. From this may we not form some conception of the difficulties, the pain inflicted by the operation upon poor, timid, and feeble-minded children. The confusion excited in their minds by the representation of the same sounds by different letters and in different ways, the absence of any apparent reason for those perplexing difficulties, the presumption that there must in the minds of men be some reason for them or they would never be affected, the despair of finding any, and the discouraging assumption engendered in the minds of the scholars that they fail from a hopeless incapacity, are productive of permanent mental injury to many of them. Then this absence of apparent reason for much of our spelling encumbers persons in advanced life with the labour of remembering, and misgivings as to the spelling which is right. The obstruction to learning our language by foreigners, as well as by different races in our own dominions, is very serious. That eminent scholar, our present Premier, Mr. Gladstone, has said—"I am afraid our language bothers the foreigner dreadfully. I often think that if I had to set about learning to pronounce English, I should go mad. I honestly can say that I cannot conceive how it is that a foreigner learns how to pronounce English when you recollect the total absence of rule, method, system, and all the auxiliaries which people generally get when they have to acquire something that is difficult of attainment." This being a correct description of the difficulties of the adult foreigner, trained in learning, we may beseech his consideration of our own juvenile foreigners to the world of life, and the few auxiliaries they generally get in skilful teaching when they have to acquire something that is difficult of attainment? By the proposed new system of national education, perhaps two or three additional millions of the little foreigners will have to be driven by compulsory measures into the difficulties he describes. Are we not bound, in common humanity, to consider them, and to try and do soon what may be done to mitigate them? The question has, too, a financial aspect, especially if the principle sanctioned by His Royal Highness, our president, is to prevail, as we trust it may in popular elementary education, that earning and learning shall go on as much as possible harmoniously together, on which principle time saved is money saved for productive service as well as for additional productive and paying acquirements, because the special object of the Society, secondary and art and science instruction, can only be obtained extensively by shortening the time now occupied in the painful attainment of primary instruction. Judging from the Society's own local reports, and from other sources, as much as three millions more of money may be needed on the present system, and it certainly will, on the single-chambered parochial school system, be required to achieve a national system of elementary education. On this system a half of a third of the expense, or half a million per annum, may be set down as the money gain from the reform of our system of spelling. Be it more or less, it is a sum worth considering, apart from the mitigation of the miseries of several millions of children, the great new army of little enforced conscripts to the national schools. It will, I think, be agreed that this question of spelling reform may well be taken up by your Council. I can tell you that it is well appreciated by my excellent colleagues. I have only heard Mr. Ellis's plan to-night, and am only prepared to say that I am favourably impressed by much of it, and that very careful consideration is due to it. Yet I confess that I am with my colleague, Mr. Hyde Clarke, most favourably impressed with the plan adopted by the Spelling Reform League of Liverpool (and spelling reform I consider a great subject for a league and for national exertion) of returning to the spelling of Chaucer, of Wycliffe, of Sir Thomas Moore, of Tyndal, and of Milton, and of our old authors. They spelt to a great extent phonetically, as shown in the programme of the league; and the adoption of their spelling would evidently be in itself an enormous relief, especially for the more common words with which children have to begin. The attention of the House of Commons to any refinements in the representation of sounds would be difficult to get, for it is now manifestly difficult to get any attention to the very bad quality of the common education, the consideration of which and the miseries of millions of children are recklessly disregarded for party fights. But a return to old spelling would be more easily comprehended, and would be more difficult to withstand. It is true that many old writers spelt many words differently, but an authority—a department of education—might make an authoritative selection for school books to begin with, and an advance might be made to public documents, and their decisions would not be mandates of painful labour, but mandates or licenses of relief from painful labour to the rising generation of children, relief from the cruelty of modern scholastic bigotry and tyranny, and, we may rely upon it, would receive joyful obedience. One authority, that of the great Academy of France, has rendered great service by settling the orthography of the French. Spain, however, has a similar authority, an academy which exercises its functions in this respect efficiently, and is so well obeyed that Spanish is declared to be the best spelt language, and the most pleasantly learned, of all living languages. It is to be hoped that we may follow in the footsteps of Spain in the relief of the miseries of childhood in national education, and for the improvement and wider propagation of that mother tongue which is becoming the foremost of the world, and to have the greatest lead in enlightened thought and action, and in modern civilisation.

Mr. Ellis, in acknowledging the vote of thanks, said that some of Mr. Jones's observations were founded upon a wrong basis. He did not wish to attack the spelling difficulty in school alone, but the spelling difficulty in life also. The principle of what was called the mute *e* for lengthened vowels was both false and unhistorical; he had investigated it thoroughly, and knew that it could not be carried out. It was impossible to use vowels in two senses, as in *famous*, *famine*, *mousing*. The use of *c* for *k* he had already tried for years, and found it fail. With reference to what had been said by the Chairman, that when members of Parliament found it was only returning to the language of Milton, Tyndal, and Chaucer, they would not be so much alarmed, he must say, in the first place, that they did not know what the language of Milton, Tyndal, and Chaucer was; no one could write it, and no one could pronounce it, except perhaps himself, for he had paid more attention to it than any one else in the present day, having studied the writings of all the contemporary orthoepists. That knowledge enabled him to say that it was totally impossible to return to their pronunciation or their mode of spelling, which did not represent their pronunciation, for during the 16th century there were at least half-a-dozen schemes for the amendment of English orthography, on account of the hodge-podge it was in. With regard to a gradual change in orthography, he might mention that two changes had been made in our orthography, one at the end of the 13th century, the beginning of the fourteenth, and another at the end of the sixteenth century. In the first place, the change, which took about 30 years to accomplish, was to substitute *ou* for *u*, to represent the sound of our present *oo*, and the second change, which also took about 30 years to accomplish, at the end of the sixteenth century, consisted in the introduction of the distinctions *ee*, *ea*, for the sounds in *beer*, *bear*, and *oo*, *oa*, for the sounds in *boor*, *boar*. These were not very favourable instances for the introduction of gradual changes. Mr. Fry said that all persons must learn both systems, and that was no doubt true at present, and he thought it would be a great advantage for them to do so, but those who were not employed in offices, and we were not such a bureaucratic nation that everybody who was employed as a clerk could write in the glossic system, and for many purposes it would be more advantageous for them to do so. With regard to Mr. Pagliardini's observations, he stated at the outset that he did not attempt to introduce the question of a universal system of writing, and that glossic was not adapted for such a purpose. Nor did he think a congress of nations, with this end in view, was at present possible, for he doubted very much if there were in France, Germany, Spain, and other European countries half-a-dozen men competent to discuss the question thoroughly, for it was a subject which persons required to be educated into. Mr. Hyde Clarke said that his system must, if introduced, supersede the other, but he advocated it as a concurrent, not an antagonistic system of spelling. At the same time, if their grandchildren thought fit to adopt it for ordinary purposes, he saw no reason why the present generation should attempt to prevent their doing so. Just as people will write as the *Times* prints to-day, and not as the *Spectator* printed in the time of Queen Anne, or as Caxton printed at the end of the 15th century, it would be found impossible to make everybody write in an old-fashioned way hereafter; and if two or three generations hence people thought fit to change their mode of spelling, there was no reason why they should not do so. England had no academy, nor did he think it possible to have one for the purpose of regulating the national language. The societies which were concerned with literary subjects were not numerous, nor were their members exceedingly enthusiastic. He was afraid an academy would prove completely abortive in this country. With regard to Spain there was this difference, that the country, considered linguistically, was very small, notwithstanding Spanish America, while the English tongue was spoken throughout immense continents, and was ever extending its area. It would be impossible for any academy in England to lay down rules which would be followed in America, Australia, and other distant lands; and he doubted exceedingly if any authority could be found to which deference would be universally paid even in England. At the present day there were different customs of spelling in different parts, for Professor Child, of Harvard College, recently stated that Cambridge (America) followed one system of spelling and New York another; and in his own experience he had found printers ask him how he would like such and such words spelt, because they had a certain custom in their house, and other houses had a different custom. He had given an instance of the difficulty of getting compositors to adopt an author's spelling in the word *flugelman* in the paper, which, notwithstanding a clear MS., had been printed *fugleman*, although the printer had, on correction, very properly altered the spelling; but in slighter instances the trouble of continually correcting these matters prevented its being done, so that, practically, spelling was to a great extent in the hands of the printers. The discussion, unfortunately, had not taken the turn which he wished it, viz., the double aspect of the question, not merely regarding the system he proposed as an apparatus for school teaching, but also as a practical concurrent system of writing, for general or special purposes, in the same way as a concurrent system of musical notation had been introduced for teaching music. He wished this system to be introduced for the purpose of teaching the thing reading, to facilitate school reading and school pronunciation, and to save those who chose to be saved the trouble of learning the present spelling, by giving them a system which they could write as soon as they could speak.

INSTITUTION OF NAVAL ARCHITECTS.

The first meeting of the eleventh session of this Institution was held on Wednesday morning last, in the Lecture Theatre of the South Kensington Museum, the Right Hon. Sir **J. S. Pakington**, Bart., M.P., President, in the chair.

The Honorary Secretary (C. W. Merrifield, Esq.) read the report of the Council and the balance-sheet of the Institution.

Report of Council, April, 1870.

"It will be necessary for the Council, on the present occasion, to address to the members and associates of the Institution more than a very few words by way of report, the internal affairs of the Institution having progressed satisfactorily.

"The Council are glad to be able to state that the Lords of the Admiralty have been pleased to renew their grant of £250. As this grant was actually paid in the month of December, 1869, it necessarily appears in the balance-sheet for the past year, although not belonging to that year's ordinary income.

"The privilege of becoming members of the Institution has been offered by the Council to the following distinguished marine engineers, under the authority of the last paragraph in the report of the Council for 1869, which was adopted by the meeting:—Edward R. Alfrey, Esq.; Alfred Blyth, Esq.; William Denny, Esq.; Sir William Fairbairn, Bart.; Joshua Field, Esq.; Telford Field, Esq.; James Henderson, Esq.; John Key, Esq.; J. G. Laurie, Esq.; Hugh Morton, Esq.; John Penn, Esq.; John Ravenhill, Esq.; George Banks Rennie,

Esq.; George Robert Stephenson, Esq.; John Trickett, Esq.

"An arrangement has been entered into by the Committee of the Canoe Club, upon terms advantageous to both Institutions, by which the committee of that club is enabled to hold periodical meetings in the rooms of the Institution, at such hours as not to interfere with its business.

"By the kind permission of the Lords of the Committee of Council on Education, this report is presented to you in the Lecture Theatre of the South Kensington Museum. You are invited to inspect the premises of the Royal School of Naval Architecture, and the magnificent collection of models in the Naval Gallery.

"The Council are informed that the alterations which have been made in the course of instruction given at the Royal School of Naval Architecture and Marine Engineering appear to promise satisfactory results. Changes of this nature, however, cannot be expected to produce immediate fruit, and the Council, therefore, await with much interest the report upon the examination of the school at the end of the present session, the first occasion of a conclusion of the four years' course. The Council observe with regret that the number of private students has decreased.

"The papers to be laid before you at the present meeting are of great interest; and while they embrace valuable contributions to the theory of naval architecture, they are, as a whole, of a remarkably practical character, and are chiefly contributed by private shipbuilders and engineers."

The Chairman—Gentlemen, I now rise to perform the duty of offering to you such observations as may appear appropriate on the occasion upon which we meet—a duty which has devolved upon me every year since I have had the honour of holding the office of your president, which I can assure you I value most highly. Gentlemen, I have always felt that, although the address of the president is a form which is always observed, and a form which is not without its value and utility in many cases, still, considering the nature of the duties for which we are assembled, it is desirable that those observations which the president may think it his duty to make should be compressed within at least reasonable, if not narrow limits, in order that undue intrusion may not be made upon those duties of the day which, in my opinion, are more important. But, gentlemen, I cannot refrain from expressing the great satisfaction and pleasure with which I find myself able to meet you again at the commencement of another annual session, and that under circumstances which, in two respects, are circumstances of novelty. I think, also, that these two circumstances of novelty may fairly be regarded as indicating a state of growing prosperity and success on the part of this institution. The first circumstance of novelty to which I refer is the fact that now, for the first time, we assemble on Wednesday instead of Thursday, that is, we assemble for a session of four days instead of, as heretofore, only three. Another innovation, and I think one of a very interesting character, is that, for the first time, by the kind permission of the Committee of Council on Education, we are enabled to assemble here at South Kensington for the proceedings of our opening day, instead of assembling, as heretofore, in the large room of the Society of Arts, where our meetings during the remainder of the week will be held. The fact of our assembling here gives us a double advantage; the one is, that we assemble close to that interesting, beautiful, and, I believe I may say, perfect collection of naval models which have now been brought together in this most interesting and instructive building, and are now open to public view, instead of being stowed away and concealed as they were, for a vast number of years, in the cellars of Somerset House. They are now brought together and arranged in a manner which enables all who take an interest in these matters (and I may almost add, who is there who does not take an interest in these national objects?) to avail themselves of the opportunity which is now afforded of going to see them; and, of course, such an assembly as I have now the honour of addressing, is one which would peculiarly delight in looking at that interesting collection of models. Another advantage which arises from our assembling here is, that we are close to that school of naval architecture to which, I think, I may almost refer as the child of this institution—a national establishment which we all concur in regarding as one of great national interest and great prospective national advantage. By assembling here on this occasion, we are enabled to go into the details, and see personally the whole of the arrangements of that most useful institution. I hope, before quitting the subject of that institution, I may be able, with perfect safety, to say that it is still performing its useful functions, and likely to bestow upon the country those advantages which were anticipated when it was first established. Gentlemen, you have heard a passage read by the secretary from the report, which alludes to the fact that the number of private students in the School of Naval Architecture has somewhat fallen off; but, gentlemen, I am far from thinking there will be, and I hope you will not think we are to infer, any serious diminution of interest or advantage in the institution from that fact. I think that we must rather regard it as one of those cases of fluctuation in numbers which is unavoidable in almost every establishment of this kind. Gentlemen, I am anxious not to detain you more than I feel it to be really my duty to do. There are several subjects to which I may, I think, with propriety advert, but which upon this occasion I will pass over. However, there are one or two others upon which I cannot be altogether silent. I am not sure whether the first of these is not one which, perhaps, I ought almost to apologise for introducing, because it is a subject not so much of naval architecture as it is a subject concerning—and most deeply concerning—the interests of navigation. Whatever touches upon the interests of navigation must be a subject deeply interesting to the marine, whether the warlike marine or the mercantile marine of this great empire. The subject I now refer to, and upon which I venture to say a few words, is the subject which is generally known as the "rule of the road at sea." The importance of that subject has been forced upon the public mind very recently by circumstances which have appealed very strongly to public feeling. There have been very recently two most remarkable and most painful instances of collision at sea. You will at once understand that I refer to the collision which occurred in the Eastern Seas between the United States frigate *Oneida* and one of the Peninsular and and Oriental Company's vessels, the *Bombay*. The other was that painful occurrence which happened close upon our own shores a few days ago, of the collision between the *Normandy* and the *Mary*, one of them, the *Normandy*, being a packet plying between Southampton and the Channel Islands. In both of these melancholy cases great loss of life occurred. Of course it would be beyond my duty, and would be travelling into ground which I could not with propriety touch, if I were for a moment to refer to that question which has arisen, and probably will again excite the public mind as to how far the captain of the *Bombay*, by his conduct, was responsible for the great loss of life which occurred. Every one will ask, Why was it that these two ships came into collision? Why was it that they could not keep clear of each other at sea? And why has any occasion arisen for doubting or questioning the conduct of the captain of the *Bombay?* This would lead to the all-important question connected with navigation, Are the existing rules with regard to the rule of the road at sea as good as they can be made for the protection of life and property at sea? Probably most of you will be of opinion that under the best and wisest regulations that can be made still danger will exist. But, so far a

I have been able to take counsel with those who are conversant with this subject, a strong impression exists that the existing laws upon this subject are not so well defined or so clear as they might be made, and it therefore becomes a question whether or not, for the public interests, it is not desirable that some inquiry should take place. Gentlemen, before I close the observations which I am now venturing to address to you, I shall have to touch upon another subject of possibly even greater importance than that to which I have just referred, with a view of asking counsel from you, the competent judges assembled here, whether it is not a subject upon which inquiry is needed; and if so, I think it may be a question whether this subject, the "rule of the road at sea," ought not to be included in any such public inquiry as may take place in the event of such an inquiry being decided upon. And, gentlemen, let me say that this interesting subject is not limited to what we generally regard when we talk of the "rule of the road at sea." I think that dreadful collision which occurred the other day between the *Normandy* and the *Mary* touches upon another branch of this subject. It is not only how ships approaching each other are to be managed so as to avoid danger of collision under ordinary circumstances; but in that melancholy case another question arises, which is, Whether the public safety does not require that some strict peremptory regulations should be adopted for the regulation of the management of ships when thick fog prevails. There can be no doubt that the melancholy loss of life in the *Normandy* was occasioned by thick fog. You will not suppose, I am sure, that I desire to prejudge any case which is now under investigation; but I think enough is known, and enough has come before the public, to prevent us feeling any hesitation as to the fact that the main and leading cause of that loss of life was the fact of a ship going her full speed, or nearly her full speed, at a time of very thick fog. It is possible that some persons may have observed that this melancholy loss of life became the subject, a few days ago, of a question in the House of Commons, and I then thought it my duty to follow up that question by inquiring whether the Board of Trade were or were not in possession of information as to the question, whether or not the usual precautions of gongs or bells had been resorted to. There appears, as far as I have yet learnt the facts of the case, to have been no such precautions, and it seems perfectly clear that the *Normandy* was going at full speed, and as fast, or nearly as fast, as her power would permit. Gentlemen, I think that brings at once before us a subject of the deepest interest, namely, whether the time has not come when some public interference should take place for the protection of that portion of Her Majesty's subjects who are compelled to trust themselves to the dangers of the deep; and whether captains of ships should not be peremptorily required to moderate their speed under such circumstances, and to resort to every precaution which can ensure the safety of those who are entrusted to their charge. Gentlemen, having touched upon this subject, which I hope you will not think I have done improperly, there remain two other subjects upon which I should have been glad to have addressed you; but I think it will be the less necessary for me to occupy your time in doing so as I see that both of them are not only about to become, but are this very day to become, the subject of papers which will be read to you, and which papers will, of course, according to our usual custom, become the subject of discussion—I allude to the two subjects of the Channel Passage and the Suez Canal, and the extent to which not only the commercial interests of the country and the navigation of the seas, but also the question, in these cases, of naval architecture, are concerned. It will be for you, gentlemen, who are scientifically acquainted with this important subject of naval architecture to consider, and no doubt the papers which will be read to you will give you the opportunity of considering, how far it is desirable that the talent of our able naval architects should be brought to bear upon these two most interesting questions:—First, what is the best mode of constructing a ship ferry, which appears, after long deliberation, to be the best mode—or at least to be the favourite mode at the present time—of expediting the transit across the Channel; and an interesting question would arise for the consideration of naval architects, how best to construct vessels which shall be well adapted to that entirely novel object of constituting ship ferries across the Channel. The other question is one of hardly less interest, namely, how we can construct vessels which shall be enabled to carry a large number of passengers and heavy cargoes from England to Alexandria, and still to be of such a draught of water as to enable them to pass through the Suez Canal, and continuously to follow their voyages to the East. These are subjects of deep interest. They are subjects which touch not only the skill of our naval architects, and call forth, in a great degree, the exercise of that skill, but they are subjects in a remarkable manner illustrating that rapid progress of science and enterprise which is one of the distinguishing characteristics of the century in which we live, and more especially of later years—the commencement, I may say, of the latter half of this century. There remains now, gentlemen, only one more subject upon which I desire to say a word, but it is a subject which has been very much, accidentally partly, in my mind of late, and a subject upon which I very much desire to take counsel with you, with the view of deciding whether or not it is not most desirable that the government of the day should be pressed to institute and to prosecute a scientific inquiry on the subject. It is a subject beyond all doubt surrounded with very great practical difficulty—I allude to the question of the load-draught of merchant ships at sea. Every one has of late been deeply touched, I am sure, by what I am afraid we must now inevitably regard as the loss of that great packet the *City of Boston*, the most melancholy event of the kind which has occurred since the loss of the *President*, under somewhat similar circumstances, some years ago. [The remarks of Sir John Pakington on the *City of Boston* we omit, at the request of the solicitors to Messrs. Inman and Co.] The effect of my having put a question in the House of Commons with regard to the *City of Boston*, was one I had not for a moment thought of or foreseen. The effect of it has been that, from a considerable number of quarters, from a considerable variety of persons, some speaking from one motive and some from another, but from all parts of the country, I have received communications, to an extent to which I had no expectation or idea, pressing upon me the immense importance of this question of over-laden ships. Two particular causes—as I am told constant causes—of disaster have been pressed upon my consideration. The first is the relaxation of a rule which did exist, but for some reason or other—I know not why—it appears to have been relaxed and abandoned. I mean the rule that every steam ship (I do not know whether it applies to sailing ships or not) putting to sea, ought to be provided with watertight bulk-heads. That is one point which has been pressed upon my attention. The other point which has been pressed upon my attention is the immense loss of life and property, arising, as I may say, partly from this neglect of watertight bulkheads, but in too many instances from the fact of ships proceeding to sea laden beyond the point of safety. I am anxious not to dwell more upon this subject than I can help, but I may state that I have been startled by the extraordinary amount, the dreadful amount of loss which has occurred within the last twelvemonths — I mean the loss of life and property in steam ships at sea. The facts I am about to mention have already been the subject, on my part, of questions in Parliament, but I think you will perhaps regard it as well on this occasion, as I am alluding to the subject, that I should repeat those figures, because they are, I think, astounding figures. The first fact I

will mention is that to which I first referred in the House of Commons, namely, that from the 1st of this last January to the middle of March, that is to say, in the first ten weeks of the present year, there were lost no less than nine steamships. Two of those steamships were lost in consequence of those collisions at sea to which I have already adverted; one or two of the others were stranded; and the remainder, more than half of the whole, appear to have foundered at sea, and nothing is known of their end. Well, gentlemen, the other fact brought to my notice was this—this latter faet was brought to my notice by a simple quotation from a public newspaper—that from the beginning of last July to the beginning of November no less than twenty-eight steamships were lost at sea. Therefore, of what may have happened during the months of November and December last I have no information at present; but, considering the period of the year, the too great probability is that they were not behind the other periods to which I have referred in the number of these melancholy casualties. But cutting out those two months of November and December, as to which I have no information, and taking the six months from July to November, and then January to March, we find a number of no less than thirty-seven steamships having been lost at sea. Gentlemen, I think you will consider this a subject for very grave and anxious consideration. Something must surely be wrong. I cannot imagine that, with the skill of our seamen, and the great skill of the naval architects in the construction of ships, that such a disastrous loss as thirty-seven steamships within the period of six months can have occurred without there being something wrong, either in the construction or loading of these ships, or both. My immediate and practical object is to take counsel with this meeting of scientific men, competent to advise upon this subject, and to ask them whether they do or not think that, under such circumstances, it is desirable that some member of Parliament should press upon Her Majesty's government that it is really due to the safety of the public and the character of our commercial navy that a public inquiry should be directed to the settlement of this subject, and to endeavour satisfactorily to solve the question whether the difficulties are really so great that no plan can be devised for increasing the safety of our ships, and the safety of the lives of our gallant sailors when they put to sea in those ships. Gentlemen, I ought not to quit the subject without reminding you that at one of our former annual meetings, shortly after a particular event of the same kind, namely, the loss of the *London*, I brought this same subject before the House of Commons. I also brought it before this meeting of Naval Architects; and you will, I am sure, remember that this institution appointed a committee of the most competent scientific gentlemen. That committee devoted a degree of time and labour to the inquiry which I consider most honourable and creditable to them, and produced a very able report. That report was presented to the Board of Trade; and I was sorry when I was told the other day by the minister who represents the Board of Trade that, upon full consideration of the recommendations of that committee, the Board of Trade had not thought it desirable to carry out the recommendations which that report contained. On the other hand, gentlemen, without any feeling other than a *bonâ fide* desire to increase the safety of the public, I am bound to say, from the answers I have lately received in Parliament, and from public events which are well known to you all, my impression is that the extent to which the Board of Trade now acts upon these subjects, and the amount of information which is conveyed to the Board of Trade with regard to these casualties, and further, that the inquiries which are carried on by the Board of Trade, are not so satisfactory, and do not give such confidence with regard to the safety of the public, as it is very desirable they should do. I am afraid, gentlemen, I have deviated rather more than I intended from my promise not to occupy your time, but the subjects upon which I have touched have been so very interesting to the public safety, that I hope you will forgive me if I have been rather longer than I should have been. Gentlemen, I will only add, before I conclude these remarks, that it has been a question in the Council whether or not, considering the additional time at our disposal, in consequence of having four days instead of three, we should relax those rules upon which we have hitherto acted, with regard to the time to be occupied by our proceedings. I have no doubt it will be fresh in the recollection of you all that our rule has hitherto been this, that no paper ought to exceed twenty minutes; that no speech in a discussion should exceed ten minutes; and that the paper and speeches together ought not to exceed an hour. We have had the question raised whether or not the fact of having one day more at our disposal should not induce us to relax this rule. But the opinion of the Council is, and I hope it will be your opinion too, that we had better adhere to our former rule, and especially for this reason, that I am very happy to say, as a proof of the interest excited by our meetings, and as a proof that we have done wisely in taking four days instead of three, the number of our papers has increased in full proportion to the number of our days; and, therefore, I think it very desirable to adhere to our former rule. But, gentlemen, here I must ask you to exercise some little feeling of compassion towards my humble self. It is a very distressing thing to a chairman to get up in the middle of an interesting paper, and hold up his watch and tell a gentleman that he must stop. Of course I am bound to obey your directions, whatever they may be, and it may become my duty, and a very unpleasant duty it is, to stop a very interesting paper in the middle. Therefore, I would rather take this opportunity of appealing to those who are good enough to write papers for these meetings, to spare me any painful interference, by taking care to compress their papers within proper limits, which they may ascertain by a little practice at home, so that the reading of their papers will not occupy more than the twenty minutes allowed. I am sorry, gentlemen, that in offering these observations, I have occupied so long a time, and will only, in conclusion, express my very earnest hope that this meeting may not in interest be inferior to those which have preceded it, and that the continued existence of this institution may confer on the country those advantages for which it was designed. Gentlemen it is now my duty to move that the report be adopted.

Mr. J. D'Aguilar Samuda, M.P.—I second that.

Mr. Charles Lamport was desirous that such an account should be presented to the members as would enable them to see the exact state of the finances of the institution. He did not wish to oppose the adoption of the report, but thought it due to the members of the institution that they should be made fully acquainted with the state of the accounts. He also strongly urged the necessity of collective action, in order to give substantial value to the proceedings of the institution. On the last occasion, he had moved that the council should take into consideration the strength of iron masts, with the view to lighten the construction of them, and the resistance to ships after they were launched, the measure of that resistance being taken by the application of the dynamometer. Although the resolution had been unanimously passed, he could not find that any notice had been taken of it. He would now ask the secretary whether the resolution had been brought officially before the Council, and at what date?

The Secretary said the subject had been brought before the council, and discussed upon two occasions. The result was that that and several other subjects were put together in a circular, which had been sent round to 150 of the leading shipbuilders and others. However, not one reply had been received.

Mr. Lamport said that that was not the object of the resolution. The object of it was that certain experiments

should be made, and that the subject might be brought before the attention of the government. The council had not acted as they should have done with regard to the matter, and he would move that the report, including the accounts, be referred back to the council for amendment.

Mr. Samuda, M.P., explained the state of the finances, and showed that the institution was perfectly solvent, and had a satisfactory balance. There were no debts and no engagements existing which the institution was not able to pay.

The Chairman hoped that, after the explanation which had been given, Mr. Lamport would think it right to abandon that extreme course which he had proposed.

Mr. Lamport, while dissenting from the explanation, withdrew his motion.

The Chairman then moved the adoption of the report, and it was carried unanimously.

ON THE INFLUENCE OF THE SUEZ CANAL ON OCEAN NAVIGATION.

By J. D'Aguilar Samuda, Esq.

The canal connecting the Red Sea and the Mediterranean is now an accomplished fact; and without change of vessel, and without half circumnavigating the globe, means now exist of passing from the Indian seas to all the ports of Europe.

The first meeting of the Institution of Naval Architects held after the opening of the Suez Canal, would be naturally desirous to take some notice of this important event; and it is with the view of considering the effects of this great engineering work on the commerce, and its probable influence on the mercantile marine of all nations, that I beg to submit some facts and circumstances in connection with it.

By substituting the canal route for the old-established sea voyage round the Cape, the following savings in distance are obtained in a voyage to England:—

	Miles.
From Bombay	5,777
„ Ceylon	3,843
„ Hong Kong	3,528
„ Melbourne	91

These savings are accomplished on voyages ranging from 12,000 to 14,000 miles in length. Roughly, therefore, the saving amounts to ½ from Bombay, ¼ to ⅓ from China, and nothing from Australia.

The first thing that strikes one is the enormous saving of distance thus offered to some of the principal highways of traffic, and the benefit that must result to all carriers from availing themselves of this shorter route.

But it had been foreseen, and is now universally admitted, that, independently of the difficulty and expense of turning sailing vessels through the canal, the navigation of the Red Sea is so unsuited to them, that the owners of sailing ships must regard the canal route as wholly unsuited to their use.

Considerable depression has naturally resulted in this class of property, and the production of sailing ships, since the opening of the canal, has been almost if not entirely stopped.

Is this depression to be temporary, or will the experience of subsequent working justify the conclusion it points to, of a general substitution of steam for sails in the great carrying traffic from the East?

To arrive at any sound conclusion on this most important subject, it will be desirable to review, by the light of our present knowledge, the capability of steam vessels for dealing with all, or a part of the new field suddenly thrown open to them.

And here I would observe that, if the opening of the canal had taken place eight or ten years earlier, scarcely a cargo-carrying steamer of any sort would have entertained the idea of profitable employment on even the most favourable of the routes; but that interval of time has been so profitably employed by steamship owners realising the importance of economy of coal and improved proportions of vessels and engines, that voyages may now be undertaken with profitable results which, only a few years back, would have been hopeless, except in cases where large subsidies were obtainable, to compensate the great cost of coal and working, compared with the carrying powers of steamers then in use.

The first great and important change in the character of cargo-carrying ocean steamers (within my own experience) occurred in 1863, when a large foreign company who had till then (on a 4,000-mile journey) empty vessels—burning 40 tons of coal a day to carry about 1,400 tons of cargo—were able to substitute them by vessels burning only 14 tons of coal and carrying 2,000 tons of cargo. The new vessels made 9 knots speed, actually averaging a higher speed than the old ones, and the effect was so startling that it led to their entire fleet being gradually replaced by the more economical vessels.

I think that economical working of steam applied to cargo-carrying requires that coal should be, if possible, taken on board, before leaving England, for both the outward and homeward trip.

Our present experience shows us that, with a vessel of 2,000 tons, builders' measurement, giving an average of 9 knots, and burning 14 tons per day, coal may be carried for the round voyage of 12,000 miles (6,000 out and 6,000 home), and leave space to carry 1,600 tons of cargo out of 2,000 tons home, and with these conditions it appears probable that a large amount of success may be accomplished. If this be so, we may regard as the natural consequence of the opening of the canal that the whole, or at least the greater portion, of the traffic between Bombay and England will be lost to sailing vessels and appropriated by steam.

When, however, we deal with China traffic, the difficulty for steam is much increased. Here a complete voyage of 20,000 miles has to be provided for, and I cannot satisfy myself that the same beneficial results will follow. With exceptionally high freights, it may be possible to compete with first-class sailing ships, but, as the same vessels referred to above would, on this longer voyage under similar circumstances, only be able to carry 1,000 tons of cargo out of 1,800 tons home, I think it doubtful if steam will do more than obtain a very limited portion of the traffic, and that the superior clipper ships may look to retain their vocation for some time, *i.e.* till further improvements in steam, in the same direction as those that have been made in the last eight years, put them in a position to compete successfully for cargoes in this increased length of voyage.

As regards the Australian traffic, where no advantage of distance whatever is to be gained by using the canal, and where the length of voyage is again increased, I look upon the profitable employment of cargo steamers as at present impossible, and that route, of course, will be left to the sailing vessels untouched.

I am well aware that the drawing off of sailing ships from the Bombay route will cause a serious competition to those on the Australian station. I also think that the development of Indian railways will shortly bring to the port of Bombay much produce that now goes from Calcutta and other parts of India, and that gradually and shortly Bombay will become the great port of India for England; but as these latter changes are more or less matters of time; and as the life of sailing vessels does not range over many years, I do not see sufficient cause to justify the panic that appears to have overtaken this class of property, and am inclined to think that their substitution and extinction will be much more gradual than the possessors of them appear to apprehend.

I do not wish to be understood as suggesting that im-

provement has reached its limit. I look to progressive and very considerable improvement in both ships and engines, and imagine that the sources of economy will be found to result greatly from the substitution, to a large extent, of steel for iron in the hulls, and from simplifying the construction and carrying still further the system of expansion in the engines; and, doubtless, a due encouragement of those who are continually, from their skill and experience, able to develop improved results in a practical form, will have much influence in shortening the period of their attainment. Such encouragement, however, I regret to say, is the exception, not the rule, for, with a short-sighted policy—accepting, indeed, the Manchester School for a platform, which, in a great degree, permeates the whole of our commercial dealings, and forms the basis of its catechism—the one ruling idea that purchasers cling to is "price"—"lowest price"—at which anyone can offer to throw together materials and labour to produce the article sought. The argument seems to be, a ship is a ship; if it has a certain tonnage and power, and has passed a certain inspection and registration, that is all that is desired, and unless skill, experience, and faithful work can present itself with the lowest tender, it need not take the trouble to offer its services, or, at all events, it will generally find them wholly ignored.

I think this general disregard for all works of character, and substitution of a mere standard of price, is one of the greatest misfortunes that our commerce has fallen under through the last quarter of a century; it has developed the wrong energies of the producers, has taught men to rely on success from the production of plausible shams, and has imparted a lower standard of products, and less worthy aim to all producers throughout the kingdom.

These remarks certainly do not apply only to shipping; all other manufactures are equally obnoxious to them; but inasmuch as shipowners are entrusted with a much higher mission than most others, and have in every instance the heavy responsibility of having the charge of much human life dependent on their care, it is of the utmost importance that they should take a prominent position in discountenancing the general decadence of commercial morality. Again, I am not sure that the power of obtaining immunity from loss by means of insurance has not been carried too far, and may, in some degree, have served to prevent the consideration of the weighty responsibility that errors in judgment, or a too ready acceptance of general usages, lays upon them; and I am by no means certain but that our legislature might confer great benefit, and greatly improve the existing state of things, if our contemplated Merchant Shipping Bill were to render it obligatory on every owner to retain at his own risk, and uninsured, one-fourth or one-third of every vessel sent to sea.

Recurring to the original subject of this paper, I cannot fail to remark that we must be prepared—and mainly through the opening of the canal—for a large share of the carrying trade of the East passing from ourselves to other nations.

Russia, France, and Germany are all too anxious to avail themselves of any means of improving their navies, to disregard the opportunities this offers them of subsidising commercial undertakings and practising their naval officers; and silk, tea, and cotton, and other produce of the East, will certainly pass in large quantities in vessels of those nations to their own ports, instead of being re-shipped as now, in most instances, after reaching England. I am quite alive to the importance of this result, and to the weighty consequence of it, as it certainly will have the effect, to a considerable extent, of diverting trade from our country, but I do not regard this with absolute alarm. Everyone must have foreseen that, since the large discoveries of gold, the countries that obtained it from us in exchange for their products would not be content to leave us in the undisturbed position we previously held, as the workshop of the world, and that they would gradually avail themselves, as they have done, of the facilities the possession of gold gave them for raising manufactories and fleets, to appropriate to themselves some of the advantages we had so long derived from its exclusive possession. But such large new fields of commerce are being daily opened to us; such increased wants from the increasing population and improved power of purchasing, that I have no great fear for the extent of our operations. What I fear much more is, that in the desire to possess more than our proper share, a system of unsound trading and reckless competition among ourselves may continue—I say, may continue, for I believe it exists in full force at present—and that we may be deprived of much of our legitimate reward in this country from the fact of everyone trying to obtain more than his fair or reasonable share of it.

It has formed no part of my intention, in this paper, to comment on the structure of the canal itself, the difficulty and cost of keeping it open, of preserving the required depth of water in its harbours, of maintaining its banks from the action of the traffic passing through it—all of great interest to its proprietors, and which indirectly will, no doubt, exercise an important influence on those who use the route—but I cannot refrain from expressing surprise that the design should have adopted Port Saïd, and avoided the use of Alexandria as the European outlet.

One would imagine that the advantages of debouching at the back of Alexandria harbour would have been so apparent, that the whole surveys and arrangements would have accepted this condition as a base.

Can French influence have caused this diversion, in the expectation that their desire to obtain sovereign rights over this great water-way between Europe and India would have passed unchallenged, if the territory they desired to acquire did not enclose the port of Egypt, or can the existence of any great engineering difficulty have led to the decision?

One can hardly imagine this in a desert and flat country such as Egypt. But, whatever the cause, there can be no doubt of the disadvantages of Port Saïd as compared with Alexandria. There is now to be encountered the doubt and difficulty, and the enormous expense that continual operations on the harbour of Port Saïd must entail; and, looking to the fact that nature has, from a time beyond the record of history, choked the present harbour of Saïd with the delta of the Nile, and will doubtless continue to offer the same obstacles to its being kept open, and tax the ingenuity and the resources of the engineers and proprietors to prevent this result, a great anxiety, to say the least, might have been avoided.

Again, vessels on their journey eastward would have been saved 120 miles of sea voyage—some twelve hours' steaming—for they are not in any degree further on their route when entering Port Said than they are at Alexandria, which is this distance short of it. As regards the carriage of passengers, and mails especially, this will exercise a most damaging influence, and may even result in maintaining the change of vessel at either end of the canal, and continuing the overland route as at present, to avoid the increased delay that must of necessity otherwise take place from the slower passage than hitherto through Egypt by the canal, being now greatly aggravated by the additional 120 miles of sea voyage, resulting, as it would, in a delay of twelve hours in the delivery of letters by every Indian mail.

And again, in addition, in Alexandria they would have to deal with a well-known and magnificent harbour, even as it is at present, and which is capable of any extent of improvement, instead of having to encounter the discomforts and difficulties which nautical men say must, with certain winds and weather, invariably affect the safety and usefulness of Port Said.

I will not, however, enlarge on these matters, which, though most interesting, may perhaps scarcely be

considered as falling within the scope of the present paper.

THE CHANNEL PASSAGE.—VESSELS AND PIERS.

By Vice-Admiral Sir Edward Belcher, K.C.B.

The subject to which I am about to direct your attention is, principally, the proposal to connect England and France by continuous railway communication, the gap, that is the Channel interval, being bridged by steamers fitted to receive and convey the trains across, and deliver them on to the rails on the French shore. And it is inferred, from their great size and beam—fitted also with heavy sponsons and paddles—that they will not roll deeply, and consequently tend to prevent that misery to weak stomachs—sea-sickness.

Now, as regards the rolling motion, I am not satisfied by assertion, when diametrically opposed to personal experience, seeing that the worst rolling affecting vessels engaged on Channel service, caused by waves set in motion by the whole western space of the Atlantic Ocean, causing, as seamen term it, merely "the deep but easy roll," is not reckoned as due to a gale, for with sufficient wind a vessel is steadied by canvas. The serious rolling is due to an opposite cause, the absence of the gale, when that unaccountable ground swell which tumbles into the Bay of Biscay lift also at the limit of soundings in the English Channel, and rolls in successive waves home to the shores of France and England, even up to the Goodwin Sands.

To adduce an example of the inefficiency of beam to prevent heavy rolling, as 60 ft. in vessels ranging about 2,000 tons, in perfectly glassy calm, I may mention the following:—The Brest squadron anchored in 1812 in Cawsand Bay, before the breakwater was commenced. It consisted of various types. Thus the *Ville de Paris* and *Abercrombie*, French; *San Josef*, Spanish; *Norge*, Danish; *Queen*, *Conquestador*, and *Magnificent*, English; lower yards and topmasts struck, riding at single anchor. It had blown heavily from S.S.W., and terrific long-jawed rollers set in. These vessels rolled fearfully, and it was asserted that the *Queen* and *Magnificent* rolled "keel out."

I then belonged to the *Abercrombie*, and being an invalid, in the captain's cabin, was lashed in two chairs at one of the ports, commanding a complete view of several ships, and especially of the *Magnificent*. The foam certainly warranted the conclusion, as nothing but the "keel awash" could have produced it.

This point, however, is immaterial. It will be said the vessels of that period were short, and deep rolling natural; yet it was rather increased, as in the case of H.M.S. *Rodney*, when Sir W. Symonds, at a much later period, increased the beam, tonnage, and draught; and, in 1823, we have proof of what heavy gales and rolling seas effected on the breakwater at Plymouth Sound.

I have had some experience in crossing dangerous bars attended by heavy following rollers; still the roll at good speed on the ship was far from agreeable, indeed, I must admit dangerous. My object is merely to show that heavy, deep, and quick rolling is a Channel difficulty, and not to be lightly despised; and that, in considering the fitness of vessels for this peculiar service, we must not fancy that a stroke of the pen or a paragraph in print rules the waves. It is our business, as pretty well tried seamen, to state what is our opinion on such matters belonging to our "craft"—what is the proper character of vessel fit for such service as contemplated; and more, whether this railway system, carried afloat, is either practicable or judicious, specially, too, as regards reasonable expense; what should be the form, size, and speed for the contemplated service; and, finally, the probability of success by any of the types offered; or if a variation, dispensing with the train system, using the present or improved harbours, or improved ships, might not equally meet the present difficulties.

I must at once observe that my own opinion, as far as safety, comfort, and freedom from that jarring, creaking, and straining, which tophamper, projections, numerous joints, gimcrack ornaments, and fastenings is concerned, the beautiful drawings which have come before me, bring to my mind no idea of peaceful repose, but rather that idea of Pandemonium which the agonies of one of our old line-of-battle ships forcibly brought to my recollection. Now what do we require for an hour's travel across the Channel? A vessel to carry us safely, and not offering us enjoyments not to be enjoyed—a structure which shall be the type of strength, smooth as the back of a whale, offering the least possible obstruction to wind or wave, and carrying a light pilot tower on the summit; in fact, a type of our ugliest ironclad, the beauty *par excellence* of our present navy.

Our outline decided, the interior fittings, those of the simplest nature succeed. To passengers who fancy the whale's back, I would offer just such enlarged accommodation as the *Cigar* ship had (85 ft. long by 8 ft. wide), by a light hurricane house and rail enclosing the turret pilot tower, the type indeed of a felting around the funnel of H.M.S. *Carron*, for surveying duties in bad weather.

The velocity proposed by the advocates for these rail boats is 20 knots; that involves, under paddle or screw, no small amount of vibration; but sea-sickness is not the result of violent motion. It is, so to speak, barometrical, the action of the diaphragm (like the aneroid) rising and falling with the motion of the ship, and specially acting on the nerves when it is influenced by the sight.

For my own part, I plead guilty to being subject to sea-sickness, but varying with the size and quickness of motion, greatest in the ships of the line, less in a cutter. If carriages are to be embarked for the hour's passage, no individuals but those possessing sea-legs would care to quit their *pose* to enjoy the deck, or smoke their pipes under the lee of the pilot tower. All fittings but those absolutely demanded obstruct the free circulation of air, inducing faintness and sea-sickness, and consequently should be avoided.

It should be borne in mind that, when we propose to construct great ships to carry such great burdens as railways and their passenger and goods trains, we pass out of the range of depths afforded by the harbours now in use; and therefore if you construct vessels capable of carrying them, you are bound to meet the question of inability to enter at certain times of tide and under certain conditions of weather. It therefore follows that your vessel must not only be calculated to cross the Channel, but also, if necessity demands, be competent to take care of herself at sea, or to return your passengers, free from sea-sickness also, at a safe port. Now, looking to certain plans and models to which my attention has been drawn, I must remark that such absurd decorated craft, with all the paraphernalia copied from the boats engaged on the inland seas of the United States, are not fit types for our Channel service.

If the floating railway schemes are to prevail, I see no difficulty in meeting the demand for proper vessels, provided, as in our harbour defences, money is to be cast away freely in the construction of adequate harbours, and if those structures are adopted, I am prepared to meet ships as well as harbours of refuge, but I cannot shut my eyes to the risks and delay of stone piers. The disruption of the breakwater at Plymouth, January, 1823 (of which I hold in my hand a copy by Whidberg, addressed to Sir Isaac Coffin); solid cemented masonry of some ten years' settlement; and at a later date the works at Alderney, erroneously assigned to my proposals in 1842 (but absolutely void of truth, seeing that the scheme proposed by me was to be carried out at Ret harbour, on the opposite side of the island, by inland excavation similar to that since carried out at Cherbourg), all attest the difficulties to be surmounted, foundations in deep water and the surf to prevent or delay completion. But, before we proceed, as to the vessels fit to carry out

this railway conjunction, and, moreover, to be impelled at a standard velocity to agree with railway time, of twenty knots or more, have satisfactory computations been made, not as to chamber practice on paper, but as to all dangers and difficulties of that wild sea, not in a smooth dock, but (as sea-sickness is imported into the question) to the absolute security of life and property on so small a draught as 5½ ft.? The plan of Mr. Fowler, giving 13 ft., is nearer to reason. That would agree with my own dimensions of 400 ft. long by 60 beam, but nothing then to spare.

Before these rail-connecting vessels are built, it is incumbent to construct piers or harbours to receive them. And if those structures are to be carried out, we should execute them on the most economical yet certain plans, bearing in mind the probability of the very close supercession of their services by the tube tunnel or bridge of the future. At this present moment, I see too many difficulties to be mastered before success can be deemed, in either of the great plans, even to loom in the future. But having such perfect confidence in the rising talent of our engineers, I feel certain that eventually a more satisfactory mode will be triumphant, for that ugly term "impossibility" but whets the ardour of inventive faculty.

First, then, if the railway question prevails, we are prepared to provide a safe vessel fit to proceed, not merely across the Channel, but even beyond the narrow seas, should she be caught in one of our severe gales on a lee shore. On the other hand, if we are satisfied with the present harbours, with their present depth of water within, and determine to improve them at moderate outlay, then we are prepared with a vessel similar in all respects for the customary traffic at the less draught of 7 ft.

For extension of piers and adaptation of the same for the large boats we are also prepared.

And here I must observe that I underrate none of the schemes before the public, as simple computations. But, as a seaman, I am satisfied that grief would come to any one of those proposed vessels unfitted and incompetent to perform full sea-work if driven into the Atlantic.

Starting, then, on the principle that it behoves us, first, to utilise and improve what we have before we cast our riches on a foreign shore, to be depreciated at no distant period by other yet more expensive undertakings, I fall back on the class of vessels which I have to propose. And, I may add that, under any change of circumstances, the outlines, in relation to size and depth, will preserve their features, the form being that of an ovoidal box, smooth from end to end, the terminal points being open to receive railway carriages of 8 ft. in width.

The following dimensions show the three classes :—

No. 1	13 ft.
,, 2	10 ft.
,, 3	7 ft.

Channel Service Steamers.—Mail Railway Service.

13 ft. Draught.		10 Feet.	7 Feet.
Length	400 ft.	350 ft.	300 ft.
Draught	13 ft.	10 ft.	7 ft.
Beam	60 ft.	50 ft.	45 ft.
Displacement	4,000 tons	3,000 tons.	1,600 tons.
Indicated H.P.	8,000 tons	5,000 tons.	3,500 tons.
Speed	18 to 20 knots	20 knots.	20 knts.
Draught	13 ft.		
Keel to deck	23 ft.	With one line of rails to carry luggage - goods' wagons, but not passenger trains.	No rails.
Deck to promenade do....	13 ft.		
Saloon, height......	8 ft.		
Steering house above do .	7½ ft.		
Deck of saloon	200 ft. by 30		
Promenade do....	300 ft. by 60		
Could carry on rails	300 tons		

There is one feature in this arrangement which, whether the vessel carries sails or not, offers important comfort to ladies and invalids; and preserves intact the comfort of the carriage in which they embark. Thus, the side cabins are in such connexion with the doors of the carriages that they can be used for exercise or accommodation during this all-important hour of travel.

The rails occupy the centre line; the carriages are home to the side cabins, and are run in and out by switches leading into the main line.

Both ends are fitted with closing shutters like shop-fronts, and, being closed at pleasure, insure in fine weather thorough ventilation, and in bad keep out wind and sea.

The mode of propulsion to be given is that of the hydraulic, or turbine. It possesses the advantage of smooth sides and perfect protection from injury from external force, and is therefore better adapted to take the sides of any irregular dock or piles.

I have special objection to the paddle system; it has not the power of sudden turning in the trough of a sea.

Further, the divided shaft proposed incurs enormous danger, and subjects the machinery to disruption, and vessels and passengers to enormous concussions.

Thus, on an even keel, it is submitted that a vessel of 400 ft. rests on a series of waves. If, then, the trough between two waves denudes the lower float, the wheel will fly round and endanger the machinery.

Again, if the wind be abeam, or the vessel roll in the trough of a heavy swell, even in calm, the rolling of one paddle out of water would cause the engine to race, and with great danger to the destruction of the machinery.

As to the over-immersed paddle, it loses considerable propelling power, at the same time as that of its opposite is utterly lost, thus leaving less than half the propelling force on the ship, and causing consequent loss of speed.

This I have witnessed, and more—the power of steerage, under these circumstances, nearly annihilated.

On this specific point the hydraulic rejoices in her superiority to all other modes of propulsion; seeing that the orifice in the air performs equally or better than that immersed, and the whole force of the engines being exerted to one purpose, and uninfluenced by wind, weather, rolling, or any external causes, acts with uniform force and precision. In fact, like the perfect chronometer, it performs equably and perfectly, secure within its case, just what is demanded.

The paddle steamer in a gale is always unpleasant to handle; the moment speed ceases she wallows in a seaway, and the shocks of the paddle-boxes, alternately striking, are distressing even to those accustomed to sea life.

On the other hand, the hydraulic is but a simple vessel lying to or under small speed, and, but for the thrilling action when at full speed, few could imagine her propelled through the water. She is peculiarly adapted for the difficult work of turning easily in a seaway, when, indeed, it would prove dangerous to the paddle.

Leaving the question of train boats, and coming to the mere passenger boat—with carriages adapted for special objects, and, indeed, appertaining to the vessels—it is proposed to adapt them to rails, and to embark the passengers in them by the aid of machinery.

The difficulty—indeed danger—which has always struck me, has been that of embarking and disembarking —passing down slippery steps frequently in dark nights, and having a lively dancing vessel ready to capsize you the instant you feel you have lost your land and have not gained sea-legs. This difficulty it is proposed to overcome by hydraulic lifts and cranes—lifting the carriages and passengers, with all their comforts about them, over openings in the upper deck, and landing them on platforms fitted to receive them on elastic springs, then moved to positions in direct connection with state rooms, door of carriage to door of state room, as before alluded to. The disembarkation would be similarly carried out, and carriages and passengers taken to the railway station or hotel, accompanied by all simple movables —heavy luggage being confined to proper trucks.

Now, in this mere passenger vessel of the second class in our table, drawing but 7 ft., it is proposed indeed,

to attain the velocity demanded of 20 knots. But I much question, in attaining such speed, if you do not annihilate all idea of comfort or freedom from sickness. All will depend on the state of the weather. It is perfectly futile to expect comfort to those embarked, if the force engaged in the propulsion is sufficient to shake the vessel to pieces, or so damage the machinery as to endanger vessel and passengers.

Leaving, then, the vessels, and looking towards their safety and accommodation on either shore, we arrive at the important question of piers. In November, 1836, I drew up, for the Corporation of Preston, a plan for the embankment of the Ribble, by a dam carried across from the Douglas River to the Naze, a distance of three-quarters of a mile. Mr. Stephenson, the celebrated engineer, engaged on the Clyde navigation, met me by appointment at Preston. That plan, which he most warmly approved, involved the construction by prepared iron caissons, to be simultaneously placed and filled, between the interval of two consecutive tides, with concrete, for which design I hold the thanks of the mayor and corporation, all other engineering authorities being set aside.

I will not contest the point with those who follow my ideas at the present day. But further, in 1858, I again proposed to saddle and fortify the Goodwin Sands by a plan of a similar nature. After an evening meeting at the Institution of Civil Engineers, my friend the late Charles May, and several leading members, adjourned to the rooms of Mr. Brunel, and discussed my plans. This resulted in the verdict pronounced by Brunel, short and pithy: "There can be no doubt of the correctness of your views; get money, and it will be done; compute the contents at 20s. per cubic yard, working expenses the same; government to supply the funds; it can be effected." So with the moot question of these piers for the accommodation of these steamers. Construct them in iron securely braced, ground and fill them in, previously working in screw piles to receive them exactly, and no sea can displace them.

It is not, perhaps, generally known that, where iron forms part of the concrete and remains in contact with salt water for years, the iron becomes converted into a carburet, suffers no further decay, and becomes an incorporated crust-like glaze, similar to the surface of the old Dunes. All iron exposed for years on coral islands becomes attached to the coral block.

Finally, the important point to be considered is time and cost. It has been assumed that the work of forming harbours in masonry would demand at least three years. But I would inquire, looking to the number of days affording the term moderate, how many working days would be required? Then, as to the security from the work being demolished by any violent gale, and further the well-known fact that blocks under ten tons in weight cannot withstand much less wave impact than the exposed parts of our Channel shores,—by the process I propose, some thousand tons of matter would be securely placed within twenty-four hours—that is, at the first operation of placing, the weight of iron composing the caissons, and the admitted water would be immovable, like a ship aground, by any sea. Therefore we may safely assume one-third gain in time, allowing a year for construction.

As regards expense, we may safely assume the same proportion—indeed less, if we take into consideration the risk of annual destruction by gales, an effect which never could enter into the calculation of cost by the method I propose.

INTERNATIONAL COMMUNICATION BY RAILWAY STEAM SHIPS.

By John Scott Russell, F.R.S.

My communication is merely a very short supplement to the paper which I had the pleasure of reading at the last meeting. At the last meeting, I communicated to you that, about four or five years ago, I think in 1866, Mr. Fowler was the engineer for the harbour, and I was the naval architect for the ships of a company who proposed then to establish this communication by railway-train steam ships across the Channel. The circumstances of this company, and of railway affairs indeed in general at that time, led to the abandonment of the enterprise, that is to say, to its postponement, notwithstanding that the Parliamentary notices had been given and all the necessary proceedings taken. In the meanwhile, I communicated also in that paper the fact that I had had the fortunate opportunity of making an experiment likely to give us some information as to some of the practical points of difficulty in this system. I communicated to you then that I had just completed a steam-ship, whose dimensions were half of those which we proposed for the steam traffic between Calais and Dover. I was able to inform you then that that vessel had just started, and that it had done its duty. Now, that was all that I told you at the last meeting, and I thought that an experiment of a ship half the size, carrying half the quantity of train for twelve miles instead of twenty-four, a very good preliminary experiment. I am happy to inform you that my latest news from that ship is this—that from that day to this she has continued to traverse the distance with perfect regularity, and not the slightest accident has happened either to the ship or to the trains conveyed by her. I have also just received a photograph of the ship with the train on board, and I thought it might be interesting to you, while discussing the larger ship, to have before you the smaller one. I must say that I constructed this ship so as to be in every way a model for the larger ship, with one exception, that I could not get up model seas and model hurricanes for the occasion, and I had to take such seas and such hurricanes as the particular latitude in which the ship was plying afforded me. I am sorry to say that the waves of my little sea, which is only 100 miles long, and from 12 to 20 miles broad, are not at all such respectable seas as I have occasionally encountered between Calais and Dover, when I have made a passage of six hours between those ports. However, this ship proves the ease, practicability, and comfort with which the continual, regular, and daily shipment of trains may be carried on, and it proves the convenient enjoyment of a ship which is enormous for the small port she has to go into; and it proves, moreover, the extreme value of detached paddle wheels, with detached engines on the two sides, for performing those continuous and easy manœuvres that were thought to be impossible. That is all the conclusion I draw from this subject, and I say it proves the mechanical arrangement to be practicable, comfortable, and convenient. It does not prove at all the cause of the measure of oscillation of the ship proposed for the Channel in the actual great rolling waves of the Channel.

Gentlemen, I will now add to the information I formerly conveyed to you a little information which I have since received, and some views which I entertain in regard to the future of this question. In the first place, the great dominant difficulty is and has been the want of a good harbour on the other side. The great argument on this question has been that the harbour of Calais was impracticable. Hence we have had harbours proposed on the other side. Hence we have had boats proposed to go into shallow harbours, such as Calais has been. Now I am happy to be able to inform you that the question of the improvement of Calais harbour has been under careful consideration by the French engineers ever since the month of June last. I am happy to inform you that on this subject, after receiving the most thorough investigation and careful examination by the most eminent authorities in France, a conclusion has been arrived at which I am sure you will hear with pleasure. There remains no difficulty in providing at Calais a harbour with 20 ft. depth of water at low-water, and maintaining the same in perfectly good condition; and as we have now at Dover 36 ft. of water, and are to have at Calais, in less than two years, 20 ft. of water, it is quite plain that we

may now attack, as Sir Edward Belcher has attacked, the problem of having a good seaworthy ship, not one floating on the surface, but a good seaworthy ship with a respectable draught of water, and one which we may manage to give very respectable qualities to. That difficulty having disappeared, I am next asked, what is the use of sending the trains on board the ship? why cannot the passengers go on board the ship without the trains? Why put yourselves to the expense and trouble of making such enormous ships, merely to carry over the passengers without the trouble of walking on board? Very well. Now, this is very soon and very easily answered. We do not build big ships at all for any such object, or with any such aim. The dimensions of our ships are not of our choosing; they are made, like other pieces of business, according to the circumstances of the case. What do you want? You want speed. Can you get speed without length? No, that is impossible. Then what length must you have to get a ship to go that distance in something like an hour and ten minutes? You all know it must be 18, 19, or 20 knots per hour. What length do you want for that speed? You all know you want very nearly 400 ft. For our speed, we want nearly 400 ft. Then what beam must you have to make a decent ship 400 ft. long? Perhaps you will say 40 ft.—that is a tenth part—that is not too much beam. Very well, I accept your 40 ft.; 40 ft. of beam, then, and 400 ft. long, is necessary to make the fast and decent ship we want for speed alone and seaworthiness alone. Now, there is the ship built for me. I do not make the dimensions of the ship—I do not choose the dimensions of the ship. Now I have got this big ship. Such ships, not so large, but exquisitely beautiful ships, which I have always regarded as the pride of the naval architecture of England, have been built under the auspices and by the hands of some gentlemen whom I see here, for a similar passage, only a bigger one, namely, between Holyhead and Kingstown. Now there they do not take any trains, and yet they have got very big ships; not quite so big as I have said, but very big ships. Why did they make those very big ships, having nothing to do with the trains? Because they wanted speed, and they wanted seaworthiness. Why do not they take the trains? My friends think they have me there; there are big vessels, good vessels, and everything we desire, and they do not take the trains. No, they do not take the trains. Do you know why they do not take the trains? I don't think you do. I don't think anybody does. I did not until I looked into it, and then I could hardly believe it when I found it out, that the British nation—that the British legislature—had made such a beautiful blunder—may I say such an Irish joke—that if you took a train and locomotive engine to-morrow on your steam packet across to Ireland, there is not an Irish railway on which they could run, for they made the mistake in making the Irish railways not to fit the English trains, so that neither locomotive engine nor carriage, nor anything in England, taken over to the other side, could possibly go along an Irish railway. It is, therefore, of not the slightest use to send over a train to those railways, because they could not move a mile. I dare say I may be wrong as to one railway, because I think there was a dear old atmospheric railway which was on the national guage, but I am not quite sure. All I know is, that the standard guage on the Irish railway is such that no English train can go upon it. It was obtained in a very curious manner. There was a discussion between wide guages and narrow guages, and a very wise engineer, whom I respect and love very dearly, was asked to find out the proper guage. So he said he thought the proper guage would be to add a narrow guage and a very broad one together, and divide by two, and it came to 6 ft. and some unknown number of inches, and that was the Irish guage. I think one was 6 ft. 2 in., and the other 6 ft. 8 in.

Mr. Oliver Byrne—Five feet four inches.

Mr. J. Scott Russell—It is the mean of some gauge. Allow me to tell you what I believe to be the enormous advantage of carrying trains over in ships. Not the saving the passengers from walking on board—not the saving of them going out on the other side, but the saving of poor bundles of merchandise from being taken out of a railway train, tumbled into a ship, hoisted out of the ship on the other side, repacked in waggons, and then sent forward after wonderful damage, wonderful delay, and no end of cost, to their destination. Of the enormous heavy traffic between England and the Continent, scarcely any passes over the ferry between Calais and Dover, though so many railways go down to both sides of the Channel; and the reason is the damage, delay, and expense of the whole transhipment between the two countries. There is the question. That is what renders it a most economical question, for it will cost less to carry over a ton of goods in those big, expensive boats than it will to perform the whole transhipment from the railway to the ship, and from the ship out to the railway station on the other side. That is the key to the whole question; and believe me, when the continent of England, and the mines of iron, and mines of coal, and manufactures of this country are put into such continuous connection with the whole countries of the Continent, that ten tons of goods placed on a waggon in any part of England or the English railways will not leave that waggon, or be disturbed till those ten tons of goods are delivered in Austria, or in Belgium, or in Germany, or in France—believe me, when that day comes, the amount of intercourse by railway between England and the Continent will be something of which at the present moment we have very little conception. Now, gentlemen, that is the great good to be achieved. It is quite true that the other is a good way, which we shall all value. We shall be delighted to get this convenient arrangement, we shall be delighted to take our place in the carriage, and not to be disturbed until the same carriage arrives with us at our destination on the Continent, because I do not imagine that the railway trains will stop short at Paris. I imagine that you will take your seat in a train in London, and that you will not be disturbed until you have arrived at whatever very large town you want to reach on the Continent.

Permit me now to say how I think the greatest convenience to passengers will be obtained. If my friend's and our views are ultimately carried into effect, we shall have what is called an American train for night passengers. An American train consists of two long ranges of cabins, like the cabins of a steamship. There are several saloon carriages also connected with it, in which you have conveniences and comforts of which we have never dreamt, in this country, in our trains. In these American trains this will happen. We expect that the time of our transport will be reduced, from Paris to London, to eight hours. We shall propose that a night train will leave London at ten o'clock in the evening; that at ten o'clock in the evening you will go to bed, that you will not be disturbed at Dover or at Calais, or till you get to Paris at six o'clock in the morning. At six o'clock in the morning, you will be awakened, before you get to Paris, in order that you may wash and dress, and make yourself extremely comfortable, and by the time you have done that the train will be in the Paris station, and you will walk out. That is our plan, and I believe that those who have the most experience in being sea-sick—I am sorry to say, not being subject to sea-sickness—I cannot give you any results from my own experience, but those who are liable to sea-sickness assure me that one of the best antidotes is to go to sleep on a kind of hollow circular bed, which does not let you feel the change of level, to keep your eyes shut, and to stay in bed till you get across. I believe that is considered to be one of the best antidotes, although I am sorry that I have never been ill enough to give you a decisive opinion on the subject. Permit me to add, also, that in the particular vessel which I have shown you there is no hydraulic machinery, there is no mechanism of any

kind employed to put the train on board. What happens is this. The locomotive never comes down with its train. In the last station it has been shunted to the other end of the train. It simply comes down with its train, and, without the slightest delay, runs the train on board. There is no stopping, no elevation, no depression.

Mr. Samuda—Is there no alteration with the rise and fall of the tide?

Mr. J. Scott Russell—Yes, there is 20 ft. rise and fall in the tide, and there is a very long, gentle inclined plane, which enables that difficulty to be surmounted. It simply then runs the train on board the ship, and on the other side the wagons arrive and are taken off, so that there is not even the delay of a second at either end. The moment the ship is at its place the wagons are attached, and at that moment away goes the train. Now, with regard to expense, I have one word to say. I have not yet mentioned to you that in the large ship, as I have already done in the little ship, I have two trains parallel to each other. You will allow me to say that each ship takes two trains of from sixteen or seventeen wagons each; and as to those two trains, I wish merely to state this to you, that the expense of carrying them across in these ships is not much greater than the expense of carrying so many miles of freight, according to the returns I have of the working of this ship of the larger build for the last twelve months. One word more, and I have done. I believe the only difficulty in reference to money is not the expense of the ships or of working them, but I believe the real point is this:—Dover harbour is the property of the government; Calais harbour is also the property of the French government. I believe if the two governments lay their heads together, and simply make their harbours accessible—as I have said to you, they now can be made at a very moderate expense indeed to the two governments—a great international communication can be easily established. Permit me to say one word in regard to the competition of railway train ships with the other plans proposed for the communications between Calais and Dover. All I have to say is said in one word. The advocates of the train steam ships are neither opponents of the tunnel under the earth, nor of the tunnel in the water, nor of the bridge in the air. They are perfectly satisfied to put the public into possession at once, within less than two years from this date, of this improved communication, and then to allow the other systems which may be adopted—say the tunnel system—to go on until they are completed. We believe it will take so much time and so much money to complete any of these other systems, that we shall have done our work and created the traffic before the others are ready to take it from us; and the day they are ready to take it from us we shall be delighted to resign it, and that is the whole thing.

Mr. Samuda said that no one could attach more importance than himself to the subject of Mr. Scott Russell's paper. The question of channel communication between England and France was a most interesting one, and he had no doubt that some effective system would soon be introduced. But he did not quite agree with Mr. Scott Russell as to the undeniable advantages of carrying the train over, as had been suggested. He was not at all certain that there were not some positive disadvantages connected with such a system. The scheme of Mr. Fowler, a most matured and well-considered scheme, involved the enormous expense of hydraulic machinery for the purpose of lowering and raising the platform, which became necessary to provide for the rise and fall of the tide. Mr. Scott Russell lightly disposed of that, by merely saying that he would let you go down an inclined plane. If such important subjects as channel communication were brought before the institution, they should be fully explained, and the members should not be left to their own imagination as to the manner in which difficulties were to be overcome. He thought Mr. Scott Russell's suggestions were deserving of great weight, but that a little more detail would have been very desirable.

Mr. C. H. Wigram said that he had, for some years, been acquainted with the practical working of the railways in Hamburg, in connection with the Elbe. There was a long incline, and the trains were run in in that way.

Mr. H. I. Liggins said that the same thing was done at Burnt Island.

Mr. Grantham stated that, in his opinion, great difficulty would be experienced from the motion of the vessel, and that much inconvenience would arise in getting the trains on board. He would not go into any discussion as to the best ships for the purpose, but thought that if proper facilities were given at Dover and Calais, with properly covered ships for the trains to enter, properly lighted, and with elevated paddle-boxes and suitable platforms, staging might be erected so convenient that people might step out of one into the other, and no greater time than five minutes would be occupied in the transhipment. He did not think that any time would be saved between Dover and Calais by transhipping the trains by the cumbrous machinery which would be requisite for that purpose, and in bad weather it would be impracticable.

Mr. Oliver Byrne said that great injury would arise to the springs of the locomotives and carriages from the rolling of a vessel at sea. The thing was done in America, in smooth water, and he supposed that that had suggested the idea that the same thing could be done in the Channel and open sea.

Mr. E. J. Reed stated that he had seen the Holyhead packets arrive alongside the pier at Holyhead many times, but had never observed any such motion in them, when alongside, as would prevent the reception of a railway train. It was really beautiful to watch the way in which the boats were brought alongside the pier, and the perfect rest at which they remained whilst there. He thought it desirable, if it could possibly be done, that the train should be taken on board, as so vast a quantity of goods was packed in a train as rendered it highly inconvenient to remove them before arriving at their destination. He believed that there were no such impediments existing as would preclude the plan which had been suggested from being carried into effect.

Mr. Ravenhill said he had no doubt that all that had been suggested by Mr. Scott Russell could be accomplished, but the question was, at what cost, and whether there would be any adequate return for the first outlay? The question was one which should be looked at not only scientifically but commercially.

The Chairman, in proposing the thanks of the Institution to Admiral Belcher and Mr. Scott Russell, said, from what he had heard, he did not think that the practical difficulties would be so great with regard to naval architects being able to construct a good ship to go over the water, as they would be with regard to the engineers being able to furnish the means of getting into that ship. However, that would be a subject to be discussed at a future time, and it was one well worthy the attention of the Institution.

Thursday, April 7th, at the Society of Arts.

ON THE LOAD DRAUGHT OF MERCHANT VESSELS.

By W. W. Rundell,

Secretary to the Liverpool Underwriters' Association, and Underwriters' Registry for Iron Vessels.

The discussions which so constantly recur upon the load-draught of merchant vessels, apparently issue only in the making of recommendations which shipowners decline to follow, and which underwriters and philan-

thropists are unable to enforce. This result no doubt deters some competent persons from writing on the subject, but perhaps the chief reason why those who are directly concerned have so little to say is, on the part of the experts, because they find it difficult to state concisely and intelligently all the considerations upon which their judgment is formed; and on the part of the shipowner, because he naturally dislikes interference with his business, and declines to take the public into his confidence. Perhaps he is also conscious that his ideas as to the proper load-draught of his vessel might vary under the following conditions—(1) when loading the vessel himself, freights being high, and shippers pressing him with desirable cargo; (2) when his ship is chartered for a lump sum, and he is anxious that she should make a rapid passage.

The proper draught for a merchant vessel is not a question to be determined in the first place by science, but by experience. Nor, so the experts inform us, is it a fixed quantity for the same vessel. It varies with the seasons, with the nature of the voyage, the kind of cargo, and many other circumstances. Science may lend her aid in defining and generalising the results of experience, but must unhesitatingly accept the dicta of those whose position and long practice make them the real arbiters of the question. The naval architect and shipbuilder must bow, like others, to the decision of those experts. This is shown in cases like the following:—There is an order for a ship to be built to carry, say 1,500 tons dead weight. There is much competition, and, to keep the estimate low, the builder bases his calculations on a free side of $2\frac{1}{2}$ inches to each foot depth of hold. The shipowner is not satisfied with this; he requires $3\frac{1}{2}$ in. to the foot, and at once adduces evidence in proof of this scale being required by those who will have to superintend the loading of the ship, and those who will have to ensure her when loaded. Differences like these—and most of us are aware of such differences—show that load-draught cannot be arbitrarily fixed by the naval architect.

Lloyd's rule, as it is termed, of "3 in. to the foot depth of hold," or the "scale of the Liverpool Underwriters," may be quoted, but these bind no one. What is termed "Lloyd's rule" was a suggestion only; it was made when iron ships were only being talked of, and when few ships except East Indiamen exceeded 700 or 800 tons, and it has never been recognised by Lloyd's committee, except as an approximate guide for the loading of certain classes of vessels. The "Liverpool scale," although it gives certain heights of free board for certain specified depths of hold, distinctly states that it is "intended for first-class vessels only, and is subject in all cases to the judgment of the surveyor. In forming his judgment, the surveyor is influenced by the age and class of the vessel, her form (rise of floor, amount of shear, general proportions, closed-in spaces on deck, as poop, spar-deck, &c.) the intended voyage, tho season, nature of the cargo, and such other circumstances, favourable or otherwise, as may come under his notice.

We find, at a very early stage, that the experts who practically rule in this matter are certain surveyors, more or less intimately connected with underwriting bodies, and who, if not directly appointed by shipowners, have secured confidence by having first obtained an honourable name in their service. These surveyors, by long experience and special training, qualify themselves to give an authoritative opinion on this much-debated subject.

Surveyors appear to have been appointed in Liverpool very early in the present century, but I have been able to gather very little more than their names, until after 1825. In 1826, Captain William Alexander was appointed, and, though now at a very advanced age, he still holds the office of chief surveyor under the Mersey Docks and Harbour Board. For some years there appears to have been no usage of measuring a ship's side, as he states that his custom was to judge, by simply inspecting a vessel as she lay in the dock, whether she was too deeply or sufficiently laden. As the business of the port increased, other surveyors were appointed. About fifteen years since, when I became acquainted with the Liverpool staff, there were five surveyors, and their duties were as follows:—Every ship from a long voyage, before commencing to discharge cargo, was visited by a surveyor, to examine and certify whether her hatches were properly secured. He thus had the opportunity of noting how deeply she was laden, and of hearing from the captain or officer in charge something of the incidents of the voyage. His next duty was to watch discharge of cargo, to observe if damage had occurred, and to inquire into its cause; thus stowage of different cargoes, and the ability of the ship to carry them in various kinds of weather were brought to his notice, the log-book being always referred to as evidence on the last point. Next came the settlement of questions of dead freight, and whether, in the opinion of the surveyors, the ship had as much cargo as she ought to carry. It will be seen that an occupation of this kind, in which, at the time I refer to, from 1,500 to 2,000 vessels were annually inspected after voyages from all parts of the world, and in all seasons, would give these surveyors a very large experience, and enable them to judge very closely as to the draught of water at which a ship began to damage her cargo, or to become otherwise unsafe. Although other master mariners would sometimes be called upon to join in a survey, the surveyors appointed by the Underwriters' Association usually had to decide disputes. Where there are several surveyors, some uniformity of action becomes necessary, varying opinions are discussed, and a common understanding is at length come to as regards loading and other topics. In this way was gradually established the following scale:—

Load Draught for First-class Vessels.

Depth of hold. Feet.	Dry side to each foot depth of hold. Inches.
10 to 12	$2\frac{1}{4}$
12 „ 14	$2\frac{1}{2}$
14 „ 17	$2\frac{3}{4}$
17 „ 20	3
20 „ 22	$3\frac{1}{4}$
22 „ 24	$3\frac{1}{2}$
24 „ 26	$3\frac{3}{4}$ to 4

This, it will be observed, is a sliding scale, and closer examination will show that the allowance for free board regularly increases at the rate of $\frac{1}{10}$ of an inch for each additional foot in the depth of the hold.

It must not be supposed that the framers of this scale knew that it could be so simply described, as, from personal communication with them, I am aware this was not the case. The large ships usually examined would, at a certain date, vary from 17 feet to 20 feet depth of hold. This period will probably correspond with some time between 1830 and 1840. Before 1834, the year in which *Lloyd's Register of Shipping* first appeared, there was a register published in London, which, like some of the present continental registers, gave the draughts to which the vessels should be loaded. As the dimensions of the ships are not given, it is now rather difficult to find what proportion of free side these draughts represent, but by tracing several of them through *Lloyd's Register*, up to tho time when their official dimensions were published, and then making an allowance for the thickness of keel floors, ceiling, &c., according to the tables of scantling of that day, I find that vessels between 16 ft. and 20 ft. depth of hold were allowed a free side or free board of rather more than 8 in. to tho foot. This confirms my supposition that, about this date, for what were then considered good proportioned and moderately large vessels the 3 in. scale was the basis for guiding the surveyors, and it was not long after this that Captain

Alexander's suggestion was brought, through the then Lloyd's agent in Liverpool, before the committee of Lloyd's for their consideration.*

Starting from this scale of 3 in., observation gradually fixed the other ratios for the larger and smaller vessels. That the scale, though thus arrived at, proves on analysis to be a regular one, must be taken as testimony to the close observation and general accuracy of the surveyors, and I would state their case thus:—By inspecting daily, for many years, a great number of vessels, under varying circumstances, it was discovered that vessels were comparatively safe when loaded according to this scale; that when laden more deeply they were liable to accidents; while if loaded to a certain depth beyond this, they were considered unseaworthy, from the mere fact of their being so deep in the water.

The experts, who were the authors of the Liverpool scale, though connected with the Underwriters' Association, were, in fact, the public surveyors for the port, and were acknowledged to be so when, on the 1st January, 1862, they were, under the powers of tho Mersey Docks and Harbour Board Act of 1861, transferred to that body. For some years I had been in daily communication with the transferred staff; and on the appointment of a new staff of underwriters' surveyors, the new staff was placed under my superintendence, and have remained so ever since. In this matter I, therefore, speak to a very great extent from my own knowledge.

The duties of the surveyors who were transferred to the dock board chiefly related to inward cargoes and their stowage; those of the new staff of surveyors were confined very much to outward cargoes and outward-bound vessels. It will be remembered that, at the time of which we now speak, there was a very great demand for iron vessels, and that the new vessels were of large size, and frequently employed in carrying heavy cargoes of machinery to the East Indies. These required special attention from the surveyors, who ultimately became convinced that these ships might, with safety, be allowed to load rather deeper than large wooden ships of the same size. The old scale for wooden vessels was re-examined and re-discussed, and was again confirmed; and a modification of this scale, as better representing the proper draught for iron ships, was adopted, after consulting the leading surveyors of some other ports.

These scales, though binding only on those persons who consent to bound by them, either because they are convinced of their correctness, or to meet the wishes of their underwriters, must, I think, be accepted as the result of a very large and a very matured experience; and I propose now to make them, so far as they relate to iron vessels, the basis of an inquiry as to whether what these experts consider a proper free side can approximately be represented by any fixed proportion of a ship's total capacity.

Wooden vessels are fast passing away, and iron sailing ships are being superseded to a large extent by steamers. Iron sailing-vessels will, in future, be chiefly employed on long voyages, and new ones will probably be of large size. As regards iron vessels, therefore, considerations depending on their age, nature of the voyage, and season of the year, as affecting their load-draught, may be omitted nearly altogether. Considerations arising from the kind of cargo to be carried may also be omitted, as it is now generally acknowledged that, with proper care, and by incurring the expense necessary for making good stowage, any proportion of dead weight may be safely carried. There remain only those conditions which relate to form and proportion, and these, I submit, are sufficiently represented by adopting the Customs measurements and registered tonnage.

* As suggestive of the size of the merchant ships of only forty years ago, I may state that Lloyd's rules, in 1834, gave no scantling for 500 tons, though it prescribed outfit up to 620 tons. At this time there were two or three vessels belonging to the East India Company between 1,400 tons and 1,500 tons. Twenty-five years earlier, there were belonging to this company 24 vessels of 1,200 tons, and one of 1,242 tons. The load-draught of these vessels was, however, no guide for that of ordinary merchantmen, though no doubt they accustomed master mariners to the sight of a very liberal amount of free side.

For comparison, I proceed to group together vessels of about the same registered tonnage, but differing as much as possible in other particulars, and I commence by examining how far $\frac{3}{10}$ths of the whole displacement of an iron vessel under the upper deck fairly represents the proportion of the vessel which should remain above water when she is laden according to the scale proposed by the surveyors. The suggestion that $\frac{3}{10}$ths of the whole displacement was a proper proportion for "buoyancy" was made, some years since, by Mr. John Jordan, formerly the chief surveyor to the Underwriters' Registry for Iron Vessels.

For this comparison, sharp vessels, or vessels with considerable rise of floor must be allowed to be properly laden when showing rather less side than the scale permits, and *vice versâ*, for very full ships, see sections C and D, Fig. 5, when the *Richard Cobden*, a vessel with very great rise of floor, is compared with a full-bodied ship of the same breadth and depth.

In the tables which are now submitted to your criticism, the particulars of sixty sailing vessels are given in groups of ten each, arranged in order of tonnage, and ranging from about 500 to 2,000 tons register, and from 1,600 to 7,000 tons total displacement under upper deck. These have been selected from several hundred vessels, as best suited for the comparison. Copies of the *Customs' Register* have in all cases been consulted. The vessels differ about as widely from each other in their several proportions as obtains in modern practice.

The tables also include similar particulars for seventeen screw steamers and four paddle boats. These are arranged in the order of their length.

Columns *a*, *b*, *c*, *d*, *e*, in the tables give the Customs' measurements and tonnages, and form the data for the remaining columns of the table. The letters of the alphabet are used to distinguish the columns, and the same letters are employed in the formulæ which follow, to indicate the quantities in the columns over which they severally stand.

Column *f* represents the approximate displacement of the vessel, calculated as equal to the register tonnage under the upper deck $\times \frac{100}{35} +$ half the registered tonnage under deck, taken as tons of 20 cwt., which will be found to represent very closely the displacement required.

The next column (g) shows for each vessel the average number of tons in each foot of depth of that part of the vessel which is usually above water. g is taken as $= \frac{a \times b \times \cdot 8}{35}$.

Column h shows the allowance made for shear of the vessel, and varies with the length of the ship according to the following scale. It is formed by taking $\frac{1}{6}$th of the average amount of shear at stem and stern:—

Allowance.		Allowance.			Allowance.		
Length of ship.	Sailing vessels	Length of ship.	Sailing vessels.	Steamers.	Length of ship.	Sailing vessels.	Steamers.
ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
140	·65	190	·90	·60	260	1·15	·70
150	·70	200	·95	·60	280	1·20	·75
160	·75	215	1·00	·65	310	1·25	·80
170	·80	230	1·05	·65	350	—	·90
180	·85	245	1·10	·70	400	—	1·00

Column i shows three-tenths of the total displacement under deck, divided by the average number of tons in each foot of depth of the part of the vessel which is above water, less the allowance for shear $= \frac{\cdot 3f}{g} - h$.

Column k shows the Liverpool scale of free side.

Column l the scale of $\frac{1}{4}$ depth of hold, usually termed Lloyd's scale.

Column m shows the free side recommended by the special committee of the Institution of Naval Architects, and as the vessels in the table are all nearly equal to or exceed the proportion of six breadths to length, the scale for freeboard will be equal to length minus breadth, divided by $32 = \frac{a-b}{32}$.

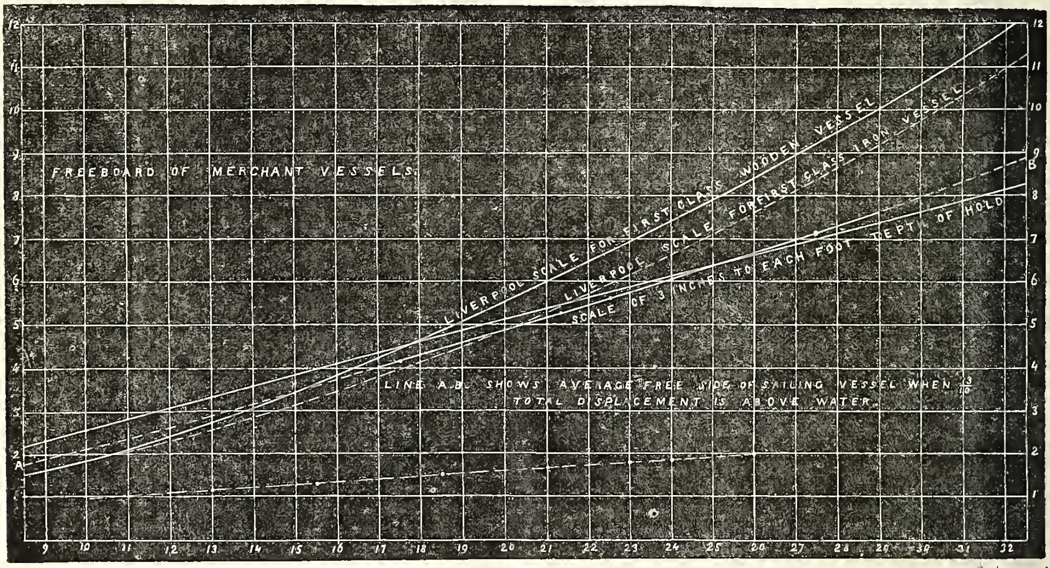
Column n shows the free side of each vessel when her registered tonnage and a half are on board, the weight of the vessel being taken as equal to 14 cwt. per registered ton $= \frac{f - 2 \cdot 2e}{g} - h$.

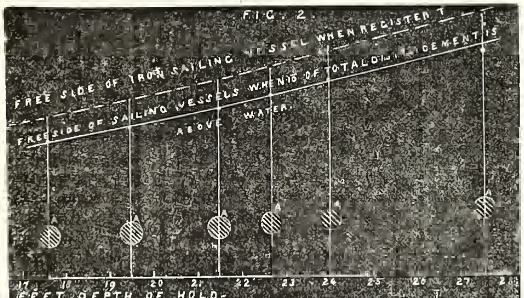
Column o represents the depth of side from the level of the decks which corresponds to the position of the horizontal plane which would separate the upper $\frac{1}{4}$ of a vessel's registered tonnage from the $\frac{3}{4}$ below, when the vessel is upright. The object of this will be explained presently.

Against each of the entries in the last five columns I have placed the difference between it and column i, for the more easy comparison of the several scales and measurements. The average and greatest difference in each group in these columns is also given.

As affording a compendious representation of the different scales, &c., attention is requested to diagrams Fig. 1, Fig. 2, and Fig. 3. In diagram Fig. 4 is shown sections of two vessels, A and B (Nos. 41 and 43) of about the same tonnage, but differing widely in proportion. Below these are the diagrams, C, D, of the *Richard Cobden*, and the full vessel which has already been referred to.

As it would be useless to include column m in a





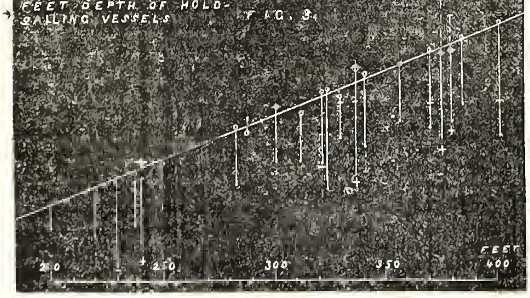
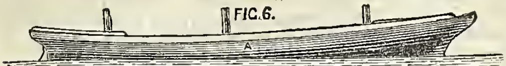
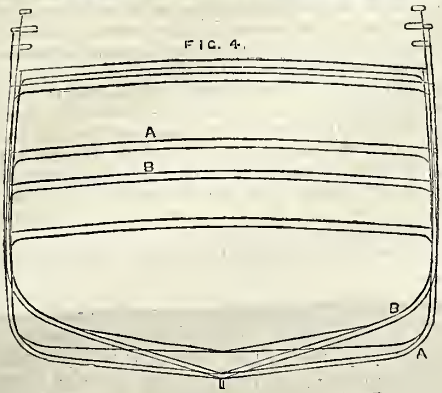


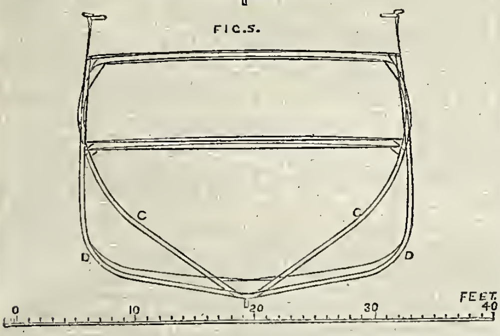
diagram arranged according to depth of hold, the particulars of this column are presented in diagram Fig. 3, together with the chief points of difference between it and column i.

The chief feature of diagram Fig. 1 is, I think, the original scale proposed by Captain Alexander and his staff as suitable for wooden vessels, ranging between 10 and 26 ft. depth of hold. Accepting this as the result of their long experience, we are at liberty to inquire why the scale of wooden vessels should vary so much, and more especially, why large wooden ships should be required to show an amount of freeboard which appears excessive when compared with that which is required in ships of 700 to 1,000 tons burthen. The reply of the experts to this inquiry will be something like the following:—

We find that large wooden ships are unable to carry, without straining, the same proportion of weight which the smaller vessels carry; that a large wooden ship is originally weaker than a small one, and that she soon falls off from her class even when heavy expenses are incurred to keep her in good condition; further, we do not consider the demand for free board excessive, because we find in practice that it is quite necessary. This reply is not only the reply received to this inquiry from the Liverpool surveyors, but also from those on the Clyde, the surveyors to Veritas, and others. Then as regards the smaller wooden vessels, it is stated that their scant-







lings are large in proportion to their size, that they are also proportionally stronger, and that, in consequence, their internal measurement (in other words, their registered tonnage) is so small in proportion to their displacement that, unless they were allowed to load below the 3 in. scale, they would not carry a satisfactory amount of cargo; that it has always been customary to load small vessels more deeply than large ones, with other more or less relevant explanations. Now these reasons, however applicable they may be to wooden vessels, certainly do not apply to iron ships. Large iron ships can be as strongly built as small ones; the shell and framework of large and of small iron vessels are so nearly in proportion to their registered tonnage that a per-centage of this tonnage is a tolerably correct way of approximately estimating their weight.

Again, referring to diagram Fig. 1, and noticing the reduction which the surveyors have already recommended in the amount of free side for very large iron vessels, we begin to doubt whether their experience, to which we implicitly bow as regards wooden ships, may not be somewhat immature as respects large iron vessels, and more especially the very large ones, of which there have been so few until within the last ten years. This doubt is confirmed when, on again turning to the diagrams and tables, we find that a certain constant proportion, say $\frac{3}{10}$ths of the whole displacement of the vessel, while it corresponds very closely with the scale of 3 in. to the foot for vessels from 21 to 24 ft. depth of hold, only indicates a very small addition to a reduction from this scale for the larger or smaller vessels. We are further influenced in favour of the scale of $\frac{3}{10}$ths for emersion or "buoyancy," when we find that it allows even a heavily built iron ship to carry her registered tonnage and a half. Inspection of the tables will show that the difference between columns *i* and *n* will allow the weight of the vessel to be taken at 16 cwt. to the registered ton instead of 14 cwt., the proportion adopted in the tables.

As registered tonnage and registered dimensions are the bases of what may be called the $\frac{3}{10}$ths displacement scale, and as, while it accords very closely with the 3-in. scale, or scale of $\frac{1}{4}$ depth of hold, it takes exact account of what ordinary scales leave to the individual judgment of the surveyor, there can be little objection, I think, to its being taken as a proper scale for ascertaining when sufficient cargo has been placed on board a vessel; but there are two points in respect to it which demand further remark. In the first place, it makes no extra allowance for extreme length of vessel, as compared either with her other dimensions or in proportion to the length and character of the waves she may encounter when at sea. The surveyors state that extreme length in proportion to a vessel's other dimensions must be considered, but, so far as I am aware, they have not yet defined to what extent. The special committee of this institution, which some time ago reported on freeboard in connection with other topics affecting the seaworthiness of steamships, appear to have been so much impressed with the importance of taking length into account, that they have sacrificed to it all consideration of relative depth of the vessel. Like the surveyors, I have not yet come to any definite opinion on this subject, and wait for better instructions.

The second point is this, that, like other scales which point out, with more or less exactness, what is the proper load-draught for a vessel, they leave us in ignorance as to what amount of departure from it will render a vessel relatively unsafe or practically unseaworthy. It certainly helps to get rid of what has hitherto been subject to the personal bias of the surveyor, by relieving him very much from consideration of fineness of form, general proportions, &c., which now require his attention, but it still leaves to him the responsibility of saying how much should be taken out of an overladen ship before he can state that, in his opinion, she is safe for the voyage. Cases like the following are not unfrequent:—A surveyor is called upon to inspect the loading of a vessel. He finds that she has been put 12-in. deeper in the water than the scale proportion, and he informs the master that his vessel is not only very fully, but, in his opinion, too deeply laden. The captain, in turn, assures the surveyor that she has previously carried a larger cargo; he states that his vessel is very fine below water, where the surveyor cannot inspect her, and that she should have an allowance of at least 4-in. on this account; next, he insists that the ship has more than the usual shear and great camber in the deck, these demand a concession of at least 4-in. more; and then comes the clenching inquiry as to the remaining 4-in., which complete the foot. Do you mean to assert, he will say, that the few inches of difference which remain between us will make my ship unseaworthy? These are the kind of discussions, not to say contentions, which constantly take place along our dock sides. Occasionally, the captain is compelled to discharge cargo. Only those who are immediately concerned can be aware of all the unpleasantness which sometimes arises from such an operation, and the compromises and negociations which it may entail. Bills of lading may have been signed for goods which yet remain on the quay; special and urgent consignments may have to be divided, or part taken and part shut out, and the goods of no particular moment may be too deep in the ship to be got at; a rival ship may, through this mishap, get twelve hours' start on the voyage. In all this the appeal is not to what is absolutely right or wrong, legal or illegal, it is solely a matter of contract. The captain, or owner, or charterer is under no obligation of which he was not fully aware, and which he has freely consented to; he has agreed to load his ship to the satisfaction of certain recognised surveyors, and has, unwittingly or otherwise, continued to put cargo on board after being cautioned that he has already exceeded the specified limits. Here there is supposed to be no

question as to the quality of the ship, but only as to the proper quantity of cargo. It may be that a compromise has been made, and tho principals have agreed to lighten the vessel 6 in. It then sometimes happens that when the ship has been lightened, say, to the extent of $4\frac{1}{2}$ in., an appeal is made to the surveyor as to whether he really means to insist on the remaining $1\frac{1}{2}$ in. Incidents like these will occur, even if the proper load-draught be fixed by Act of Parliament; and if they happen in places like London and Liverpool, where there are acknowledged experts to refer to, what may we not expect at some of the smaller ports, where questions of loading arise under the new Merchant Shipping Code—cases in which a Board of Trade surveyor, or the nominee of some local court, will be called upon to decide such knotty points, and where, instead of a first-class iron ship, the vessel in question may perhaps be a wooden one, just going off her class, or perhaps without any registered character at all. I confess that I am somewhat curious to see the instructions which are to govern the practice of the Board of Trade surveyors in these and similar cases.

Although the point at which a vessel becomes too deeply or dangerously laden must perhaps always remain a matter of opinion only, something may be done to indicate when a good iron vessel is fairly laden. For example, if the scale of $\frac{3}{10}$ths of the total displacement be accepted as an approximate guide, the following plan may be worthy of consideration:—

Let a round spot, 9 in. in diameter, be conspicuously painted on every vessel over 300 tons register, on each side amidships, at the points through which a horizontal plane would pass, which would cut off the upper quarter of the vessel's registered tonnage when she is on an even beam. This would be useful in indicating pretty accurately when three-tenths of the whole vessel are out of the water, by observing (see diagram Fig. 2) that in vessels of about 500 tons, this mark should be fully its own diameter above the level of the water. That in vessels of about 750 tons it would be one and a half times its own diameter above water. That in vessels of 1,000 to 1,500 tons it would be two diameters above water, and in larger ships two and a half diameters. Here no kind of instruments would be required to make the observation, and it could be estimated at a considerable distance. Thus, if the spot were very near the surface of the water, the ship would certainly be very fully laden, and if it touched the water she would be very deeply laden, and if it were immersed or out of sight, we should not be far wrong in supposing that the vessel was dangerously laden. The approximate position for this spot can be easily calculated by anyone conversant with shipbuilding, and the Customs' officers for the measurement of shipping could, without trouble, decide its exact position.

This proposed new imposition upon shipowners would not much increase the burden they now have to bear, under regulations for painting a ship's name in letters of a certain size and colour on a ship's stern, for indicating by figures of a certain size the draught of water at stem and stern, or for carrying side lights of a certain size and pattern. On the other hand, it would give the shipowner and others concerned information which would frequently be of service; and where a ship was fine under water, and long in proportion to her depth, it would check misrepresentation as to the extent of her loading. I do not think it would hurt the shipowner in any way, or much affect the appearance of his vessel, and perhaps, on consideration, he will find that the suggestion has certain advantages. At any rate, the proposed mark on the side would indicate a fact and not an opinion.

I now submit the suggestion, and the tables on which it is founded, to the consideration of the Institution of Naval Architects, and I shall be glad to find that they elicit some expression of your opinion.

These tables will appear at full length in the Transaction of the Institution.

THE FLEET OF THE FUTURE—FOR COMMERCE, FOR WAR.

By John Scott Russell, F.R.S.

Mr. Scott Russell, after a review of the last ten years the revolution in public opinion as to wooden ships, and the progress of railway and other communications, said—It is our business here to-day merely to see what effect all these things will have on us, on our brethren, on our duties, on our country, on our commerce and manufactures, and ships.

The nature and duties of our mercantile fleet will help us to decide the construction and armament of that fleet of men-of-war which will have, as its chief duty, to protect our merchant fleets, and to protect that commerce which feeds them.

It is necessary to examine the nature of the merchant fleets of the future. Nothing in the progress of commerce is more striking than the effect of railways on ships. Railways and ships help each other, and also harm each other. Railways tend to kill the smaller, slower classes of ships. They are hostile to sailing ships especially. Railways help to load ships expeditiously. Railways supply large cargoes punctually and quickly. They favour large ships—punctual ships—quick ships. Railways deprive small ships of cargoes. They do the trade of distribution inland without the help of coasting vessels. Railways have killed coasting sailing ships, and they inevitably run a severe race against coasting steamers. They take away their passengers, and inland they take away their customers. This effect will go on increasing. They will take the cream of local trade, and what remains will not be worth having. The future of commerce by ships lies not therefore in small ships and local trade; it lies in large ships, long voyages, commerce between continents. Modern commerce flows more and more every day into large centres; mercantile transactions become larger and larger. What is wanted has to be done at once, punctually—in bulk—out of hand. quick delivery is indispensable. We want a new merchant steam fleet. Its size must be proportioned to the length of its voyage, or the stages of that voyage; its power must be proportioned to the special nature of its work; its speed is a mere matter of finance.

The new round voyages of the future, through the Suez Canal, and, later on, through the canal of Panama, are as follows:—

		Miles.
England	Suez	3,000
England	Bombay	6,000
England	Calcutta	7,500
England	Hong Kong	10,000
Hong Kong......	Yokahama	1,500
Hong Kong......	San Francisco ..	6,000
Hong Kong......	Isthmus of Darien	8,500
Hong Kong......	England	12,500

The size of merchant cargo steamship for this kind of voyage is 3,000 tons, builders' tonnage. Such a ship may be 330 ft. long, 44 ft. beam, 22 ft. load draught of water. The speed of this class of ship should not be less, and need not be more, than 10 knots. It will be dangerous to have this class of vessel of less speed than 10 knots, because in narrow waters she may be unable to "hold her own," and so be driven on shore. It will be wise to have larger cylinders than usual, and to have productive and powerful boilers, so as to have a reserve of power in case of sudden need. But this precaution need not involve either waste of money, room, or fuel, for larger cylinders and stronger boilers will do their work cheaper, save fuel, and save fuel-room, and last much longer with less repairs than if smaller cylinders and stinted boilers are used for the same speed or nominal power. Reserve of power is therefore wise, safe, right, and, in the end, profitable. Ten knots with reserve power will be safe, and will enable fuel to be sparingly used in favourable weather.

Engines of 300 nominal horse power are the least

that should be used for the ship of 3,000 tons. To do their work surely they should possess every modern improvement, be made by the very best makers, and worked only by able, intelligent, educated, and experienced engineers under highly skilled steam captains. It is essential that their working arrangements admit of enormous exertion of power for a short time under sudden emergency, as well as of high degrees of economy in common use. I think three cylinders on one crank with high degrees of variable expansion the best engine for this use. The boilers should be able to stand high steam. If the engineers of the ship are skilled and trusty, surface condensers may be used; but they want mnch science, experience, and trustworthiness in those who make and use them.

Engines of 300 horse power, skilfully made and used, will do 10 knots in a 300 ton ship, on 1 ton of fuel. For 6,000 miles' voyage this requires 600 tons of fuel. The fuel for the round voyage to Bombay and back is, therefore, 1,200 tons for our 3,000 ton ship.

Our ship of 3,000 tons nominal may have stowage for 5,500 tons bulk, and carrying power for 3,500 tons dead weight over and above engines and ship's equipment and stores. The voyage out, with 1,200 tons of fuel for the round voyage, and a reserve of fuel, say 300 tons, leaves a carrying power of 2,000 tons dead weight out. But it leaves bulk for 4,000 tons of light freight, if that could be found outwards.

The return voyage is more profitable. It leaves carrying power for 2,600 tons dead weight, or 4,600 tons bulk, and it is just room not weight that is wanted for the home freight. Our 3,000 ton ship can, therefore, carry her 4,600 tons freight independently of fuel and machinery.

The question of profit and loss is settled partly by the size of ship and freights, partly by price of fuel. One ton of fuel to ten miles each hour, gives a price in England of 10s. per ton, or 20s. per ton, according as the fuel is taken in at a port which is close to coal mines or far away. It therefore becomes important for these new ships to take in their stores of fuel the last thing before leaving England at a coal port. Possibly Milford Haven may thus become the great coaling port for these voyages of the future. Our 3,000 ton ship leaving Liverpool will call at Milford Haven to fill up her fuel on her way out, and get it cheap and good.

If our ship on her way out take in 1,200 tons of fuel, and burn them, that is £600 at 10s. per ton, £900 at 15s. per ton. Fuel is, of course, not the whole cost of steam—good engineers, stores, repairs, new boilers, are elements of current cost. On the other hand are, the smaller crew to tonnage as compared to a sailing ship.

But the great element of saving to the steam ship is the saving of time. I think I am not mistaken in saying that a cargo steam ship, as against a sailing ship, if rightly proportioned and worked, will do four voyages for one in this new kind of trade. The shortened distance to India, if it be combined with the use of steam power for discharging and delivering, as well as for propelling, and the use of the electric telegraph in securing freights before arrival, and the use of railways in prompt and punctual delivery—all these things well organised are the elements of the profitable working of the fleet of the future.

When we consider that the freight of a steam cargo out, at £1 per ton, would give £2,000 for the voyage out, and 4,500 tons home, at £2, would be £9,000, or £11,000 on the round voyage, we get £11,000 for fuel consumed, or only 10 per cent of the freight. And as the voyage out and home occupy only, say, 60 days, it is plain that with expedition in loading and unloading, much work may be done in a year. Of course I know too well the insane competition which ruins the profits of shipowners. The figures I have given are not actual freights, which vary indefinitely; but with regularity in supply and demand, which punctual delivery will tend to produce, freights will become steady, certain, and, I trust, not insanely competitive.

The conclusion I draw from this examination is, that a well-proportioned, well-organised, well-worked steam trade from England to Bombay, through the Isthmus of Suez Canal, will pay at equal freights even better than sailing ships round the Cape. I therefore believe in a fleet of such ships, 3,000 tons and 300 horse power, as our fleet of the future for the cotton and coffee and other valuable and bulky products of India.

The future voyage to Calcutta is 7,500 miles out, and 15,000 miles out and home.

The fuel for this voyage is 750 tons out, or 1,500 tons out and home. With a reserve of 300 tons, that gives 1,800 tons out and home.

On the outward voyage there is left for freight 1,700 tons dead weight, 3,100 tons bulk. On the home voyage 2,300 dead weight, 3,700 tons bulk. The time of the voyage, 75 days out and home. To make this ship as profitable there must be higher freight.

The voyage to China, which is 10,000 miles out and 10,000 miles home, or 20,000 miles, would require 2,000 tons of fuel, leaving only, with a reserve, 1,200 tons weight out and 2,200 tons bulk, and on the return voyage 2,200 tons weight, and 3,200 bulk. This ship might still pay with good freights; if not, and freights go down by competition, larger ships must be built of 4,000 tons for the Calcutta voyage, and of 5,000 tons for the China voyage. I have no doubt that ships of this size will be necessary, and in ten years will be in use. It is quite in the power of a good naval constructor to construct good steamships of this size to navigate the Suez Canal.

It is my conviction that we shall require in the next ten years a new steam fleet for these voyages, of ships propelled by steam, able to do 10 knots; that the best size for the present is 3,000 tons, but that gradually we shall require 4,000 tons, and later on 5,000 tons; and this steam fleet will for most purposes supersede sailing ships; that these ships will work through the Suez Canal; that later, when the Isthmus of Darien is cut, we shall find the largest of these classes to be the smallest profitable size, and shall go on to larger. I beg also to add that the abundant working of coal in Labuan, Borneo, and other portions of the Eastern Archipelago, perhaps also in China and Japan, will exercise a formidable and favourable influence in the development and prosperity of our new fleet of the future.

The modern war fleet, built in the last ten years, has mainly been built for other purposes than that which I am about to consider. Ironclad ships of the line, protected throughout, are still wanted to batter down fortresses—to protect coasts, channels, harbours, and sea ports. Ironclad frigates and corvettes are still wanted to form Channel fleets and Mediterranean fleets, and encounter ships of their own sort with guns in turrets, or in partial batteries, or in both. But there is a new class of ships urgently required.

A new sort of war fleet is wanted, in addition to the old, for this new service round the world by the Suez Canal. It has to protect the modern merchant steam fleet of the future, their harbours and commerce. In the next war the first aim of the enemy will not be to destroy fortresses, but to destroy our merchant steam fleet and its commerce. The protection of that fleet requires wise forecast and prompt preparation.

If, then, it is the peculiar duty of our merchant fleet of the future to make long voyages through the Mediterranean, in the Indian Ocean, through the Indian Archipelago, in the Chinese Seas, and in the Pacific Ocean, it is plain the war cruise of our war fleets lies along the same waters. This war fleet must not only have higher speed, but must have longer endurance—coal for long voyages, and stores for long periods. The war ships must be larger, longer, and fleeter than the merchant fleet, yet they must not draw more water. Where one goes, the other must follow, or go before.

There should no longer be any doubt as to the true nature of the new naval weapon. It is no longer guns, turrets, or broadsides that end the fray. It is "the stem" that wins or sinks. Give her the stem, is the order of battle. Lay her alongside, is a manœuvre of the past. "Right athwartships," that is the new way to win. "Sink your enemy by running down," that is the work to be done. The instrument must be fitted to do it. That is why we want a new ship—a new fleet of ships.

Naval men have been quicker to find out this fact of the future than to acknowledge it. But after ascertaining the true opinions of the most eminent, accomplished, and experienced officers who are likely to command the fleets of the future, it is quite certain they mean to "give the stem."

It is better not to deceive ourselves or others on this point any longer, but at once set about building these ships for their work.

For the manœuvre of cutting down, high speed is the first requisite—you must out-speed your enemy. It is quite certain that ships built for this purpose must go 15, 16, or 17 knots in battle. I think our enemy will attain one of these speeds. The value of speed is manifold, choice of time, choice of position, choice of action or inaction: speed gives that. Collision merely is not battle. Giving the stem means more. It is collision the way you want it. His broadside with your stem. Speed at any price, that is the first point.

High speed and handiness should be one. The fast ship is easy to steer, and sure. In spite of length, I still think ships can be made much more handy than they are. I call the attention of this meeting to this point. I think much more is to be done than has been accomplished. It is the second quality in value.

For this section of our fleet, I place the value of armour only third in order. Some armour is indispensable. Engines, magazines, boilers, steering, commanding, all that wants armour. I venture to say that gun battery and gunners do not want armour, at least not in the degree hitherto attempted.

A battle—an engagement at sea—is quite a new phenomenon. Think of an engagement between two fleet ships of modern speed. They are two miles apart, and in four minutes one is stem on in the other, perhaps they strike, perhaps they miss. If they strike it is over. If they miss they are off full steam to come on again. That is a sea fight.

What is the value of guns in this case?—of one, or two, or four guns, as in a turret ship? I must say I do not think two or four guns likely to do much in a battle of four minutes. That is why I don't care to spend much armour in protecting few guns. I say, rather let us have many guns, not much protected if at all. Let them all be discharged in one broadside at the right moment, and they may win the battle by firing only once. If the first encounter fails, there may be time to fire them all once more, but that in any such engagement they will be wanted to fire often I cannot conceive.

It seems odd to talk of giving security to ships in such circumstances, nevertheless we must do our best. The one way I value of giving security to a war ship is as follows:—Let the whole structure of the ship consist nearly entirely of water-tight partitions. Let iron decks divide her everywhere, where possible, into between decks, say, 9 feet high. Let cross bulkheads divide the ship everywhere at convenient distances, suiting the internal stowage. Let the gun deck even be divided by partitions everywhere, forming real casemates round the guns, to prevent the explosion of shells from spreading. Let two longitudinal bulkheads divide the centre of the ship from the sides throughout, except where the ends being fine do not want it.

Then fill all the outer exposed and end compartments with coals and all other substances of convenient stowage belonging to the ship, and with proper and convenient iron doors of communication, also water-tight and air-tight, then you have a ship of war nearly unburnable, unshellable, unsinkable. Of course, her large middle body carries a sound casing of armour. That is the ship I should build for modern battle.

Summing up all these conditions of the warfare of the future, I find the war-ship of the future not very unlike the original design of the *Warrior*. The difference I should now make on that design would be more displacement and less draught of water. The same nominal but more effective power. Thicker armour, less extent of armour differently disposed; two screws, more numerous iron decks and transverse bulkheads, iron partitions for the guns, less masting. In other words, a faster, larger, stronger *Warrior*, with much heavier battery could now, with ten years' experience and knowledge, be constructed with all the good sea-going qualities of the old one, and with the requisites of modern sea tactics and modern gunnery added to it. We cannot see to this nor set about it too soon.

Mr. Lamport wished to remind Mr. Scott Russell that he had drawn the same picture in 1863, when he depicted in glowing terms the war-ship of the future. He then gave them the *Great Eastern*. It was to speed they must look, and not trust too much to armour to keep out balls from guns. It was impossible satisfactorily to depict the ship of the future. During the last ten years what had taken place? A ship of war was laid down, but, before she was completed, a different class of vessel was proposed, and so things had been going on. It was utterly impossible to depict the typical ship of the future.

Captain de Horsey hoped the day would never come when it would not be the duty of a man-of-war to protect merchant-ships, but protested against the idea of that being the first duty of a war-ship, or being the express purpose for which war ships were constructed. The express purpose for which a man-of-war was constructed was to fight the enemy's ships, and prevent the enemy's ships from crippling the commerce of the nation, and not to sail round the world in company with the merchant ships. He thought it would have been a satisfaction if Mr. Scott Russell had given more information about the interesting subject of the channel through the Isthmus of Darien. It seemed to be proposed to cut it through without any tunnels. He thought that that was hardly possible. There was great difficulty in getting inland. There was a chain of mountains stretching across, in which it would be exceedingly difficult to make either a cutting or a tunnel. Another difficulty was the hostility of the natives. It was almost impossible to travel safely across the Isthmus.

Vice-Admiral Belcher said that the ground in question had been surveyed by him in 1838. As far as the entrance from the western side was concerned, there was not sufficient water for a gig flowing into the river, and it was so infested with mosquitos that a ship of war was obliged literally to run away. Mr. Scott Russell had not put before the Institution any tangible proposition. They had no drawings, no proportions, and nothing to guide them about the vessels of the future, which, of course, were necessary before they could properly discuss the question.

Captain Selwyn thought the question of speed of infinitely greater importance than the question of guns or rams, for you could not fight with your guns and rams unless you catch your enemy.

Mr. Scott Russell said he must apologise for not having given the particulars and dimensions and all the explanations which he should have been so happy to have given had the rules of the Institution allowed him sufficient time to have done so. He had given the principal points, and stated the matter generally, but it was impossible to enter into all the details without far exceeding the limits of time allowed for these discussions.

ON CERTAIN THEOREMS RESPECTING THE GEOMETRY OF SHIPS.

By M. Emile Leclert,

Professor in the Ecole Impériale du Génie Maritime in Paris.
Translated by C. W. Merrifield.

I.

The frequent use in naval architecture of considering a floating body which heels over while retaining the same displacement, has led to the study of—

1. The surface which is the envelope of the planes which cut off displacements of a constant volume (V). This is called the surface of flotation, or more shortly, surface F.

2. The surface which is the locus of the centres of buoyancy, or centres of upward pressure, of these volumes of equal displacement, called surface of buoyancy, or more shortly, surface C.

The well-known memoir of M. Charles Dupin* has established the remarkable geometrical properties of two kinds of surfaces.

In particular, for a vessel floating upright, the radii of curvature r and R of the surface C—that is to say, the metacentric heights corresponding severally to an infinitesimal, transversal, or longitudinal inclination—have for their algebraical expressions :

$$r = \frac{i}{V} = \frac{2}{3}\frac{\int y^3\,d\,x}{V},\ R = \frac{I}{V} \quad . \quad . \quad (1,)$$

where i and I express the principal moments of inertia of the water section, and y the ordinates of the perimeter of this water section taken perpendicularly to the middle line plane. With regard to the surface F, M. Charles Dupin's investigation gives, as the expression for the transverse radius of curvature :

$$r_1 = \frac{\int y^3 \tan.\ \alpha\, d\, s}{\Omega} \quad . \quad . \quad . \quad . \quad (2,)$$

where $d\ s$ indicates an infinitesimal element of the perimeter of the water section, α the angle of the inclination of the side of the ship to the vertical direction, and Ω the area of the water section. The longitudinal radius of curvature R_1 is expressed by an analogous formula.

The formulæ (1) are easily calculated, and it is usual to compute them for all designs of ships for various values of V, but this is not done for formula (2). Nevertheless, a knowledge of the value of r_1, whether it be regarded as serving to determine the surface F, or whether it be considered as giving for small transverse inclinations a sufficient idea of this surface ; and again, the knowledge of the value of R_1, with a view to questions relating to difference of trim, appear to be of more than merely theoretical interest to the naval architect. New expressions for the radii of curvature r_1 and R_2, capable of being easily calculated, may therefore prove useful in the preparation and consideration of designs for ships.

I shall in the first place establish my formulæ as consequences of the formula (2), and I shall afterwards give an independent demonstration of them.

II.

Consider (Fig. 1) a floating body in its upright position. Let us take as known quantities Ω, V and i for a water section F L, defined in position by its distance z from a parallel plane taken as origin. We have :

$$d\,V = \Omega\, d\, z$$

Let the floating body be cut by a plane $\phi\ \lambda$ parallel to F L, and separated from it by a distance $\Delta\ z$ which we shall by-and-bye make infinitesimal. Let the volumes thus cut off from the floating body be called $V + \Delta\ V$, and the moment of inertia $\phi\ \lambda$ about a longitudinal axis be called $i + \Delta\ i$.

* "Memoir on the Stability of Floating Bodies," read before the Académie des Sciences, the 10th January, 1814.

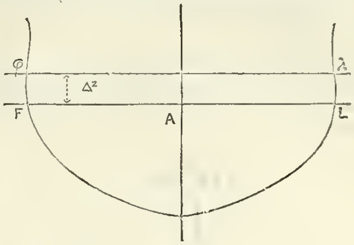
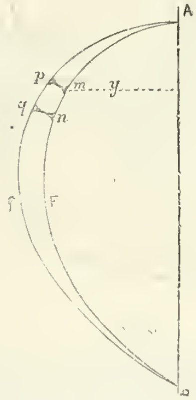


FIG. 1.



$\Delta\ i$ is simply the moment of inertia of the area comprised between the projections of the two planes of flotation on the water section. Let $m\ n = d\ s$ be an elementary portion of the perimeter of F L, and let us draw $m\ p$ and $n\ q$ normal to this perimeter. If y be the ordinate and α the angle which the vertical through m makes with the surface of the floating body,

We have,

$$m\ p = \Delta\ z \tan.\ \alpha$$

Neglecting infinitesimals of the second order,

$$\text{Area } m\ n\ p\ q = \Delta\ z \tan.\ \alpha\ d\ s$$
$$\Delta\ i = \Sigma\, y^2\, \Delta\ z \tan.\ \alpha\ d\ s,$$
$$= \Delta\ z\, \Sigma\, y^2 \tan.\ \alpha\ d\ s;$$

whence,

$$\frac{d\ i}{d\ z} = \int y^2 \tan\ \alpha\ d\ s.$$

Consequently, by virtue of equation 2,

$$r_1 = \frac{1}{\Omega}\frac{d\ i}{d\ z},$$
$$= \frac{d\ i}{d\ V}. \quad . \quad . \quad . \quad . \quad (3).$$

Before stopping to consider the conclusions which may be drawn from this relation, I shall transform it. Taken together with (1) it permits us to write,

$$r_1 - r = \frac{d\ i}{d\ V} - \frac{i}{V},$$
$$= \frac{V\ d\ i - i\ d\ V}{V\ d\ V},$$

which leads to,

$$r_1 = r + \frac{V\ d\ r}{d\ V}. \quad . \quad . \quad (4.)$$

I give the preference to this last formula, as expressing r_1 to quantities r, V, which are usually shown explicitly on our plans for various values of z.

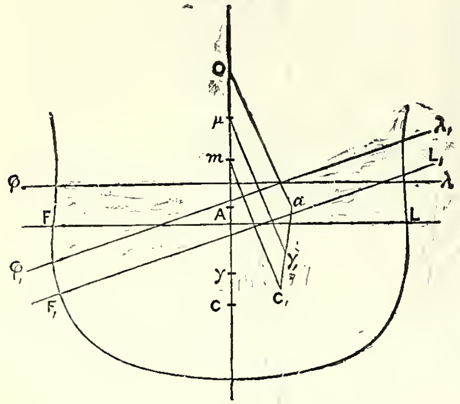
I now proceed to establish it by direct method :

1. For a volume of displacement V, let the upright water section be F L, the water section $F_1\ L_1$, being

inclined at an infinitesimal angle θ, C and C_1 the corresponding centres of buoyancy, m the metacentre, r the metacentric height C m.

2. Corresponding to a displacement $V + \Delta V$, the water sections $\phi\ \lambda$, $\phi_1\ \lambda_1$; γ, γ_1 the corresponding centres of buoyancy; μ the metacentre, and $r + \Delta r$ the metacentric height $\gamma\ \mu$.

FIG. 2.



Let us mark with the letters A, a, the centres of buoyancy of the slices comprised between the upright and the water sections respectively. The point of intersection O of the lines A O, a O perpendicular to F_1 L, F_1 L_1, tends to coincidence with the centre of tranverse curvature of the flotation envelope of displacements, equal to V as ΔV approaches zero; and at the same time the length A O tends to equality with r_1. This settled, it will be remarked that γ_1, lies on the right line C_1 a, and that since the right lines O a, $\mu\gamma_1$, m C_1 are parallel, the point μ divides the distance m O in the same ratio as γ divides C A, we thus obtain the set of equations:

$$\frac{O\,m}{m\,\mu} = \frac{C\,A}{C\,\gamma} = \frac{O\,m - C\,A}{m\,\mu - C\,\gamma} = \frac{V + \Delta V}{\Delta V}$$

We have also the following identities: firstly,

$$O\,m - C\,A = (O\,m + A\,m) - (C\,A + A\,m) = O\,A - C\,m = O\,A - r;$$

and secondly,

$$m\,u - C\gamma = (\gamma m + m\mu) - (C\gamma + \gamma m) = \gamma m - C\,m = \Delta r.$$

The two last terms of the set of equations among the ratios thus enables us to write down,

$$\frac{O\,A - r}{\Delta r} = \frac{V + \Delta V}{\Delta V};$$

or,

$$O\,A - r = (V + \Delta V)\,\frac{\Delta r}{\Delta V},$$

which becomes at the limit,

$$r_1 - r = V\frac{dr}{dV},$$

which agrees with formula (4).

The method of calculation is that which is usual in such cases—to tako for $\frac{d\,r}{d\,V}$ tho ratio $\frac{\Delta\ r}{\Delta\ V}$ relatively to two consecutive groups of simultaneous values of r and V. It is very easy, moreover, to draw a curvo of which V is the abscissa and r the ordinate. Theoretically, formula (4) gives, with tho help of this curve, a very simple construction for r_1, whatever bo tho scales on which V and r are set off. In any caso, such a curve will be a useful graphic auxiliary to the computation above-mentioned.

III.

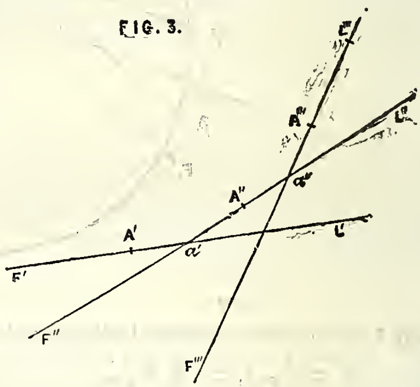
In what goes before, I have only considered the vessel as being upright in its vertical position. If it be inclined, the expressions corresponding to r, r_1, would be those for the radii of curvature of the cylinders with horizontal generating lines circumscribed to the surfaces, F, C. The right sections of these cylinders are usually called the envelope of flotation and curve of buoyancy when we are examining a ship's heeling, or when we wish to plot its metacentric evolute for transverse inclinations.

The use of the radius of curvature, r_1, abbreviates the plotting; in fact, let F′ L′ (Fig. 3) be the trace of a water section cutting off a volume, V, A′, the centre of gravity of the water section, r'_1, the radius of curvature of the flotation envelope at A′; a water section, F″ L″, of the same displacement, making a small angle, θ, with F′ L′, will cut F′ L′ at a point, a', such that

$$A'\,a' = r'_1\ \tan.\ \tfrac{1}{2}\,\theta.$$

We can thus pass in succession from the upright position to any series of inclined positions, by calculating for each of them such as F′ L′ (Fig. 3); the position of its

FIG. 3.



centre of gravity, A′; the radius of curvature of the curve of buoyancy (the metacentric height for an infinitesimal angle measured from F′ L′), or

$$r' = \frac{i'}{V};$$

the radius of curvature of the envelope of flotation, or

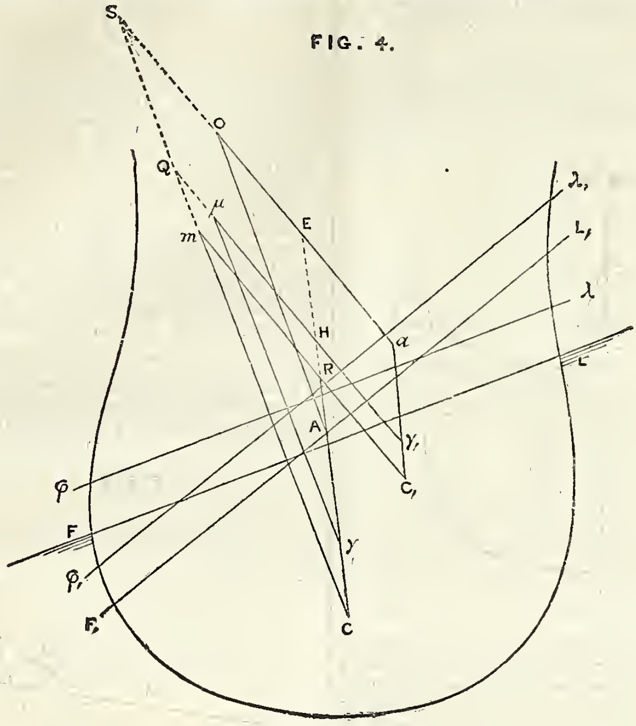
$$r'_1 = r'_1 + V\,\frac{d\,r'}{d\,V};$$

the ratio $\frac{\Delta\ r'}{\Delta\ V}$, used to get the co-efficient, $\frac{d\ r'}{d\ V}$, will be found by means of auxiliary water sections (one or two) parallel to F′ L′, and very near to it.

The last inclined section of the series may be verified by a direct calculation of its volume by one of the ordinary methods. If a correction has to be made, it will be easy to introduce the necessary corrections into the intermediate sections by means of interpolations obtained with the help of tho auxiliary water sections. Thoy may even be settled by the simple consideration of the continuous character of the variation of the lengths, A′ a', a' A″, A″ a'', ... in consequence of the equality of the angles, θ, which the successive water sections F′ L′, F″ L″, F‴ L‴, . . . make with one another.

Besides, thero are not wanting methods of tracing the metacentric evoluto by means of the calculated lengths of tho radius of curvature $r\ r'$ &c., of the curvo of buoyancy. If it becamo necessary to plot the flotation envelope, and the metacentric evoluto for various values of V, it would be easy to give the extension nccessary for this purpose to the artifice of introducing tho auxiliary water sections which wo have just mentioned.

FIG. 4.



IV.

Finally, I wish to point out that the leading formulæ—

$$r_1 = \frac{d\,i}{d\,V}, \; r_1 = r + V\frac{d\,r}{d\,V},$$

and the corresponding formulæ for the longitudinal radius of curvature—

$$R_1 = \frac{d\,I}{d\,V}, \; R_1 = R + V\frac{d\,R}{d\,V},$$

are the algebraical expression of the theorems which explicitly connect the elements of curvature of the surface F with those of the surface C. Apart from their special application to naval architecture, it appears to me that these theorems lead, as a question of pure analysis, to some interesting considerations relating to the geometrical inter-dependence of these two classes of surfaces.

NOTE.—The direct proof of formula (4), as thus extended, is easily established, when the initial water section is inclined, as is the case with F L (Fig. 4). From this point of view, Fig. 4 is a repetition of Fig. 2; the centres of buoyancy or of upright pressure C, γ, A, are in one right line, as are also the points C_1, γ_1, a. The directions of the different pressures considered, give rise to two series of three parallel right lines C m, γ μ, A O, and $C_1 m$, γ_1, μ, a Q. These last intersect the line C A produced in K H E, and the C m produced in Q and S.

This stated, by similar reasoning to that which we used in the case of Fig. 2, we obtain the following series of equations:—

$$\frac{E\,K}{K\,H} = \frac{C\,A}{C\,\gamma} = \frac{E\,K - C\,A}{K\,H - C\,\gamma} = \frac{V + \Delta\,V}{\Delta\,V} \quad . \quad . \quad (a.)$$

But we have identically,

$$E\,K - C\,A = (E\,K + K\,A) - (C\,A + A\,K) = E\,A - C\,K,$$
$$K\,H - C\,\gamma = (\gamma\,K + K\,H) - (\gamma\,K + C\,\gamma) = \gamma\,H - C\,K;$$

whence,

$$\frac{E\,K - C\,A}{K\,H - C\,\gamma} = \frac{E\,A - C\,K}{\gamma\,H - C\,K}. \quad . \quad . \quad (b.)$$

Again, from the figure,

$$\frac{E\,A}{O\,A} = \frac{E\,C}{C\,S} \qquad \frac{C\,K}{C\,m} = \frac{C\,E}{C\,S} \qquad \frac{\gamma\,H}{\gamma\,\mu} = \frac{C\,H}{C\,Q},$$

the three second members being clearly equal, the first must also be, and we get,

$$\frac{E\,A}{O\,A} = \frac{C\,K}{C\,m} = \frac{\gamma\,H}{\gamma\,\mu};$$

whence it follows that we can write,

$$\frac{E\,A - C\,K}{\gamma\,H - C\,K} = \frac{O\,A - C\,m}{\gamma\,\mu - C\,m}.$$

Consequently, according to (a) and (b), we have,

$$\frac{O\,A - C\,m}{\gamma\,\mu - C\,m} = \frac{V + \Delta\,V}{\Delta\,V};$$

that is,

$$\frac{O\,A - r}{\Delta\,r} = \frac{V + \Delta\,V}{\Delta\,V}.$$

Then at the limit,

$$r_1 - r = \frac{V\,d\,r}{d\,V}.$$

Dr. Woolley thought that Mr. Merrifield had not fully represented M. Leclert's meaning. The investigation was not confined solely to one single small displacement from the upright position, but you could trace what was known as the metacentric curve, and the evolute of flotation, which was quite a different thing. They owed a great deal of their knowledge of the theory of naval architecture to French writers. There was no person who had placed the general capabilities of ships and floating bodies with regard to statical stability in so beautiful and so readable a form as M. Dupin. But one great merit of M. Leclert's paper was that, whereas one

part of M. Dupin's theory was rather defective with regard to his investigation of the evolute, M. Leclert had produced it in elegant form, and with that connexion which everybody knew must exist between the several surfaces of the ship. M. Leclert had pointed out how that was connected with other considerations, giving the evolute of the centre of buoyancy. The connexion between the surfaces was at once shown, one being the radius of curvature of one of the surfaces, and the other being the radius of curvature of the other.

Mr. Barnes said English naval architects had paid no attention to the surface of flotation as a rule, while, on the contrary, the French had regarded it as a matter deserving great consideration. M. Leclert, it appeared, pre-supposed that the surface of buoyancy was known, and, taking that for granted, proceeds to find, by his formula, the radius of the curvature of flotation. At present, what they did was to find the curve of buoyancy in its integrity from point to point, which was mere geometry, and could be done very accurately, though it took a long time to do. There were several methods of doing it, one of which was his own. His method not only gave this curve, but also gave the surface of flotation, and you actually found the centre of gravity of the inclined water line. The centre of gravity of the inclined water line was exactly the point in the surface of flotation, so that you would do really for the one what you would do for the other. Without troubling about the radius of curvature at all, you got it from point to point, and in getting the curve of buoyancy you got the curve of flotation also.

The Chairman (Mr. J. Scott Russell) said it was an auspicious symptom for the future, that a gentleman placed in the position of M. Leclert should send such a communication to this institution, for there was a School of Naval Architects in France who, long before the existence of the institution in England, had devoted themselves in a most profound and admirable manner to the development of the whole principles of naval architecture. He would add that there was a gentleman, comparatively unknown in England, of the name of M. Resch, in the same school as M. Leclert, and who was probably the man in the whole world most profoundly conversant with the mathematics and mechanism of naval architecture. He was an associate of M. Leclert, and while the institution thanked M. Leclert for his paper, they might say that they would be very grateful for any further communication he might make.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The following, relating to the appointment of the French Commission, is taken from the *Moniteur* :—

Report to the Emperor.

Paris, April 5, 1870.

Sire,—Your government has been officially informed, by her Britannic Majesty's Ambassador at Paris, of the opening in London, in 1871, of an International Exhibition of the Fine Arts and of Industry, which is to form the first of a series of annual exhibitions to be held there for five consecutive years, so as to pass in review the different branches of industry and of art.

As one of the articles of the programme of the Exhibition requires foreign governments to state, before the 1st of May, 1870, what space they wish to be assigned to them, it is necessary to submit to your Majesty at once the measures which are calculated to facilitate the participation of France in these national competitions.

Hitherto your Majesty's government has always, under similar circumstances, appointed commissions, which, owing to the reputation of those who composed them, have contributed largely to the success of our productions at the various International Exhibitions.

It is, therefore, now our duty to appeal to the aid of men whose energy and ability will enable them to render considerable facilities in the administration of this matter.

We have, then, the honour to propose to your Majesty—

First—That your Majesty should appoint a superior commission, charged with the duty of framing and submitting measures relating to the French portion of the Exhibitions which are to commence in London on the 1st of May, 1871, and to be continued for the four following years.

Secondly—That your Majesty should authorise the Ministers who preside over the departments of agriculture, commerce, and the fine arts respectively, to appoint, acting under the advice of the superior commission, special committees corresponding to the several branches of art and industry, as may successively have place at the International Exhibitions in London.

If your Majesty should be graciously pleased to approve of these proposals, we pray that you will affix your Majesty's signature to the project in the decree here annexed.

We are, with the most profound respect,
Sire,
Your Majesty's most humble, most obedient, and most faithful servants,
Maurice Richard, Minister of Fine Arts.
Louvet, Minister of Agriculture and Commerce.

Decree.

Napoleon, by the grace of God and the will of the people, Emperor of the French. To all whom it may concern, greeting.

On the report of our Ministers of Agriculture, Commerce, and the Fine Arts, we have decreed, and do hereby decree, as follows :—

Article 1. Under the presidency of our Ministers of Agriculture, Commerce, and the Fine Arts, a superior commission is appointed, empowered to frame and propose measures adapted to facilitate the participation of our countrymen in the International Exhibitions which are to take place in London in 1871 and for the next four years.

Article 2. The following are named as members of this commission :—

MM. Amé, Director-General of Customs.
André (Edouard), Deputy of the Legislative Body.
Arago, Chief of the Division of the Fine Arts.
Baugraud, Member of the Standards Commission.
De Cardaillac, Director of the Civil Structures.
The Count de Chambrun, Deputy of the Legislative Body.
Cornudet, President of the Section of the Council of State.
Delarbre, Councillor of State, Director of Accounts in the Ministry of Marine and of the Colonies.
Denière, President of the Chamber of Commerce of Paris.
Drouin, President of the Tribunal of Commerce of Paris.
His Excellency M. Drouyn de Lhuys, Senator, Member of the Privy Council.
Du Sommerard, Director of the Museum des Hermes and of the Hotel de Cluny, Assistant Commissary-General.
Gautier, Councillor of State, Secretary-General of the Ministry of the Emperor's Household.
Gérome, Member of the Institute.
Guillaume, Member of the Institute.

Guillot, Comptroller-General, Councillor of State, Director of Accounts in the Ministry of War.
Lefevre, Member of the Institute.
Meissonnier, Member of the Institute.
De Montagnac, Deputy of the Legislative body.
Count de Nieuwerkerke, Senator, Member of the Institute.
Ozenne, Councillor of State, Secretary-General of the Ministry of Agriculture and Commerce, Commissary-General for the Exhibition in London.
Rolle, Deputy of the Legislative body.
Baron Alphonse de Rothschild.
Sieber, Member of the Consulting Committee of Arts and Manufactures (wool-weaver).
Viollet-Leduc, architect.
Weiss, Councillor of State, Secretary-General of the Ministry of Fine Arts.

Article 3. Our Ministers of Agriculture, Commerce, and Fine Arts shall have power, acting under the advice of the superior commission, to appoint special committees, corresponding with the different branches of art and industry. Each of these committees shall be placed under the presidency of one of the members of the superior commission.

Article 4. The following are appointed secretaries of the herein-mentioned commisssion:—MM. Ameline, Private Secretary to the Minister of Agriculture and Commerce; Gerspach, Private Secretary to the Minister of Fine Arts; Fréauff Ozenne, Chief of the Bureau for the Direction of Foreign Commerce. M. Leort, Private Assistant-Secretary to the Minister of Agriculture and Commerce, shall discharge the duties of Assistant-Secretary.

Article 5. Our Ministers of Agriculture, Commerce, and the Fine Arts are charged, each one in his own department, with the execution of this decree.

Given at the Palace of the Tuileries, the 5th of April, 1870.

(Signed) Napoleon.

(Countersigned)
Maurice Richard, Minister of Fine Arts.
Louvet, Minister of Agriculture and Commerce.

Napoleon, by the grace of God and the will of the people, Emperor of the French, to all whom it may concern, greeting.

On the report of our Ministers of Agriculture, Commerce, and the Fine Arts, we have decreed, and do hereby decree, as follows:—

Article 1. M. Du Sommerard, Director of the Museum des Hermes and of the Hotel de Cluny, is appointed Assistant Commissary-General for the International Exhibition of the Fine Arts and of Industry which is to take place in London in 1871 and following years.

Article 2. Our Ministers of Agriculture, Commerce, and the Fine Arts, are charged, each one in his own department, with the execution of this decree.

Given at the Palace of the Tuileries, the 5th of April, 1870.

(Signed) Napoleon.

(Countersigned)
Maurice Richard, Minister of Fine Arts.
Louvet, Minister of Agriculture and Commerce.

AMENDMENTS TO THE EDUCATION BILL.

The amendments to be proposed by Mr. Dixon and Mr. Winterbotham, which affect the religious question, were given in last *Journal*. The Manchester Education Bill Committee have now published a full report on the effect of all the amendments of which notice has been given, many of which, however, are not of very great importance, and the principal only are referred to here.

In Clause 5, Mr. Vernon Harcourt proposes to insert words to secure "an education in all respects efficient in its character, and offered upon conditions fair and equal to all," in lieu of the words "suitable provision is not otherwise made," &c., so as to define more closely what shall be regarded as "suitable provision;" and to enact that all schoolmasters shall be in all respects "efficient" persons, "a provision (says the report) which might be extended with advantage to all other members of the community." The amendments in Clause 7 are very numerous, and appear "more or less to aim at the secularisation of existing denominational as well as rate-provided schools."

Mr. Candlish proposes to insert a provision requiring "the principal teacher of every school to ascertain from the parent whether he consents or objects to his child being present at the religious instruction, &c.," so "that something like a religious census would have to be taken by the schoolmasters."

Mr. Thomas Hughes proposes to insert at the end of section 2, an amendment which proposes to treat an existing denominational school, which by itself meets the wants of an entire district, or one receiving any aid from local rates, as if it were a rate-provided school.

Dr. Brewer proposes to leave out the conscience clause and insert a rigid time-table conscience clause. On this the report says:—"It is difficult to see how conscientious objections to pay for religious teaching during ordinary school-hours are satisfied by a time-table conscience clause, as proposed by Mr. Winterbotham and Dr. Brewer. It simply relegates such instruction to a particular hour; but authorizes and provides for its being given at such hour by one sect only."

In clause 9, Mr. Morrison would abolish the "year of grace" to denominational schools, while Mr. Cowper-Temple proposes to give them half a year more.

Clauses 10, 11, and 12 are vital clauses, and contain the provisions which bar the immediate creation of school boards. Mr. Hibbert's amendments on them are intended to raise the question of the immediate creation of school boards in every district. "The Bill as it now stands" (says the report) "is open to the objection that those districts in which ample provision has been made for education are placed in a worse position than those in which the people have altogether neglected their duty. The former would still be left to voluntary effort, while the latter might be helped out of the rates. The postponement of the election of a school board until increased school accommodation is proved to be needed will prevent the most being made of existing schools, by deferring the compulsory provisions of the Act."

Clause 14 relates to new rate-provided schools only, and the amendments proposed are most important.

Mr. Jacob Bright proposes to insert the words "but no religious catechisms or formularies shall be used in any such school, nor shall anything in support of or in opposition to the peculiar tents of any religious sect or denomination be taught therein; provided that nothing herein contained shall be held to exclude the reading of the Holy Scriptures in such school."

Other amendments are proposed by Mr. Baines and Mr. Candlish, in reference to which the report says:—"This clause, as it stands in the Bill, leaves to School Boards the power of deciding the religious character of the schools provided by them. Thus, at nearly every election the parish will be disturbed by a violent religious controversy. The amendment of Mr. Jacob Bright is intended to obviate this evil, by insuring the unsectarian character of the schools, but not excluding the Bible. Mr. Baines and Mr. Candlish both aim at the same object, but the latter gentleman goes beyond the scope of this clause, and includes existing denominational schools receiving any aid from rates." Mr. Dixon's amendment was given last week.

Under clause 17, Mr. Dixon proposes the establishment of free schools. Sir Charles Dilke has also an amendment relating to this point.

After clause 22, which specially relates to existing

denominational schools, Mr. Jacob Bright proposes to insert a new clause:—"A school board may permit any school under its management and control to be used for religious instruction at the hours when the school is closed for the purpose of this Act, and, on such conditions, to insure perfect fairness towards each religious denomination as shall be sanctioned by the Education Department, provided that no teacher in any such school shall be allowed to give any such religious instruction, and no expense incurred in respect thereof shall be defrayed by the school board."

In clause 34, Mr. James Howard proposes to insert the words, "The education department shall, in the case of small parishes, cause a united school district to be formed by the grouping of two or more adjoining parishes, containing in the aggregate not less than 5,000 inhabitants;" also to leave out clauses 42 and 43. "The adoption of this amendment" (says the report) "would remove many of the objections to the 'school unit' proposed in the Bill. The average population of a parish, in three-fourths of all the counties in England, is 900; and the average throughout England is only 1,500. In such enlarged districts, it would be possible to establish 'graded' schools, affording increased economy and greater efficiency. The Faversham Union is a well-known case in point."

In clause 66 (compulsory attendance), Sir T. Bazley proposes to insert the provisions drawn up by the Manchester Education Bill Committee, instead of the power to make permissive-compulsory bye-laws. Dr. Brewer and Mr. Mundella propose to enact "that every school board 'shall' instead of 'may,' with the approval of the Education Department, make bye-laws to compel attendance."

Some new clauses are proposed by Dr. Brewer, providing that, after a certain date, no person shall be employed nor apprenticed, nor "be allowed to fill any public office, or exercise any parochial, municipal, or imperial franchise, who has not obtained a certificate of having passed an examination in the standard which has been determined;" in reference to which the report says:—"The annual review and registration of the certificates of parochial, municipal, and Parliamentary voters would be complicated and costly. In Manchester alone, at least 50,000 persons would require to present themselves annually before the overseers or the revising barrister."

Colonel Beresford proposes a clause to provide "that in all existing schools under Parliamentary inspection and control, or to be hereafter established under the provisions of the Bill, the Holy Scriptures shall be daily read from the authorised version, and that the right to the Parliamentary grant shall be dependent upon such compliance."

It will be understood that want of space renders it impossible to mention all the amendments; but most of those which really affect the main features of the Bill have been pointed out.

CORRESPONDENCE.

THAT THE SENTIMENT OF THE STATUE OF THE PRINCE CONSORT IN THE NATIONAL PRINCE CONSORT MEMORIAL SHOULD BE DEVOUT AND IN HARMONY WITH THE SACRED CHARACTER OF THE STRUCTURE IT IS TO OCCUPY—WHICH IS A COLOSSAL SHRINE—AND THAT THE STATUE SHOULD BE OF MARBLE, AND NOT IN BRONZE GILT.

Sir,—The same plea which prefaced my last letter, on fronting the Prince Consort Memorial to London, for seeking a place in your pages for those remarks, equally apply to these.

The late Baron Marochetti was, some years ago, commissioned to prepare a colossal statue of the Prince Consort for the National Prince Consort Memorial in Hyde-park. He made a full-sized model of a seated figure, which was approved while in his studio, but when it was tried up in its place, under the canopy of the memorial, it was at once condemned. This great artist died in Paris about that time, and thus the first stage of the statue question ended. After a time, however, this failure not apparently having discouraged the advocates of a seated attitude for the statue of the good Prince, another eminent sculptor was employed to furnish another seated statue, and his full-sized model likewise is to be tested under the canopy of the memorial. When this has been done, probably the idea of a seated figure for the situation in question will be considered to have been sufficiently tried.

There are various admirable seated statues in existence, and among modern works I would instance the most characteristic statue of Voltaire, in the Théâtre Francais, in Paris. Also, in the last Exhibition of 1866 in that city, no work of sculpture more justly rivetted public attention than the noble-seated statue by Signor Vela, called "The Last Days of Napoleon the First." Also, we ourselves possess some simple and satisfactory seated statues by Sir Francis Chantrey. But all these statues are on comparatively low pedestals, and their effect would be entirely marred by being placed in very elevated positions, such as that destined for the statue of the Prince in the memorial, in which case, in the front view, as necessarily seen from beneath, the feet, knees, and head of a usually posed seated figure come so close together in the visual angle that they are confused, and the figure shuts up, as it were, and loses all dignity. In the back views, the appearance is vacant and ungainly, and the chair or seat becomes the principal object, while, even at the sides, the effect is not happy.

It is just because I recoil from the idea of a seated statue in this case that I would, in fairness, seek to do full justice to that attitude, and thus I proceed to instance one seated figure, which in truth does look admirably in a somewhat elevated position. I refer to the fine seated statue by Michael Angelo, of Lorenzo di Medici, over his tomb in the chapel in Florence. This statue has been reproduced in so many ways, and is so well known, that it offers a ready illustration of what I would say, and therefore let us consider it. How is this statue treated? It is posed with the head forward and resting on the hand, and the feet are drawn up beneath him as he sits. By these means, in the front view, the head, knees, and feet are kept well clear of each other in the visual angle from beneath, and thus treated, without compromise or any unnatural shortening of the thighs, as the Goths practised on such occasions, the great Florentine produced, not only one of the finest seated statues in the world, but one that looks well in a somewhat elevated position. But then let us bear in mind that the figure is in a niche, and the side-views are but partially seen, and the back not at all, and so the artist had practically only the front view to regard.

Now, in the Prince Consort memorial, the conditions are quite different, for the eye and mind have to be contented in all views. While the figure will be more elevated, at the same time the back will not be concealed. The colossal shrine which is to receive it is equally open, complete, and decorated on all four faces, and invites inspection as much at the sides and back as in the front to that which it protects—the statue of the Prince.

Well, I submit that, if the great Buonarotti were alive and could be consulted, his reply would be that, although a seated figure can be justly composed for an elevated niche, where only a front view has to be satisfied, as he has proved, yet that no such agreeable result can be attained by a seated figure in an elevated position, open to the view from every quarter; and, as far as I recollect, all the best practice, ancient and modern, has avoided the attempt. As an illustration, this very statue of Lorenzo, excellent as is the front view, at the back, as seen from beneath, it is quite insufficient, and has a

strange appearance, but of course that is of no moment in that case, as the back is wholly concealed in the situation for which it was designed. But this is not so with the statue in the memorial, and I presume we shall not go the length of shutting up any of its four arches in order to conceal the short-comings of the treatment of the figure. The difficult nature of the case is this, that whatever modifications may be made in the figure, to adapt it to be seen in front from below, will be all the worse for the back and side views; and I apprehend that, under such conditions, the best that can be done with a seated figure will be but a compromise, and we know the fate of compromises in art.

Indeed, considerately and advisedly, I venture to submit that, even solely in an artistic view of the subject, and putting aside for the time the far higher consideration of appropriate sentiment, there appear to be but two positions of the figure of the Prince that are likely to fulfil the requirements of the situation it is to occupy, namely, a kneeling position and a standing one. We will briefly consider these. The pure artistic advantages of a kneeling figure in a high situation, open to view all round, are, that the greater its elevation, within compass, the more favourable the effect; also, in that it may be expressive and picturesque at the back, in which respect even a standing figure is deficient, and a seated figure, whether with or without a chairback, ungainly and without interest. The advantages, on the other hand, of a standing figure, exist in that its direct front is easily adjusted for the purposes of art, and that it would occupy a perfectly square pedestal, in accordance with the general ground-plan and scheme of the memorial—the present pedestal being a departure from this—and that probably it might suffer less than either a kneeling or a seated figure from the clustered columns at the four angles of the shrine, which obstruct, perhaps, the best views of the statue. *Apropos* of this, a canopy supported by six columns is more suited, in this respect, to display a statue than one with four, as affording three-quarter views as well as a front view of the work protected. However, all said, I hold that a kneeling figure is, on the whole, even in a purely artistic view, the better treatment, but when to this are added the considerations of sentiment and of harmony with the pervading character of the memorial, this conclusion appears inevitable. It is not only the cross at the summit of the memorial that illustrates this character, but the whole nature of the structure, which, as being that of a colossal shrine, every day's progress now makes the more evident, and while this is, to the full, carried out by the figures of angels that—tier above tier, cluster round its graceful spire—the sentiment of the core, the heart of the memorial, the statue of the Prince, must not come short of its accessories. Does not this lead up manifestly to the conviction that the sentiment of the statue should be devout? For this reason I submit that "he might well be represented as kneeling in dignified humility and noble devotion beneath the shrine surmounted by the cross which is so justly raised to his memory." Of course this sentiment is most fully rendered by a kneeling position, and I cannot think it can be made too emphatic.

In, however, the possible event of this being judged to be so, then, next in advantage, *proximus sed longo intervallo*, comes a standing figure embued with as much devoutness as that position may attain. It is true that some nations even pray standing, and even with us, in the advance to the Communion table, thoughts and expressions of devotion may be felt, and even perceived, perhaps almost as much as when kneeling at the altar itself, but we must still remember that the complete act is kneeling. May be, however, that the degree of devoutness which the statue should express is a subject for more mature consideration, but devout surely it must be, or not only will it be out of harmony with the shrine it occupies, but, with such associations, it will do injustice to the memory of the good Prince; besides other considerations on which I will not at present enter,

However in verity, I cannot retreat from what I have held from the first, namely, that the more devout, short of representing actual prayer, the statue be made, the more truthful, noble, and consistent with its theme it will be; and I am one of those who trust that—in degree—the memorial of the good Prince will continue the lesson of his life.

With the same hope for sentiment, in all respects, in the work, I trust that the statue will not be executed in gilt metal, with which we are threatened in the sketch-model at present exhibited in the South Kensington Museum, but, on the other hand, that it be wrought of the purest and hardest marble, which has in all ages been justly esteemed the finest material for sculpture. There is, indeed, a poetry in the very material of marble that especially fits it for rendering subjects of high and pure art, insomuch that replicas in any other material scarcely appear to be from the same model, and are vastly inferior in refinement, and I earnestly suggest that we should not be content with anything short of sculpture's noblest material for the statue of the Prince.

Moreover, considered in relation with the other features of the memorial, it is evident it should be in marble. The groups around the base of the memorial are in marble, and they are not protected from the weather, while, on the other hand, the statue of the Prince will be protected, not only by its superior scale, which makes all the finer parts and details so much stronger, but it is specially sheltered by the canopy above, the mission of which is to preserve the statue, or what due reason is there for its presence? The marble statue of the good Prince, the core of the composition, should indeed form the culminating point and completion of the marble groups of sculpture beneath, in like manner as the cross, which crowns the whole, is the culminating point and completion of the architecture. At present, in the sketch model, the marble groups around appear disconnected with the rest of the composition, for lack of that unity and combination which would be supplied by the statue of the Prince being in marble. It is true that a mass of gold colour is a requirement beneath the canopy as well as above, but that were easily fulfilled by the pedestal of the statue, instead of the statue itself, being gilt. I am not aware of a precedent for a marble statue on a gold or enriched gilt pedestal, but I believe it would present a noble and simple as well as a rich effect.

To summarise—I submit that the representation of the Prince Consort in the national Prince Consort memorial should be of the purest marble, which selection of material is subsidiary to the sentiment of the statue. That this sentiment should be devout is my stand-point; but the degree of devoutness that it should express must be decided by a higher judgment and the spirit of the age.—I am, &c., Epsilon.

TRAMWAYS AND THEIR VEHICLES.

Sir,—Referring to my communication on this subject, which appeared in last Friday's *Journal*, I beg leave to explain that the concluding remarks as to the unsuitableness of tramways for crowded thoroughfares, and in favour of the on-and-off system, convey my own opinion, and were not quoted from the letter of my correspondent, Mr. Nairn, as might appear from the way in which my communication is printed.—I am, &c.,

W. Lloyd Wise.

Chandos-chambers, Buckingham-street, Adelphi,
London, W.C., April 11th, 1870.

GENERAL NOTES.

Metropolitan Sewage.—The daily average quantity of sewage pumped into the Thames at Crossness is said to be 174,914 cubic metres, and at Barking 165,972 cubic metres, equivalent to about as many tons by weight.

Iridium.—Iridium, used as a colouring matter for glass and porcelain, gives a tint of intense blackness.

Tom-toms and Cymbals.—M. Riche has found that tom-toms and cymbals are made of bronze that can be worked cold, the same as iron or aluminium bronze. The best tone is produced by an alloy composed of 78 parts of copper and 22 parts of tin.

Rock Salt in Prussia.—In Sperenberg, near Berlin, borings for rock salt have been carried on for the last two years. In February, a depth of 2,725 ft. had been reached, and the thickness of the salt bed explored to 2,439 ft.

A Druidical Stone.—A curious stone, believed to be Druidical, has just been discovered in a field near Dingle. It is 8 ft. long, 4 ft. broad, and about 2 ft. thick. There is a hole in the middle of it, 14 in. square and the same number of inches deep, neatly cut with a chisel, with the lower end of it coming to a point, or tapering from top to bottom.

Test for Arsenic.—Bettendorf has discovered a test so delicate that it is said to be capable of detecting one part of arsenic in a million parts of solution, nor does the presence of antimony affect it. The arsenious liquid is mixed with hydrochloric acid until fumes appear; chloride of tin is then added, which produces a basic precipitate, containing the greater part of the arsenic as metal, mixed with oxide of tin.

Postage Reduction.—With reference to the announcements made by Mr. Lowe last week, an official communication has been received from the Post-office, stating the intention of the authorities with respect to the use of the halfpenny stamp. It is to be paid upon each newspaper not exceeding six ounces in weight, and will not carry a packet of newspapers under that weight. It will, however, be permissible to transmit newspapers in packets, under the arrangements of the book-post, at the rate of one halfpenny for every two ounces, whenever such a course would be more economical.

The Solar Temperature.—A paper published by Padre Secchi, in *Les Mondes*, states that the temperature of the sun undoubtedly reaches many millions of degrees, though the means of estimating it are imperfect. This high degree of heat may have been caused by the force of gravitation, which has united the elements of which the central point of our solar system has been made up; the initial temperature, therefore, the result of mechanical action, will, of necessity, have been greater than the present temperature of the sun is, which is certainly cooling down. But whatever this loss of heat may be, it is imperceptible to us, as it is slowly taking place, and partly compensated by chemical actions which take place in the sun, which is most probably in its interior a mass of strongly-compressed and condensed nebulous matter.

Silver.—The tenacity of silver has been studied by Matthiesen, and can be stated for comparison as follows:—Alloy of tin and copper, 1; gold, 3·6 to 4·3; copper, 4·3; silver, 7·2; platinum, 7·2; iron, 13; steel, 30. It is so ductile that a grain of it can be drawn out 400 ft., and it can be hammered into leaves so thin that it would require 100,000 of them to make a pile an inch in height. Its conductivity for heat is to copper in the ratio of 100 to 73·6; and for electricity, as 1,000 to 954. Cast silver expands, according to Calvert, between 0° and 100° per cent, 0·001991; and its specific heat is 0·05701. Although silver conducts heat remarkably well, its power of radiation is very small, so that a silver vessel retains the heat of a liquid contained in it longer than any other metal. Pure silver, if highly heated in oxygen, will absorb 6·15 to 7·47 volumes of that gas, and, under the same circumstances, will take up 0·907 to 0·938 volumes of hydrogen, 0·486 to 0·545 carbonic acid, and 0·15 carbonic oxide—in this property differing considerably from palladium.

The Purification of Camphor.—Crude camphor is adulterated with common salt, sulphur, vegetable matter, tar, and water. It is most successfully purified by sublimation in glass flasks of a capacity of 8lb. to 10lb., at a temperature of 400° F. These flasks are made of thin glass, with flat bottoms and short necks. They are put into a sand bath, where the heat can be uniform and rapid. The crude camphor is broken up, mixed with three to five per cent. of freshly slaked lime, and one to two per cent. iron filings, well-sifted and introduced through a funnel into the neck of the flasks. The flasks are then put into the sand-bath, covered with sand to the neck, and heated gently for half an hour to expel the water. As the temperature increases the camphor softens, and at last melts. After the whole mass has become fluid, the sand is removed from the upper part of the flask, and a paper stopper put in to close it partially. The heat is then carefully preserved at a point sufficient to sublime the camphor, but not to remelt it. In this way a very pure article can be obtained.

A Process for Re-sharpening Files.—M. Werdermann has exhibited a very interesting and economical process for this purpose, before the Société d'Encouragement of Paris. Well-worn files are first carefully cleaned with hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts of sulphuric acid, 80 parts of nitric acid, and 1,000 parts of water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises towards the surface. This arrangement is the result of practical experience. When the files have been in the bath ten minutes, they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner, but should the effect not be sufficient, they are replaced in the bath for the same period as before. Sometimes two operations are necessary, but seldom more. The files, thus treated, are to all appearance like new ones, and are said to be good for 60 hours' work. M. Werdermann employs twelve medium Bunsen elements for his batteries.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. A. W. Williamson, F.R.S., "On Fermentation."
Inst. of Surveyors, 8. Mr. F. Ryde, "Parochial Assessments."
R. Geographical, 8½. 1. Baron Osten Sacken, "Russian Expedition across the Naryn in 1867." 2. Mr. Delmar Morgan, "Progress of Russian Exploration in Turkistan."
Actuaries, 7. Mr. T. B. Sprague, M.A., "On the Proper Method of Estimating the Liabilities of a Life Assurance Company."
Medical, 8.
London Inst., 4.

Tues ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Discussion "On the Maintenance and Renewal of Railway Rolling Stock."
Antiquaries, 2. Annual Meeting.
Ethnological, 8. 1. Mr. E. B. Tylor, "On the Philosophy of Religion among the Lower Races of Mankind." 2. Dr. Donavon, "On the Brain in the Study of Ethnology."
Royal Inst., 3. Prof. Blackie, "Moral Philosophy."

Wed ...Society of Arts, 8. Mr. D. A. Lange, "A Narrative of the Works of the Suez Canal."
London Inst., 12. Annual Meeting.
Geological, 8.
R. Society of Literature, 8½.
Archæological Assoc., 8.

Thur ...Royal, 8½.
Zoological, 8½.
Royal Society Club, 6.
Royal Inst., 3. Prof. Tyndall, "Electricity."

Fri ......Royal Inst., 8. Prof. Blackie, "Interpretation of Popular Myths."

Sat ......Royal Inst., 3. Prof. Grant, LL.D., "Astronomy of Comets."

Journal of the Society of Arts.

FRIDAY, APRIL 29, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

CONVERSAZIONE.

Their Royal Highnesses the Prince of Wales, President of the Society, and the Princess of Wales, have graciously signified their intention of honouring with their presence the Society's Conversazione at South Kensington Museum on the 4th of May.

The Council have every confidence that the Members of the Society will aid them, by all means in their power, in protecting their distinguished guests from that crowding which unfortunately is but too common in public places in England, and in securing to them that freedom of movement among the various objects of interest which is accorded to the guests generally.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

MAY 4.—The Society's Conversazione at South Kensington Museum.

MAY 11.—"On Railways for India." By W. P. ANDREW, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways.

MAY 18.—"On International Money of Account, independently of International Coinage." By JACOB A. FRANKLIN, Auditor of the Society; in sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1855.

MAY 25 (At Three o'clock).—"On the New Organ in the Albert Hall of Arts and Sciences, South Kensington." By I. WILLIS, Esq. At this meeting Sir Michael Costa will preside.

CANTOR LECTURES

The third course of Cantor Lectures for the present Session is by Professor A. W. Williamson, F.R.S. The course consists of four lectures, "On Fermentation." The first was delivered on Monday evening, the 25th of April; the others will be delivered on the 2nd, 9th, and 16th of May, at 8 o'clock.

LECTURE II.—MONDAY, 2ND MAY.

Cyclical action analysed: 1. In known cases; 2. In less known cases.—Theory of "contagiousness" of chemical action.—Composition of yeast, and changes which it undergoes.—Assimilation of food by yeast plants during life.—Decomposition of yeast plants during life.

LECTURE III.—MONDAY, 9TH MAY.

Propagation of ferments.—Prevention of fermentation.—Germs in air: how removed; how destroyed.—Processes for arresting fermentation.

LECTURE IV.—MONDAY, 16TH MAY.

Wine-making and wine-keeping.—Chemical changes which improve the quality of wine.—Chemical changes which deteriorate the quality of wine.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

INDIA COMMITTEE.

The report of the Conferences on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell and Daldy, price one shilling.

PROCEEDINGS OF THE SOCIETY.

TWENTIETH ORDINARY MEETING.

Wednesday, April 27th, 1870; J. F. BATEMAN, Esq., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Barr, Edward George, 76, Holland-park, Kensington, W., and 36, Mark-lane, E,C.
Harding, George Edward, New York, and 98, Newgate-street, E.C.
Johnson, John Henry, St. Osyth-priory, near Colchester, and 29, Portland-place, W.
Merriam, L. P., 6, Claremont-villas, Torrington-park, N.
Newdigate, Albert L., M.A., Mount-lodge, Blackheath-hill, S.E.
Taylor, Richard, 26, Clarence-terrace, Seven Sisters'-road, Holloway, N.
Tennant, Sanderson, 3, Stanford-road, Kensington, W.
White, Charles, 262, Kennington-road, Lambeth, S.E.
Whittet, James, 41, Charlwood-street, Warwick-square, S.W.
Wilks, George, Boston-spa, Tadcaster, Yorkshire.
Wright, Herbert Montague, 4, Addison-gardens South, W.

The following candidates were balloted for, and duly elected members of the Society:—

Billing, Archibald, M.D., 4, Grosvenor-gate, Park-lane, W.
Curtis, James, 13, Moore-park-road, S.W.
Filliter, Freeland, St. Martin's-hall, Wareham, Dorset.
Girardot, E. G., 60, King Henry's-rd., Primrose-hill, N.W.
Mardon, William, Christchurch-chambers, 99, Newgate-street, E.C.
Ryder, Rear-Admiral A. P., United Service Club, S.W.
Wire, Travers Barton, Croom's-hill, Greenwich, S.E.

The Paper read was—

A NARRATIVE OF THE SUEZ CANAL WORKS.

By Daniel Adolphus Lange, Esq.

After the conquest of Egypt, in 638-40, Amrou, wishing to establish a communication between the two seas, wrote to his master, the Caliph of Omar, describing the vanquished territory as follows:—"An undulating green meadow, with ploughed fields, such is the delta of the Nile. A dusty desert, a liquid and clayey plain, a black slush, such is the Isthmus to cut through." The Caliph,

however, objected to the piercing of the Isthmus, fearing that it would open out the country to the influx of foreigners.

Twelve hundred years afterwards, M. Ferdinand de Lesseps proposed to cut a direct maritime canal from Pelusium to Suez, across the dusty desert and the black swamp of Lakes Menzaleh and Ballah. I remember his speaking to me about it when I was quite a youth, more than thirty years ago. When, however, later, the project was seriously brought forward, it was declared to be impracticable. It was said, "You can never surmount the difficulties of the desert. Nothing stable can be erected on those treacherous shores, doomed by nature to sterility and desolation." In fact, so strong was that opinion, that the captain of a small craft who first received orders to proceed to Pelusium, smiled with incredulity, but resigned himself to what he thought a fool's errand, much in the same way as a slave would obey the whims of his master.

Truly, nature has indeed put every obstacle in the way of landing. Land and sea seemed to be blended, and the shallow, shelving coast rendered it impassable. There was the surf to wade through, to begin with; and if you were not dashed to pieces by it, and managed, after great exertions, to get a footing on land, you found yourself not quite on *terra firma*, but something between the two. In fact, on a narrow belt of land, not more than 150 yards wide; and behind this treacherous slip, comes a second sea as far as the eye can penetrate, with this difference, that it is calm and shallow, but at the same time absolutely unapproachable. Anyone rash enough to attempt to wade through the liquid slush would probably never have an opportunity of doing so for the second time. Such is Lake Menzaleh—such is the liquid plain spoken of by Amrou—which, for no less than twenty-eight miles, the Suez Canal had to pass, after having surmounted the difficulties of passing the strip of land already alluded to. It was under such conditions that not only a harbour but a town had to be created in a part where there was no longer any sea, and where the land had yet to be formed. That was the site on which Port Saïd now stands, viz., in the Bay of Pelusium, which, in fact, is the Greek word *Pelos*, meaning mud; and the Arab designation of the coast, which they call "Tineh," equally signifies mud.

As M. Lesseps could not approach this coast by sea, he attempted to do so by land. The caravan destined to explore these regions, after having for eight days wandered about the isthmus, reached a point where the travellers were prevented from going further. On the summit of the last accessible "dune" 170 camels were grouped together, carrying the baggage and provisions of the party. From this point, the plain of Pelusium could be perceived at a distance, but how to get there! Lake Menzaleh had to be reached, but, to add to the difficulty, the Nile had not risen so high as usual that year, and in consequence there remained large uncovered black patches of mud, through which no boat could pass. To arrive at the belt it was necessary to go round this immense basin, but the party were impatient to reach the end of their journey. Much time would be saved by a direct passage through it. M. Lesseps decided, at all events, to make the attempt. The conductors of the caravan opposed it as rash, but without effect. M. de Lesseps, at the risk of being swamped every instant, waded cautiously through the basin, while the caravan were anxiously watching his movements. The attempt succeeded, and, soon after, a party of the caravan on foot were at the ruins of ancient Pelusium. The explorers then walked along the shore, both east and west, and discovered, to their great relief, that the part of the belt at Pelusium was not only firm, but gave every indication of a good and safe anchorage for vessels. After this personal examination, M. de Lesseps considered that the creation of a harbour was practicable on the spot where Port Saïd now stands, and soon after returned to Alexandria to make this fact known.

He then proceeded to France, but found that little heed was taken of his sanguine expectations, and scarcely any interest shown in his project—for indeed at that time nobody cared about the Suez Canal, and many Frenchmen scarcely knew where Suez was, some inquiring whether it was in Algeria or Sweden, others whether it would abbreviate the passage by the North Pole. Ludicrous as it may seem to an intelligent audience, I can assure you that such was really the fact, for amongst the many brilliant attributes of the French, I am forced to the conclusion that a knowledge of geography is not their *forte*.

The first great difficulty was to arouse public attention to the matter. Many of M. de Lesseps' best friends would scarcely listen to him in France. In a word, he could not obtain a hearing, much less make the slightest impression. Nor could it be wondered at. "The gay City of Paris," absorbed in the pursuit of amusement, was scarcely suited to become the nucleus of the greatest engineering undertaking of the age; and yet it ultimately did become so, but not until a very important phase had been gone through, and in which England played a very considerable part.

In 1857, I received a communication from M. de Lesseps, reminding me of the friendship which existed in our families, expressing a wish to come to England, with reference to his idea of making a canal in Egypt. I encouraged the plan, and urged him to come over at once, feeling convinced that in co-operating with him I was assisting the cause of humanity. I entered heart and soul into his project, and abandoned every other pursuit in consequence. On M. de Lesseps' arrival in London, we lost no time in visiting all the leading towns in Great Britain, where meetings were held, viz., in London, Liverpool, Dublin, Cork, Belfast, Glasgow, Edinburgh, Leith, Dundee, Aberdeen, Hull, Manchester, Birmingham, and Bristol. Armed with the collective opinions of the commercial classes of the United Kingdom, and a most valuable record it is, M. de Lesseps returned to Paris.

It seems a very curious thing to say that the opposition in England was the cause of the success of the canal, yet so it was. It was most strenuously opposed on political grounds by the late Lord Palmerston, with whom I had the honour of having several interviews on this matter, and whom I opposed, as far as my humble powers allowed, tooth and nail. Finding my efforts in this direction were of no avail, I endeavoured to bring the matter before Parliament, and I am pleased to be able to say that 64 members of the House of Commons voted against any English interference in Turkey. Finding, however, that this made very little difference with regard to the action of the English government, I then issued a small pamphlet, called "The Suez Canal Viewed in its Political Bearing," and I think you will agree with me that the views there expresed will still bear examination.

Seeing the attention England had paid to the subject, the French, in their turn, began to talk about it. Gradually a spirit of international rivalry was sown into a commercial undertaking, a company was formed, and the capital subscribed. The works were then commenced, and I shall now endeavour to give a brief narrative of them.

At Port Saïd, two piers running out into the sea were constructed. The length of the western mole is 2,500 metres, equal to $1\frac{3}{4}$ mile, and the eastern 1,900 metres, equal to $1\frac{1}{3}$ mile in length. It required about 250,000 cubic metres of concrete blocks, weighing about 30 tons each, to make the two jetties. The low marsh where Port Saïd now stands was raised 10 feet above sea level, and occupies an area of 67 acres. The harbour has a surface of 132 acres; the excavations amounted to 4,669,943 cubic metres.

It was necessary, previously to entering upon a work of such magnitude, to prepare dwellings, storehouses, factories, forges, and a lighthouse, indeed, all the

accessories indispensable for putting in motion the huge mechanical appliances intended to be used. All this was done in the newly-created town of Port Saïd.

Among the numerous obstacles which were encountered, none were half so formidable as effecting a channel through Lake Menzaleh, which extended 21 miles (from Port Saïd to Kantara). This was, indeed, the true difficulty; and while our adversaries were discussing the dangers of the Red Sea, the drifting sands, and other dangers looming in the distance, our real pre-occupation was the Lake Menzaleh.

When this mud was stirred under the burning sun of Egypt, the sulphuric exhalations were almost unsupportable; but, strange to say, such is the nature of the water of the lakes that it was not hurtful to the health of the men. We had the good fortune to have not much more sickness here than in the other localities. Besides, the lake fishermen are accustomed to wade up to their waist in the water, either to push their boats along or fix their nets. They are a fine, vigorous race of men, and these we employed for the work. They had to throw up the liquid mud with their hands, so as to form a kind of dyke; and had it not been for the powerful Egyptian sun, which dried up the mud so exposed within a few hours, the task would have been hopeless, as there is no known mechanical applicance to overcome an obstacle of this sort. When something like an opening had been made, and the water began to flow in, rafts were constructed, and in these the men slept, under tents made of mats. We employed about 15,000 of these fishermen. They are supposed to be of Assyrian origin. On the west side of the lake, and while the works were progressing, an alley of sphinxes was discovered, possessing the same features and type of face as the fishermen themselves. On the shoulders of one of the sphinxes Mariette Bey deciphered the name of Pharoah, at the time of Joseph, his prime minister, and who inhabited the village of Tsane, Avaris, or Tannis.

When the men had scooped out with their hands a passage of sufficient dimensions, dredging-machines were introduced, and they returned to their original occupation of fishermen. Bit by bit this trench was widened, until it reached the dimensions of 330 ft. wide, and 26 ft. deep. The banks on both sides are solid and firm. It was on these parts that dredgers with long shoots were used, of which a drawing is in the room. The shoot is 220 ft. long. The whole stands upon an iron pontoon, 107 ft. long by 28 ft. wide, and drawing $4\frac{1}{2}$ ft. of water, with 35-horse power engines.

The dredgers, with long shoots, dispensed with the expensive mode of disposing of the *débris* of the dredgers into hopper barges, and then conveying them to sea to be emptied. These dredgers have each excavated from 300,000 to 350,000 metres per annum, and some have done 3,000 cubic metres each in a day.

At the southern extremity of Lake Menzaleh, the canal quits the region of stagnant waters, and we come to Kantara, the name for bridge. This was formerly a town of importance, rivalling Pelusium, Tanis, and Rameses, and other flourishing cities on the delta of the Nile.

The caravans which conveyed to the Syrians the products of Africa, and to the Egyptians the wonders of Sidon and Tyre, and the great wealth to Jerusalem, must necessarily have passed by Kantara, then containing a population of 500,000 souls. It was destroyed in 344, by the Persians, and rebuilt by the Romans, to be again abandoned. An ancient inscription, found in the temple of Karnak, Thebes, alludes to the ancient splendour of a town in the neighbourhood of Kantara. In digging the canal, the workmen discovered nine antique lamps, of Roman origin. An old well was discovered near Kantara.

The news soon spread in Egypt and Syria that a town was being created, where provisions could be had, and, above all, fresh water; and a large influx of caravans, as in ancient times, was the result; but when the water from the Nile was brought to Kantara, an immense movement followed. During the last six months of 1864:—42,929 camels, 9,350 horses, 2,489 mules, 2,835 donkeys, 3,392 head of cattle, 23,063 sheep, and 18,575 goats. Such a traffic soon gave importance to the town, which has now a population of 7,000 inhabitants.

The influx of Europeans through the canal will not alter the Asiatic and African type of Kantara, destined to become the point of transit and trade between Egypt and Syria, as in ancient times.

From Kantara the maritime canal passes through another marsh, frequently dry, called Lake Ballah, for a distance of twelve miles, to El Ferdane, and these parts were dredged with the same means as those employed across Lake Menzaleh. It is the most desolate spot possible to conceive, absolutely barren, and without the slightest vegetation. A bank of crystallised gypsum was discovered here; lime-kilns were immediately erected on the spot, and these proved of great service for the constructions at Port Saïd. A Frenchman, who was in charge of the lime-kilns, had a hard time of it. He lived like a hermit, with a few Arabs, pitching his tent upon any dry spot he could find, and often obliged to change quarters when any inundation occurred. He went by the name of "L'Homme au Platre," but seemed perfectly contented under these trying circumstances.

From Kantara to El Ferdane the canal passes through an undulating country, where several elevations occur, and the dredgers with long shoots, which did such good service along the Lake Menzalah, were of no use here. It required an apparatus fitted to enable the silt to be thrown over these elevations; and this necessarily led to the invention of a totally different mechanical appliance, which goes by the name of the "elevateur." A plan is in the room. The dredger excavated the canal, and deposited the contents in a floating barge placed near it. This barge has six loose compartments. When these compartments or boxes have been filled, the barge quits the dredger and goes alongside the elevator. The elevator is a kind of railed bridge, starting from the level of the water, and ascending to a height of 56 feet. This aerial railway is supported by two iron posts, the one resting on a barge and the other on the banks of the canal; the whole structure being joined together by solid cross beams. The full boxes are raised out of the barge by machinery, and travel along the railed bridge till the extreme end is reached, at a height of 56 feet, and then discharge their contents on the banks, returning empty to be again refilled as before. Eighteen of these elevators, with 700 boxes, have been employed on the works in those parts of the canal where the banks were too elevated to allow the use of the long "couloirs," and where the distances from the sea and lakes was too great for the hopper barges to be used with advantage and economy.

The Lake Ballah terminates at El Ferdane, where the desert commences. This land is determined by a ridge of sand about three feet above water, a slight depression follows, the undulations become more marked, and extend along a distance of six miles. Then a sudden rise occurs, and we find ourselves in face of a mound 55 feet high and 650 feet in length. After that comes the last depression, a sort of valley descending 13 feet, and the Seuil d' El Guisr presents a veritable rampart of 61 feet high. It was necessary that the maritime canal should pass through this cutting, in order to allow the waters of the Mediterranean to flow in the vast depression which follows, and is destined to become the interior port of the canal, viz., Lake Timsah. At this point all our efforts had to be concentrated; this barrier had to be removed. A trench was cut, which enabled the supply of provisions from Port Saïd. The encampment of El Ferdane became the "victualling entrepot." Two wells were opened, which supplied fresh water, and the shrubs of the vicinity served for fuel.

The fishermen of Lake Menzaleh having accomplished their difficult task, it now remained for the Egyptian population to surmount this second great obstacle. Before

availing ourselves of the army of Fellaheens the Egyptian government had agreed to furnish for the works, it was necessary to take practical measures in advance. This operation was two-fold. It was not only a question for them to dig the canal, but likewise to carry the excavations to the summit of the embankments. Wherever a steep incline rendered the labour of wheeling up a hand-barrow severe, by a simple contrivance of making the descending empty barrow assist in drawing up the loaded one, the labour was equalised and its severity negatived. In other parts, where it was necessary to remove the soil across a dry level at great distances, strong wire ropes were stretched to posts firmly fixed at the extremities of the opposite banks, and large wooden buckets filled with earth, slung to these ropes, travelled with a rapidity regulated according to the incline, which was obtained by means of raising or lowering the ends of a lever to which the wire ropes were attached. By this contrivance, the toilsome task of removing such masses of earth by hand was considerably alleviated, and labour made to yield ten-fold what it would have done without such appliances. When all was ready, and proper shelter had been prepared, the Arabs were summoned to their work, which was apportioned with great order and regularity. The men were divided into gangs, and in each division a notice in Arabic was posted up, indicating the quantity of earth to be dug, and the wages paid per cubic metre for its completion. Besides the Egyptians, the descendants of the ancient Philistines, from the countries bordering the desert of Syria, came to join in the work, and the Bedouins also found employment.

Twenty thousand men were engaged in digging the Seuil d'El Guisr; and, pending the completion of the fresh-water canal, which had to traverse 80 miles of desert, drinking water had to be procured to supply this army of men from a distance of 20 miles, a camel's day's journey. There were 2,000 camels employed, each carrying two water casks of 25 gallons of water each. The men worked cheerfully, and were treated with justice. "If you want the birds to come," said the Imaum of the mosque at El Guisr, "you must throw bread to them. If you want the men to come, you must sow justice, and our men will work for you."

The Fellaheens having completed their task, sufficient depth had been obtained for the dredgers to take their places. But here a new difficulty arose. How to dredge a channel, and then to get the earth removed out of this hollow? No less than four millions of cubic metres had to be dug out of it. The difficulty was overcome by the invention of the excavator, or dry dredger. A locomotive engine on two rails, running parallel with the canal, formed the motive power. From the locomotive descended a chain with iron buckets, which scooped up the earth as it was drawn up the slope, and then emptied into waggons. When a sufficient number were filled, these waggons, in their turn, were drawn up to the summit of the embankment, along a succession of tramways winding at sharp angles, till they reached the top. These excavations were completed on the 1st February, 1866, amid great rejoicings. We shall now leave El Guisr, and proceed to Lake Timsah.

From the summit of El Guisr to Lake Timsah the plateau still continues, undulating for about three miles, terminating abruptly like a cliff, and here we found ourselves completely in the desert.

How impressive is that dreary, shadowless desert, with its breathless silence, its awful solitude, and its solemn repose! A tacit record of a perishing world, whose race is run, of mighty kingdoms, of tumults and wars, of pestilences and plagues, of woes and death—all swept away in bygone ages, and now entombed in this mournfully silent wilderness; reminding man of the evanescence of all earthly things, with the consciousness, in that solitude more than ever felt, that he is not there alone. There are few spectacles more gorgeous than a sunset in the desert, and very unlike what is witnessed in the north of Europe. The placid sweetness of a northern day may be said to expire gradually—a flickering twilight foreshadows its consummation long before the curtains of night are drawn round the earth's bed, bidding man to rest after the fatigues of the day; and then slowly the lamps of heaven are lighted up, and all is still as death. Whereas in the desert there is no lingering of the sun's rays. Night, black and cloudless, seems, as it were, suddenly to assume its prerogative, extinguishing the beautiful light of day, and, without forestalling its approach, dims the sunshine in the very zenith of its splendour; for in this dreary waste there is not an object to throw out a shadow which would foretell the fall of the evening. Centuries have passed over this unchanging surface, and daily the same unvarying scene continues. Here, on this hallowed ground, the wanderer's footprints leave no trace behind, to mark the spot where man has been before. Slowly our camels wended their way amidst the gloom of night, their noiseless, measured tread, unrelieved by any sound in the distance, save the occasional barking of the desert dogs, as they came rushing in upon us, and, frightened at their own temerity, disappeared in the gloom. Nothing can describe the awful grandeur of the vault of heaven at night. The eye seems to penetrate deeper and deeper, to soar higher and higher into the transparent ether, until, humbled with its limited power of vision, it wanders again back to earth, silent and meditative. There is much inexplicable to man's narrow reason, but nothing more overwhelmingly fascinating than to gaze upon those luminous orbs, the spangled firmament in that unfathomable dome, waiting and waiting in silent glory, one would almost imagine, for some awful summons to come forth.

It was in the midst of that dreary shadowless desert that a town had to be erected, and it was done. Ismailia now stands on the scene I have described, and the desert has been made to blossom like a rose.

I remember the 4th March, 1863, as a day somewhat memorable in the annals of Ismaila. M. de Lesseps and myself were having our early coffee, and I suggested changing the name of Timsah (by which the new town was then called) to Ismailia, out of compliment to the present ruler, Ismail, considering that Port Saïd was called after Said Pasha. M. de Lesseps, with that prompt action which characterises his movements, immediately called the workmen together, and, under fire of a few bottles of champagne, in the presence of an English gentleman, the Rev. E. B. Elliot, the town was rechristened Ismaïlia.

The filling of Lake Timsah required 80,000,000 cubic metres of water. When it was filled, and the dredgers floating at El Guisr were producing important results, the question was again how to get rid of the stuff. Special barges were constructed for that purpose, each capable of conveying 90 to 120 cubic metres, which were discharged on the borders of the lake.

Leaving Lake Timsah, the canal passes through a succession of small hillocks, and crosses the Seuil of Serapeum, rising 30 ft. above the level of the sea, and continuing for a distance of seven miles. This sand barrier separates the depression of Timsah (now converted into a lake) from the ancient coast-line of the Red Sea, which for centuries has been dried up.

Between Lake Timsah and Serapeum the scenery becomes most interesting. There is a hillock here, called Gebel Miriam, after the name of the sister of Moses and Aaron.

We now come to Toussoum, where the first encampment was installed. It was the centre for provisions, and all around nothing but desert. In 1860, it was already a town, and promised to become the leading city along the canal, but Ismaïlia has entirely eclipsed it. However, Toussom will not be entirely forgotten. The tomb of Sheik Ennedek, held in great veneration among the Bedouins, will always bring visitors to that spot. The story goes that this Sheik was a pious

Mussulman, possessing great wealth in lands and sheep. On his return from Mecca he renounced all this wealth, and became a voluntary exile on the plateau of Toussoum, that he might die alone and in peace. Many Mussulmans came to consult him, and the only payment he exacted was a stone from each person, and with the stones so obtained, he made his own tomb. It is very much visited by the Bedouins of the desert, and they bury their dead round the tomb.

The fresh-water canal in the direction of Suez has to run parallel along the maritime canal, in order to enable the conveyance of provisions by water to the different encampments. In 1862, 12,000 men were concentrated on the first section of the fresh-water canal, and a communication between Toussoum and Ismaïlia was effected. During the months of November and December of that year the fresh-water canal was prolonged to a distance of six miles, progressing always in advance of the excavation of the maritime canal, so that the labourers always found fresh water ready for their use—a most important matter in the desert. Three millions of cubic metres had to be dug out of these parts by manual labour, and the able contractor, M. Lavalley, hit upon a plan to bring his dredging machines over the top of those hills. It was done as follows:—As I said before, the fresh-water canal runs parallel with the maritime canal, and comes close to the Serapeum. It so happened that the natural level of this artificial derivation from the Nile, the fresh-water canal, was at the same level with the highest parts of the undulating hill of Serapeum. M. Lavelley consequently made a cutting through the intervening space, with the object of inundating these heights, and in that way introduced water, and floated the dredgers, which were ready in the fresh-water canal to come in. This contrivance did away with the necessity of a large contingent of men, and greatly expedited the work, which, with manual labour, would have been both tedious and expensive, and, in fact, presented serious difficulties. At first it was feared that the water would not have sufficient hold on the loose sand of these dunes, and that imbibition and evaporation would be too considerable for the retention of the water, and it was not without great misgiving that this bold experiment was tried. Owing in a great measure, to the circumstance of the sand here containing fine particles of calcareous matter, and the admixture with the muddy deposits from the Nile rendering the earth sufficiently impervious to retain the water, the result was that the experiment proved eminently successful.

The hollows thus filled with water from the Nile were kept isolated from the other portions of the canal until the dredgers had effected a cutting from those heights of 26 feet deep. The dams were then removed, and the water allowed to run off into the Mediterranean and Red Sea, until the sea-level had been obtained. Meanwhile the dredgers gradually sank with the receding waters, and, as a natural consequence, ended by floating on a level with the two seas. They then continued dredging until the required depth of 26 feet below sea-level had been reached. The soil dredged out was then carried away by hopper barges, and emptied into Lake Timsah. In this manner the difficult problem of dealing with the Serapeum was successfully solved, and vessels of 4,000 tons have since safely floated between these sandhills in the desert.

After Serapeum we come to the depression of the Bitter Lakes. They were separated from the Mediterranean until the necessary arrangements had been completed, by the erection of temporary weirs and sluices for the gradual admission of water.

Historians tell us that these lakes were, in ancient times, the limit of the Gulf of Suez. One thing is certain, that the shells and fossils found here are of the same species as those in the Red Sea. The conjecture the least contradicted is, that an earthquake caused the upheaving of these parts, and the sea to recede to Suez, leaving the lakes and interior basin, which in process of time has evaporated.

This depression is divided into two, which form the "Bitter Lakes;" the first, descending from the heights of Serapeum, is thirty feet below sea-level, and sixteen miles in length. The second is twenty feet below sea-level, and nine miles in length. The surface soundings taken in the latter lake, showed sand and sulphate of lime with clay more or less mixed with quartz. Those in the larger lake gave the same result, with the addition of a coating of salt of considerable thickness. In both lakes isolated water-lines of high and low tides are easily discovered, also sediments of gravel, and a horizontal bank of agglomerated fossil shells about seven inches thick. These lakes were completely dried up, with the exception of the lowest portion, which still retained sufficient humidity to make the earth moist and swampy.

When the water from the Mediterranean had flowed past the Serapeum, and its progress was arrested at the "barrage" already alluded to, orders were given for the construction of sluices, in order to regulate the flow of water in the lakes, so as not to injure the banks. It was decided that a portion should be drawn from the Mediterranean, and the largest quantity of water from the Red Sea. On the 18th of March, 1869, the sluices were finished, and ready to receive the water from the Mediterranean into the Bitter Lakes. On the 18th of April in that year, in the presence of His Highness the Khedive of Egypt, the waters from the Mediterranean entered for the first time into the Bitter Lakes.

The Emperor Napoleon and Her Majesty the Empress sent a telegram to M. de Lesseps, congratulating him on his success. Soon after, their Royal Highnesses the Prince and Princess of Wales visited the works of the canal, and expressed themselves gratified with all they had seen. At a given signal, and in the presence of their Royal Highnesses, about twelve sluices were opened, and the sea-water rushed in. They admired the arrangements, which permitted the flow of four millions of cubic metres of water in twelve hours.

It required 1,900 millions of cubic metres of water to fill these lakes. From the 1st of March till the 1st of October it was drawn from the Mediterranean, and from the 1st of July till the 1st of October from the Red Sea; that is, during six months from the Mediterranean, and three months from the Red Sea, at the rate of 40 metres per second at the commencement, and 70 metres per second towards the finish.

At the point where the depression of the Bitter Lakes ceases, the land begins gradually to rise, until it attains the height of 16 feet above water-level, and forms, in fact, the third elevation, called the Seuil of Chalouf, where the very hard bank of rock was found of 15 to 23 inches in thickness at the southern portion, and from six to nine feet below the level of the Red Sea. The other part of this rock was sunk 13 to 16 feet below the same level.

The Seuil of Chalouf is about four miles long, and then, from Chalouf to Suez, the maritime canal flows through a vast plain of about thirteen miles in length. This was a most difficult cutting, aggravated by the presence of this rock, which had to be blasted with gunpowder. Then, again, it was not possible to apply the same principle so successful at the Serapeum, on account of the immense tract of land it would be necessary to submerge to allow dredging-machines to float. It was consequently decided to excavate this part by hand-labour. Barrows along inclined planes deposited the soil in waggons drawn up by chains fixed to a steam-engine. Pumps were placed at certain distances, to carry off the water from infiltration at the bottom of the cutting into a trench to the Bitter Lakes.

In 1869, the difficulties of the desert between Chalouf and Suez were finally overcome, 75,921,270 cubic metres having been excavated; and on the 15th August, that year, the artificial barrier which separated the Red

Sea from the Bitter Lakes, then filled with water from the Mediterranean, was removed, and for the first time the two seas met. The inauguration of their union was celebrated at Suez, and, on the 28th September, M. de Lesseps steamed from sea to sea in 15 hours, all difficulties having been surmounted, and a maritime passage opened to the vessels of all nations for the benefit of mankind.

It was for this work that I abandoned all other pursuits, and devoted 13 years of unremitting labour towards its accomplishment. I remember the time when every hand was turned against the canal—when it was almost treason to advocate its cause—when scarcely a voice could be heard in its favour. All this has changed now. Success has caused popular opinion to turn. When I listened to the papers recently read at scientific institutions in praise of this great work, I often think what would I not have given for some of this a few years ago. It would have been most useful then; now that the work is finished, it comes too late.

With regard to the country through which the maritime canal is now opened, it may be said that time was when Egypt was the admiration and a proverb of surrounding nations. In learning she far excelled her contemporaries. If any knowledge was sought, Egypt was the source. If important decisions perplexed the minds of kings or councils, Egypt was appealed to, and the powerful army of the Pharaoh was looked to for protection.

Will Egypt ever be a recipient of that light which can alone restore her to true greatness? May not the contact of men of northern climes, commingling with her people, one day dispel the darkness from her shores, before those pyramids have crumbled to decay, and the symbol of Caduceus shall be shorn of all save the cross as an emblem of her faith? These are questions which time only can solve.

It is well known that the Egyptians taught with subtle argument that the Divinity must be symbolised by serpents, and fallen man obeyed their teaching but too well, for the divinity they worshipped was the spirit of evil.

The sign of Caduceus, which first originated in Egypt, became in actual fact the emblem of earth's religion in that ancient time. It was formed by two serpents, representatives of the sun and moon, and their bodies intertwined depicted the solar circle and lunar crescent, and the cross the four elements.

Although that visible sign is not now acknowledged, and man no longer bows to the idol snake, nevertheless there is a worldly worship of the serpent still.

Whatever be our outward form of religion, that subtle animal is ever there, gliding imperceptibly round our motives, retarding the progress of good, causing fear and distrust, jealousy and hatred, among men and nations. It is that deadly poison which has made man lose the perception what is due to others in the all-engrossing thought of self. It has been said that it were enough to make the very angels weep to see how we frail beings, whose life is brief as a summer's cloud, do spend it in warring with one another.

Egypt seeks no longer to be powerful or independent, nevertheless she may be great in the esteem of nations. If the hope has long since been extinguished of occupying the proud position she held before the aggrandisement of Babylon and Persia, the immediate forerunners of her decay, she may, without presumption, look forward to a time when, after resuming the gigantic work of the Ptolemies, she will open out the heart of her country to all the nations of the earth; and the present generation, from whose brow the accursed brand of the Pharaohs' rule has never been entirely obliterated, may yet live to witness a bright future dawning upon them.

It has been observed, that the first people who arrived at an advanced state in the arts of civilisation were early encouragers of agriculture and commerce, and possessed countries whose riches consisted in the produce of the soil, and that opulence and power succeed in the proportion as their condition is improved. It was this which made Egypt great and opulent. The soil of Egypt still retains all the fertility of ancient days, for those interminable unproductive wastes in the land of Goshen have assuredly not lost in richness from lying fallow since the time when "Joseph came to Pharaoh and said, —My father and my brethren, and their flocks and their herds, and all that they have, are come out of the land of Canaan; and, behold, they are in the land of Goshen." And when Pharaoh replied, "The land of Egypt is before thee; in the best of the land make thy father and brethren to dwell: in the land of Goshen let them dwell." Nor is the husbandman's arm of the present day paralysed for work.

It is impossible to traverse that beautiful land of Goshen, abounding as far as the eye can reach with vast tracts of the richest soil in the universe, lying for centuries untilled and unproductive, without feeling that this should not be, and, in the ordinary course of events, cannot much longer be. Pelusium, at one time a bulwark against powerful aggressors, has, after a lapse of ages, become in the present day the corner-stone upon which the great work of regenerating Egypt has to be commenced; but no longer in the fashion of ancient times, when strongholds were deemed necessary, and her power extended over the vast countries between Gaza and the Euphrates.

From the shores of Pelusium (Zin), whose perfect desolation attests the awful fulfilment of the prophecy in Ezekiel, "And I will pour my fury upon Zin, the strength of Egypt," and skirting Lake Timsah, which in the days of Moses arrested the progress of the Red Sea, thousands of human beings were congregated to remove that narrow neck of land which has, since Vasco de Gama, proved a stumbling-block to her progress, by isolating her shores from the commerce of the world, and rendering those resources barren which would have made her soil productive and her country prosperous.

Curious it is to follow out the working of man's ideas when supported by an indomitable will, and yet not wholly relying on his own strength. Not many years since, the shadows of a small group of Europeans might be seen, thoughtfully groping their way through the desert, with the light of science for their guide, marking the spots intended for future operations. Feeble and hopeless seemed these efforts at first, but the plans there matured were not destined to remain long hidden from the world, and by slow degrees other votaries, anxious to join in a work of universal utility, flocked to the scene, now no longer the undisturbed haunts of the hyæna and gazelle, but manifesting signs of human life, where man's voices ceases to be a startling sound, and where dwellings break the desolation of the scene. Fearfully at first, but re-assured by the mild sway which pervades over this isolated community, appeared the Bedouin of the desert, willing to lend his stalwart arms and assist in the intended work. The Fellah of Egypt, unused to seeing his labour requited, soon spread the joyful tidings, and from the shores of Syria men flocked to join in the benefits hitherto unknown in Egypt, of free and requited labour. Henceforth, the wretched homes of these people were no longer wretched, and a smile of gratitude lit up their wan faces as they gazed upon their benefactors and improved condition. Thus, with the cement of kindness and the mallet of humanity, has the first stroke been given to the corner-stone destined to lay the foundation of Egypt's prosperity. Villages soon usurped the place of solitary dwellings, and these again have grown into populous towns; and a blank, dismal waste has thus been changed into a scene fruitful with life and hope, sown on the barren sands of Egypt.

Surely this is a work worthy the ambition of men! Of these, at least, it cannot be said—"*Eheu! vitam perdidi operosè nihil agendo* (Alas! I have wasted my days in toil and have done nothing)." It is impossible to predict the advantages which may accrue from opening a maritime highway

between the two hemispheres, bringing into closer union a population of 300 millions in the western and 600 millions of souls in the eastern quarter of the globe. Can this commingling of races fail to be the means of opening a path for the introduction of that light which it is the missionary's joy to spread in distant lands, brilliant with the glare of solar rays, but o'ershadowed by the darkness of unbelief? Is it not meeting him half-way in his holy work, and preparing a stupendous revolution in the traffic of the world, by changing the geographical proximity of England's great possessions in the east?

Here we behold a mighty empire in India, gradually recovering from the staggering effects of her disasters, straining every nerve to fill up a void so deeply felt in large districts in England, where a great industry is languishing from want of the accustomed supplies of cotton from foreign countries. Her lands wonderfully adapted for its cultivation, and capable of alone supplying all that England can possibly require, but unable hitherto to occupy the void left vacant, because America has the advantage of geographical proximity; and while a fratricidal war was raging in those distracted States, the peaceable scene in the Desert of Egypt presented a spectacle which was not the less striking in its solution of those difficulties because it is silent and undemonstrative. And should the cloud regather in the west, and unhappily plunge England in all the horrors of war, her merchant ships, laden with treasure from the East, and liable to piratical seizure in their circuitous voyage of ten thousand miles round the Cape, and along a sea-board too exposed to be effectually guarded, would be shielded from such dangers by a passage through the Egyptian Canal.

Aided by every contrivance which science has furnished, we have struggled to remove this barrier which nature interposed between mighty empires, changing their relative distances, and realising results for the benefit of mankind which all the conquests in the world could never have achieved.

DISCUSSION.

Mr. John Cheetham, M.P., President of the Manchester Cotton Supply Association, said he had for a considerable time taken a very warm interest in the progress of the canal; and the Cotton Supply Association, of which he had the honour of being president, some years ago, waited on Lord Stanley for the purpose of securing the neutrality of the canal as a passage for all nations. He was afraid, however, that nothing had yet been done in this way; he hoped it would not be lost sight of. There was no doubt that the canal would be a source of profit, from the great advantage it would give of the interchange of commerce between this country and India and China, for the great cotton manufacturers of Lancashire were closely identified with India, from whence they drew a large portion of their raw material, and they also depended on India and China for the consumption of their manufactured articles. It had been said that the canal would only be useful for steamers, and this no doubt was the case, but at the present moment there were so many steamers lying at Bombay chartered from this country, and waiting to receive cotton, that they were taking freights at so low a rate as to be very little more than those of sailing vessels round the Cape. Some speculative gentlemen might say they would rather the cotton came round the Cape, because it would then reach the market at a time when it was not so closely in competition with the American supply, but consumers of cotton had no such notions. They were now obtaining their supplies from America by steam vessels, and the same feeling would influence them in bringing cotton from Bombay. Again, he had heard that day that there were some defects in the present condition of the canal, and that several vessels had met with difficulties in the passage, but he had no doubt that these points would be met as they arose, and difficulties removed. His friend, Sir Thomas Bazley, had informed him that at a recent meeting he had suggested that the canal should be widened to double its present size, and deepened, and as they could not expect the company to undertake such a Herculean task, he proposed that the great powers should come forward with some five or six millions sterling to do so. He did not believe Great Britain would be behind the other nations in such an effort, if it were once taken up; but he feared it was yet too soon to expect such a thing to be done. The capability of the canal must first be conclusively demonstrated, and then he had no doubt that whatever was required to perfect it would be readily accomplished. He must say he regretted that as a nation the English had done so little to aid in this great work, but the causes of this apathy were various. He remembered some years ago the subject being brought up in the House of Commons, when the late Mr. Robert Stephenson stated that he had travelled on foot the whole of the isthmus, and that, whereas in the works of the French *savans* it was stated that there was a difference in the elevation of one sea and the other to the extent of $30\frac{1}{2}$ ft., he found there was no difference whatever; and the argument he adduced from that was, that although the canal could no doubt be made—for it was simply a question of money—it would inevitably tend to fill up, for want of a sufficient current of water. It was now found that that eminent engineer was mistaken with regard to this point, and that there was a difference of level sufficiently great to cause such a flow of water as would prevent the result which Mr. Stephenson expected. He was followed by the late Lord Palmerston, who denounced the whole thing on political grounds. He said the whole thing was a French project, and that whoever had possession of the land adjoining the canal, by erecting batteries at each end, would be masters of Egypt, and therefore Great Britain ought not to support the undertaking. There was no doubt that Lord Palmerston was also mistaken, for it was not likely that any one country could maintain such supremacy over Egypt as to prevent communication passing between Europe and the Eastern hemisphere. At the same time, if it were possible, he should like to see the idea which the Cotton Supply Association had suggested carried out, and the canal declared neutral for all time and to all people.

Mr. Spencer Price thought that when Mr. Cheetham expressed his own feeling and that of the Cotton Supply Association of Manchester, that the Suez Canal should be neutralised, as it might be called, he must have had still ringing in his ears the words of Lord Palmerston in the House of Commons. He did not think the navigation of the Suez Canal was at all likely to be obstructed in the future, and if the powers of Europe did not feel disposed to neutralise it, England had nothing to fear. He believed that this country had by means of the Suez Canal a highway to their eastern possessions which would become of more and more importance to them. There was no doubt that for the last ten years England had been labouring under difficulties in getting at her eastern dominions by way of the Cape, and he had been much interested in reading a recent paper read by Mr. Samuda, M.P., at a meeting of the Society of Naval Architects, in which he had adduced certain statistics as to the relative positions of sailing vessels and steamers, and said that the great difficulty experienced by the latter in going *viâ* the Cape was that of carrying sufficient coal, and he seemed to think that in the long voyage to China, clipper ships might possibly be able to hold their own. He maintained that only steamers could use the canal. With regard to Bombay, there was no doubt that the Suez Canal was the direct route, as, by that means, 5,000 or 6,000 miles were saved, and steamers coming through the canal could make the voyage in about one-half the time. The argument seemed to be that ships must be

constructed to carry coal from the port of departure in England to the port of discharge, and therefore they must be constructed of such a tonnage as to carry so many thousand tons of coal as would very much reduce the profits of the voyage. He should like to know, therefore, whether it was not possible to carry coals to Suez and Aden by the canal at such a low rate as to enable ships to take in coals there, instead of having to carry them to Bombay and back. With regard to the widening and deepening of the canal, he had no doubt that something of that kind was wanted, but he doubted the necessity of making it double the present dimensions. He had no doubt that if the nations of Europe had subscribed a million sterling each, two or three years ago, M. de Lesseps and M. Lange would have been very glad of their assistance; but now that they had done without the aid of Europe, he fancied they would hardly thank them for offering money, and he should like to know whether the Canal Company were able to hold their own, or whether they would accept assistance.

Mr. Hyde Clarke regretted that Mr. Cheetham had borne so hardly on Lord Palmerston, in relation to his proceedings in connection with the Suez Canal, though he did not wonder at the author of the paper having done so. He himself had been from the first a supporter of the undertaking; and having seen, as an indifferent outside observer, what took place with regard to it, he must say that it was of great importance that it should become, not a French, but an international enterprise. Mr. Lange had truly said that M. Lesseps first received support in England, and he well remembered the enthusiasm with which the scheme was received by the mercantile community, and that enthusiasm only abated when there seemed imminent danger of its being converted into a political enterprise; and however improbable it might now appear, owing to altered circumstances, if the canal had remained under the old state of the law—the capitulations, as they were called, of Turkey with the European powers—the whole of that canal from end to end would have been practically French territory, on which no local police officer could have exercised his most ordinary functions. It was a matter of the greatest importance to Europe that such should not be the case, and for the alterations in the capitulations which would shortly come into operation they were really indebted to Lord Palmerston. Throughout the Turkish empire, down even to the present moment, the privileges granted to English merchants in the commercial ports had been perverted to such an extent that it was perfectly easy for any descendent of a European, in the fourth or fifth generation, far in the interior of the country, to put up an English flag and to defy the governor of the district and the whole of the local authorities. And the same principle would have been applied to the vast amount of territory which, thanks to the energy of M. Lesseps, had now been reclaimed from the desert, and which would ultimately become one of the most valuable assets of the canal company. It was owing to the practical mind of Lord Palmerston that such a state of affairs had been prevented, and that there was now a prospect, as he hoped, of seeing this great undertaking made one really international. He would not enter into the political aspect of the matter further than to call attention to the great services rendered by Lord Palmerston, not only to England, but to Europe at large, by intervening to prevent the confusion which might have arisen from the canal being converted into protected ground under the plea of the capitulations. The practical result was that the Viceroy of Egypt was at the present moment endeavouring to obtain the virtual abolition of the obnoxious privileges of the capitulations, and, under those circumstances, the whole territory of the canal would be under a better and fairer jurisdiction. Lord Palmerston, therefore, must not be looked upon simply as the opponent of a great commercial undertaking, but as one who defended the interests of Europe at large in this matter. It was a pity, therefore, that petty jealousy on the part of England should be spoken of in connection with the Suez Canal; it was not a matter of petty jealousy but of great political importance, and the services of Lord Palmerston in connection with it should not be overlooked.

Mr. Devonshire said that, having recently had an opportunity of personally inspecting the Suez Canal, he desired to bear testimony to the graphic description of it which had been given by Mr. Lange, and also to add his testimony to its great value and lasting importance. No one could be at Suez, and see at the entrance of the comparatively narrow canal the flags of all nations, without being struck with the magnitude of the enterprise, and with its importance as affording an improved means of communication between the eastern and western world.

Vice-Admiral Sir Edward Belcher, K.C.B., said it had been urged that in the event of war the passage of the canal might be disputed, but he believed English men-of-war had never yet encountered any obstacle which could not be surmounted. In the first place, too, any enemy other than the Khedive must possess the adjacent land in order to raise any obstruction, and if any foreign power took possession of the land, and attempted to hold it, he would soon be dispossessed by shutting up the two ends of the canal. He did not fear much on that score, therefore, though there were one or two other points of some importance which ought to be attended to. In the first place, if the canal had been constructed with a view to vessels of a certain size, those of larger tonnage should not be allowed to enter. He had noticed a statement in the *Times* that no less than six or seven vessels passing through had broken their fans, and he should like to know how that happened, because as far as he had heard there were no irregularities at the bottom, and the screw of a steamer was at least 18 inches above the lowest part of the keel. Such an accident might arise from loose piles or floating spars, or possibly from the vessel striking the ground, straining and throwing her tumbling shaft out of gear, as in the case of the *Phœnix*. It appeared to him that if vessels were constructed purposely for the canal, on the turbine principle, avoiding either paddles or screws, they would not only traverse it with more safety and at higher speed than they could do now, but, at the same time, they would keep the bottom of the canal clear. Mr. Samuda, in his paper before the Institute of Naval Architects, pointed out that on the voyage between Nagasaki and England, the great distance was not so much the inconvenience as being obliged to go out of the regular line of passage to go through the canal; that it only took 96 days now to steam from Japan; and that in coming from New South Wales clipper ships would make a shorter passage *viâ* the Cape than by way of Suez. However, he thought the world was much indebted to M. Lesseps for his great work; and he had no doubt that when the experiment had been practically proved to be successful there would be no difficulty in providing whatever funds were requisite for widening and deepening the canal.

Sir Chas. Trevelyan, K.C.B., said it was important that there should be an end to any idea of national jealousy on this subject, and he really could not understand how a channel through the Isthmus of Suez could alter the balance of power. The canal was only a work adapted for navigation, and that country which held the greatest naval superiority evidently held the key to it. Surely, if any nation had any special advantage with reference to this subject, it was England, which had a chain of military and naval stations from here to India, including Gibraltar, Malta, and Aden, which was becoming every day of greater importance. Again, it had been conceded that the principal, if not the only class of vessels which would benefit by the canal were steamers, and, however much the industries of England were declining, as some people said, it had never yet been asserted that other

nations were building better or cheaper steamboats. As to the capitulations, it was a very mixed question, but it applied equally to every European power, or if any one had an advantage it would be that country which had most trade with Egypt. On the whole, therefore, seeing that England would reap the greatest advantages from the canal, it was somewhat remarkable that it should have been projected and carried through by a Frenchman. England owed a debt of gratitude to her neighbours on that account, and he felt that if it were true that the canal required deepening or widening, France having commenced the work, England should finish it, not in a spirit of rivalry, but in the same spirit of international good-will and universal benevolence in which it had been commenced.

Mr. Jones said the French, and particularly the Emperor, had the greatest possible right to be proud of the canal, because it was in the time of the first Directory that the first idea of the canal was in these latter ages projected upon the world. A commission was sent out by the Directory to inquire into the possibility of making such a canal, with a view to going by that way back to India, and recovering from England that which had been lost in that portion of the globe. Of course, as soon as England began to speak of danger to India, all this original enthusiasm burst out again, and he believed that had been one main reason of the French coming forward so readily with their money, and carrying out the work. But no doubt those who would gain most by its construction were not the French or English, but our vast Indian population. At present they were reduced to a condition simply of agriculture, but, as everyone knew, manufactures were the great source of wealth, and it occurred to him that when a cheap mode of transit was afforded for coal to India, Bombay machinery would be able to compete with English. At the present time, coal at Bombay cost £2 10s. per ton, but even at that price the cotton mills there paid a small dividend, and if the Suez Canal reduced the price of coal, as he apprehended it might, to something like 35s., it would enable them to pay such large dividends that an immense amount of capital would be embarked in the manufacture, and Lancashire would have to go to the wall.

Mr. Lange, in reply to the various observations which had been made, said that two out of the seven vessels which were said to have met with accidents in their passage through the canal, the *Hooghly* and the *Imperatrice*, belonged to the Messageries Imperiales, who, on being communicated with, said they did not attribute the accident to the canal in any way whatever. With regard to the other five vessels, their existence was a myth, the report having been copied into the *Times* from another paper, against which proceedings had been commenced.

Mr. George Campbell said that Sir James Elphinstone had given a very circumstantial account of accidents to several vessels not belonging to the Messageries Imperiales.

Mr. Lange said he did not remember the circumstances; he was referring simply to the report mentioned by Admiral Belcher. With regard to Mr. Price's question about coals, he could only say that Port Saïd and other ports were open to all the world, and it would depend on competition what price was obtained. At Port Saïd coals had already fallen to about 35s., and he believed that they would ultimately be much cheaper. With regard to making the canal neutral by international treaty, it was well known that the Cotton Supply Association made an effort in that direction some time ago, but they were rather premature, for, as Lord Stanley had told himself, diplomacy could only take cognisance of accomplished facts, and nothing, therefore, could then be done. However, he considered it of the greatest importance to England that this neutrality should be guaranteed, and he had, with the consent of M. Lesseps, done all he could to that end, but, as he had said, it was then too early. At present the canal was simply kept open by an arrangement between three parties, the Sultan, the Khedive, and M. Lesseps, and either one could, if they took it into their heads to close it, do so, therefore it would be much better to have the canal guaranteed by international treaty. He had read with great interest what had taken place in the India Council with regard to making a donation towards improving the canal as a means of obtaining a share in it, and he only regretted it could not be done. He being the only English director, had all along done his best to induce his countrymen to take a share in the enterprise, but had not been successful, and now his colleagues would not hear of any such scheme as had been suggested. If England were to offer millions not a farthing would be accepted. The irregularities in the canal, which were fully described in the most admirable report recently made to the Admiralty by Captain Richards and Colonel Clarke, in some parts the depth being greater at the sides than in the middle, were being removed, and arrangements had already been made with the Admiralty for the *Jumna* and other troop ships to pass through. It was also hoped before the end of the year to remove the angles, which were rather inconvenient, particularly towards Suez. The expense would be about £320,000, and this it was believed would be provided out of profits. On the 14th March he received a letter from M. Lesseps, in which, speaking of the proceedings at the Conference held by the India Committee of the Society of Arts, he said—"I see at the same meeting there is an idea put forward that the great governments of Europe and America should provide each a million sterling towards the perfection of the canal. I regret that you did not feel yourself authorised at once, as you know you always are, to repeat to the members who composed that assembly that I had declared in your presence and written you that the company does not need any funds to ameliorate the situation of the canal, and that its funds suffice for all present exigencies for the general passage of navigation. The company has the intention and the certitude to suffice, by its own resources, for all necessities, and governments are in no way to interfere." M. Lesseps had always had an objection to government interference, and he was surprised that it should still be said that the Emperor Napoleon had helped forward the undertaking. In the first place, there was no man in France more indifferent about the matter than the Emperor; so much so, that when the English representative at Constantinople had Lord Palmerston's instructions to interfere in the matter, M. Thouvenel could not get from the Emperor a single line in opposition to that action. No doubt, when it was found the canal was a success, and that there were 25,000 French shareholders engaged in it, the Emperor thought it was time to pay some attention to the matter, but he had often told M. Lesseps, "You are making this canal for England, but with French money." At the eleventh hour he believed England would be glad to have a share in the undertaking, but at present he could only say they must wait and watch the progress of events and the development of the canal.

The Chairman, in proposing a vote of thanks to Mr. Lange, said he was fortunate enough to be present at the opening of the canal, as representative of the Royal Society, and he could only speak of it in the highest possible manner, not so much for the engineering features, though they were by no means common-place, but as reflecting an amount of credit upon a single individual such as had scarcely ever been earned by one man before. Three things were necessary for greatness, self-reliance, courage, and perseverence, and no man, so far as his character could be read by the difficulties he had overcome, and the feats he had accomplished, possessed these qualities in a higher degree than M. Lesseps. The hour was too late for him to make any remarks upon the undertaking itself,

except to express his great admiration of it, and his firm conviction that those who lost their screws or broke their fans did it through bad steering, and not from any defect in the canal, though it certainly was yet far from perfect. Nevertheless, it even now afforded sufficient accommodation for carrying the commerce of the eastern and western hemispheres, and his firm conviction was, not only that it would remain open as long as civilisation lasted, but that it would be commercially remunerative. Certainly England had not supported it much beyond that approbation which the commercial community had always bestowed upon it, and, therefore, a great obligation was owing to France for carrying through a task of such magnitude. At the same time, Mr. Lange, who had devoted thirteen years of his life to this great work, must not be forgotten, and indeed there could be no doubt that his name, together with that of M. Lesseps, would be handed down to posterity as one of the greatest benefactors of mankind.

INSTITUTION OF NAVAL ARCHITECTS.

By permission of the Council the meetings on Thursday, Friday, and Saturday, April 7th, 8th, and 9th, were held in the Great Room of the Society. The following condensed report of the proceedings is continued from last week:—

Thursday, April 7th.

The Right Hon. Sir John Pakington, Bart., M.P., G.C.B., *in the chair.*

LOAD DRAUGHT OF MERCHANT VESSELS.

Report of the Discussion on Mr. W. W. Rundell's Paper.

Mr. J. D'Aguilar Samuda, M.P., asked for an explanation of how the freeboard, the three-tenths of the displacement, could ever be under that given by Lloyd's rule, which allowed 3 in. of freeboard for every foot of hold.

Mr. Rundell observed that there was the thickness of the floors and ceiling, which would have to be taken into account, in addition to the depth of the hold, which was the registered depth. There would also be variations of shape and capacity sufficient to account for the difference.

Mr. Lamport said the object was that the vessel should do her work in the best possible and safest manner when conveying cargo from one part of the world to another. The strain upon a vessel in a sea-way depended a great deal more upon the disposition of the cargo than the actual weight of it in reference to the capacity of the ship and the amount of freeboard. In an equal scale, a pound weight on each side would balance, and produce an easy, equable, and safe motion, but with a steelyard, the long arm of which was ten times as long as the short one, there would be 1 lb. on one side, and only a tenth part of it on the other. When a ship, which was at a certain load-line when in dock, came to get into a sea-way, she would be subject to enormous strain. It was difficult to fix any arbitrary rule. There was a difference of about 3 per cent. in the buoyancy when the vessels got to sea. One great cause of the overloading of vessels was the desire to economise freight by compressing goods exported to foreign countries, which was done by hydralic power. Mr. Rundell had spoken exclusively of sailing-ships and not steamers. A steamer which carried her coals with her out and home (as Mr. Samuda said she ought to do) would be daily lightening herself to a considerable extent. All vessels could not be put to the same crucial test. Another point was, the length of time a ship had existed. Iron vessels were constantly shelling off oxidated matter, the plates became thinner and thinner, and the strength less and less. Again, was a ship built by firms of high character to be placed in the samo category as a ship built by some unknown person?

Mr. John Dudgeon said the question was whether they were to be tied down by a set of arbitrary rules, when by constructing a vessel in a scientific and judicious manner they could render it impossible for the water to come on board. The President of the Institution, in his address, had, though no doubt unintentionally, cast a stigma upon the constructors of ships in Great Britain, with reference to the losses which had occurred during the last year from vessels foundering at sea. In truth, the constructors were not to blame. An iron ship should be so built that the bottom was sufficiently strong to carry the whole superstructure, which should be in the nature of a roof to it, and that would settle for ever the question of vessels foundering at sea. There was no sea and no force of wave that could penetrate a plate of iron an eighth of an inch thick. Another point was, that the steerage power of vessels, as a rule, was not good enough. The method of applying the power to the rudder, especially in single screw steamers, was such that it was not quick enough to meet the necessities of the sea. In twin screw vessels that defect was remedied to a very great extent.

Mr. C. H. Wigram said everybody must feel that it was much easier to find fault with a rule than to find a remedy. The rule proposed did not essentially differ from that now in existence, namely, Lloyd's rule, which regulated the draught and height of freeboard, and a departure from the present understood rule would simply be perplexing matters uselessly. The method pointed out would not be available for steamers in which the draught varied so quickly. It was an admitted principle that steamers could be loaded deeper than a sailing ship. But the stowage of the cargo was a matter of much importance. Everybody accustomed to the stowing of ships knew what difficulties there were to contend with; but a great deal of damage and injury arose from sufficient attention not being paid to the stowage by captains and owners.

After some remarks from **Mr. Henwood** and **Captain de Horsey**,

Mr. Samuda said something ought to be done, and if any investigation could take place, having for its object the acquirement and dissemination of much more general information as to the course to be followed by shipowners with regard to this great question, that should be the great aim which such an inquiry ought to have; but in an early stage, by actual restriction and legislation, to draw a hard and fast line to cut away that responsibility which ought naturally to attach to certain persons, would be unwise.

Mr. J. Scott Russell said all were agreed that any good practical shipbuilder would build an unsinkable ship, if that were required. But what would become of all the poor insurance brokers and a great many other people? Their trade and occupation would be gone. Shipbuilders could build ships which seas could not hurt, and he was satisfied that with iron they could beat water any day. Taking that as an axiom, the next point was to ensure an intelligent and well-informed captain.

Mr. W. M. Fenning said he was an underwriter at Lloyd's, and had suffered in pocket in consequence of the uncertainty of the regulations as to loading vessels, which materially affected their safety. For somo reason or other, the losses at sea of vessels had been very much more frequent during the last three or four years than they had been within the previous fifteen or twenty years. Ever since the last cyclone at Calcutta, the weather seemed to have changed throughout the globe, and there had been nothing but a succession of storms everywhere. That might account, to a certain extent, for the unusual increase in the loss of shipping. But there was another cause, and that was overloading, and unless that were dealt with, the losses would go on increasing. An owner who did not overload his vessels

could not suffer by any law passed against overloading vessels, but would profit by it, for underwriters would charge less premium. An objection had been raised to fixing a load line on the ground of the difference which existed with regard to salt and fresh water. That difficulty could be overcome by loading the vessels 9 in. deeper when in a fresh water dock, so as to make an allowance for the additional buoyancy when at sea.

Mr. Rundell having replied,

The Chairman said the subject was a very difficult one, but, having regard to the frightful loss occurring from day to day both to life and property, it was time that there should be some authoritative investigation. No doubt the casualties would be very much diminished if captains took care that their vessels never went to sea over-laden. The discussion had been most interesting and useful, and he hoped it would be productive of good results.

Evening Meeting, J. Scott Russell *in the chair.*

THE EXPERIMENTS RECENTLY PROPOSED ON THE RESISTANCE OF SHIPS.

By C. W. Merrifield, Esq., F.R.S.,

Principal of the Royal School of Naval Architecture and Marine Engineering.

I think it desirable that the Institution of Naval Architects should be exactly informed as to the position in which this matter now stands.

At the meeting of the British Association at Norwich, in August, 1868, I read a paper "On the Necessity for Further Experimental Knowledge respecting the Propulsion of Ships." In that paper I pointed out that the experiments which, in my opinion, were most urgently needed as a proper basis for theory were direct experiments on the traction and propulsion of full-sized vessels of usual type; and I applied to the British Association to form a committee to discuss the means of carrying them out. A committee was appointed to consider the matter, consisting of Mr. Bidder, Captain Galton, Mr. Francis Galton, Professor Rankine, Mr. Froude, and myself. Besides the question of propulsion and resistance, the association added to the subject matter of reference to the stability and sea-going qualities of ships. A copy of our first report, which was read at the meeting at Exeter last year, has been sent to every member and associate of the Institution.

On the question of resistance, the majority of the committee adopted my view of giving the preference to experiments on full-sized models.

It happened, however, that Mr. Froude had been engaged independently in the prosecution of those important experiments upon models, some of the earlier results of which appear in our former volumes of *Transactions.* Before the report of the committee had been presented to the British Association in August of last year, Mr. Froude had already memorialised the Admiralty to give him assistance in carrying out a large series of experiments on the resistance of models and on their rolling; and this proposal of his had already received favourable consideration from the Lords Commissioners of the Admiralty, although no immediate action had been taken upon it. The difference between Mr. Froude's views and my own are summarised by himself in the explanations which he has added as an appendix to our report to the British Association. On the 27th September, 1869, I addressed a letter to the secretary of the Admiralty, proposing the experiments recommended in the report. To this the Admiralty have returned the following answer:—

"Admiralty, S.W., 9th February, 1870.

"Sir,—With reference to your letter of the 28th September, 1869, I am commanded by my Lords Commissioners of the Admiralty to inform you that, after full consideration, they are unable to give a general assent to the proposal of your committee to conduct experiments upon her Majesty's ships in the fiords of Norway or on the inland waters of the west coast of Scotland; but my Lords have been pleased to sanction certain experiments upon models, to be conducted by Mr. Froude, a member of the committee, and will cause the results of those experiments to be communicated, when complete, to the Institution of Naval Architects, the British Association, and such other professional bodies as to my Lords may seem desirable.

"I am, Sir, your obedient Servant,

"(Signed) Vernon Lushington.

"C. W. Merrifield, Esq., F.R.S.,
"Secretary to the Committee on Stability, &c.,
"of British Association."

Although I still adhere to my preference for experiments on full scale, as being those which are most directly needed in the present state of the science, I feel that I can acquiesce with very good grace in the substitution for them of a set of valuable detailed experiments upon models, conducted under such superintendence as we may depend upon these receiving from Mr. Froude. We have far too much to learn not to be glad of any carefully-conducted experiments on the resistance of ship-shaped forms, whatever may be the absolute dimensions of the subjects of experiment; and it is quite conceivable to me that experiments performed on models of the same shape, but of varying absolute dimensions, may lead to a knowledge of the relations to be observed between speed and magnitude, in order to secure corresponding performance. The present theory is, that the velocities should vary as the square roots of the lineal dimensions when the resistance of vessels of different sizes is to be compared. There is reason to believe that the comparison under these conditions very fairly represents the facts; but we are at present very far from knowing how nearly this law approaches to the truth, or what are its limitations. I look forward with interest to Mr. Froude's experimental investigations as likely to throw much light upon this point, as well as to give us other very valuable information.

I feel a very strong conviction that the final discussion of his results will bring out in a stronger light than ever the necessity of supplementing our knowledge by experiments upon full-sized ships.

Friday, April 8th.

Vice-Admiral Sir E. Belcher *in the chair.*

ON THE LAW OF RESISTANCE OF ARMOUR PLATES, COMPOSED OF ONE OR MORE THICKNESSES.

By Sir William Fairbairn, Bart., LL.D., F.R.S.

In my last paper, read before the Institution of Naval Architects, March, 1869, I endeavoured to establish the following laws of resistance of armour plates to a continuous statical pressure, analogous to that which is produced by the force of impact.

1. That the ultimate pressure varies as the product of the diameter of the punch by the thickness of the plate, that is, $P \propto 2rt$.

2. That the work requisite to perforate a plate varies as the squares of the thickness of the plate, multiplied by the diameter of the punch, that is, $U = Crt^2$; where the constant C, in the case of statical pressure, by punching 10,640, and, in the case of flat-ended steel bolts, discharged from cannon, the constant $C = 24{,}400$, or about $2\frac{1}{4}$ times the value of the constant in the former case; and that this accumulated work, lost or expended uselessly in the latter case, was due to some or all of the following causes, viz., to the work expended in distorting the shot; to the shot breaking up a larger perforation than the net diameter of the shot; to some other injury done to the plate besides that of simple perforation; to the oscillations or recoil of the armour plate upon being

struck by the shot; or to the want of directness in the line of impact.

3. That the ultimate pressures on the flat-ended punch, and on the round-ended punch, requisite to perforate a given plate are nearly the same, but that the work expended in the former case is considerably less than in the latter; and hence it followed that, other things being the same, the flat-ended punch, or the flat-ended bolt—in the case of guns—is more destructive than the round-ended punch or bolt, as the case may be.

In the present paper I purpose to show the advantages, if any, derived from having the plates (1) supported by an oak backing, and (2) from having double armour plates in the place of single solid ones. It will be seen from the results of the experiments, that a great advantage is gained by the use of the oak backing, both as regards the ultimate pressure requisite to produce rupture, as well as the work expended in perforation. And, comparing the strength of the double plates with the single ones, under the same conditions, whilst the ultimate pressure in the former case is somewhat less than in the latter, yet the work of perforation expended on the double plates is greater than that expended in the single ones, so that it may be a question open to further experiment how far these results are borne out by experiments with ordnance. The experiments with the flat-ended and point-ended punches fully confirm the law before found relative to the higher destructive powers of the flat-ended punch or bolt, as the case may be.

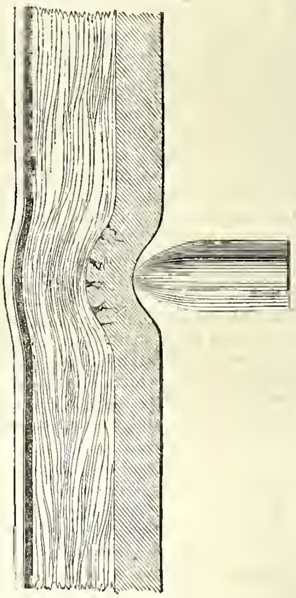
Although it may be desirable that further experiments should be made on a large scale, yet it may be fairly stated that the labours of the Iron Plate Committee, during the four years of its sitting, were most praiseworthy, and that the results obtained were most important, both as regards the properties of armour-plates as applied to ships of war and forts, and the strength and power of guns.

In the course of these experiments, the armour plates were first strengthened with a timber backing, then with iron, and finally, with cushions or buffers of india-rubber and other compressible materials calculated to soften the blow of the shot; but all of these contrivances were abandoned for a solid teak and English oak backing, averaging from 9 to 10 in. in thickness. It was found that the face of the backing to which the plates were attached should be sufficiently strong and unyielding, not only to maintain the plates in position, but also to prevent them from undergoing any violent jar from the collision of the shot. When such supports were not employed, every shot broke the bolts at the nuts, and also injured the armour-plates as well as the inner skin, representing the sides of the ship, to which they were attached. In ships of war it has been found necessary to increase the thickness of the skin of the ship, to which the armour plates are attached, from $\frac{3}{4}$ to 1 in. thick, and, in some cases, it was found essential to have an additional lining of plate from $1\frac{1}{4}$ to $1\frac{1}{2}$ in., which was united to plates on edge intervening between the joints of the wood backing, so as to form a strong bed or compressible cushion, to soften the blow from the shot as it impinges on the face of the armour plate.

The object of the present experiments may be regarded as supplemental to those already recorded, being chiefly instituted, as I have already stated, to determine the numerical advantage of the oak backing, and to ascertain the strength of double armour-plates as compared with the single armour plates. The results of these experiments—which were carefully made—are recorded in a series of tables. [These tables will appear in full in the published *Transactions* of the Institution.] The formulæ expressing the laws of resistance, &c., as on former occasions have been deduced from the experiments by my friend Mr. Tate.

It might be interesting to compare these results with those derived from the impact of shot where the indentation and work done are nearly the same in both cases. The law of resistance of wrought-iron plates to perforation by statical pressure has, to a great extent, been established by the experiments recorded in the reports of the Iron Plate Committee. They were all of them, however, conducted on single plates, and without backing, whereas those in the present paper are made up on both single and double plates, and the perforations effected against a solid steel disc in the first instance, and a cushion of hard oak in the second. From this it will be noticed that the indentations are much greater against the backing which yields to the pressure in form analogous to that produced by the impact of shot. It is quite evident that a perfectly rigid unyielding backing would be a great support to armour plates, as shown in the the late experiments on the Fort Target, where three thicknesses of plates were employed, with intermediate spaces filled with iron cement, and forming a thickness of more than 2 ft. This construction is, however, not applicable to ships of war, and hence the usual teak or oak backing must be resorted to, in order to prevent the breaking of the fastenings.

In the perforation of plates against wood backing the deflection of the plate, whether produced by statical pressure or by impact, is, as near as possible, the same, and may be described as follows:—Supposing an armour plate, attached to the side of a ship, with a backing of hard teak, as shown in the annexed figure. In this



position, when struck by a spherical shot, a large area of the plates is deflected forwards into the backing, as shown at A, as may be seen in the every-day experiments at Shoeburyness.

In the experiments recorded in this paper the results as to the deflection of the plate were nearly the same as those produced by shot, and hence the increased depth of deflection under circumstances where the yielding medium of support is wood.

ON THE TREATMENT OF IRON MASTS BY SAILORS OF THE MERCHANT SERVICE.

By William Symington, Esq.

The drawing, page 539, represents a transverse section at the mainmast of a ship of about 1,600 tons register, with three decks. The mainmast is 90 feet long by 32 inches diameter at the middle deck, and made of $\frac{7}{16}$-inch iron plates, with three internal angle irons. It is wedged with pitch pine at the lower and middle decks

as is the universal custom in the merchant service. It is likewise supported by six shrouds of 5-inch wire rope on each side, the breaking strain of each shroud being 38 tons, and the Admiralty test 28 tons 6 cwt. Now I think I shall be able to prove that this mast must break, in consequence of the wedging at the middle deck, long before a strain of 10 tons can come on each shroud.

It is the usual practice, in London and Liverpool, to "set up" the rigging a short time previous to the ship leaving dock on an outward-bound voyage, and this work is generally done under contract by the riggers, under the nominal superintendence of the chief officer; I say nominal, because that officer is usually too much occupied with his cargo to be able to give the necessary attention to such an important matter, therefore the riggers are pretty much left to themselves.

The operation of "setting up" may be described thus:—A luff tackle and runner are generally applied to the lanyard, and a good strain is hove on the shroud—say to about five tons. When the shroud is considered sufficiently tight, a spun yarn "racking" or strand "nipper" is applied, to temporarily secure the lanyard, and the tackle is let go; immediately there is a considerable decrease of tension before the "nipper" or "racking" will bite; afterwards the end of the lanyard is secured above the dead-eye, the racking taken off the lanyard, and again there is a considerable decrease of strain, until finally there is usually less than two tons tension on the shroud of a 1,000 or 1,500 ton ship. If we consider that this work is done by contract, very often hurriedly and slovenly, it will be conceded, I think, by most sailors, that I have not misstated the amount of strain on the shroud of a 1,000 or 1,500 ton ship.

The vessel leaves the dock with the rigging thus "set up," and whatever may be the actual tension in tons on the shrouds, it appears to me no further, or at least a very limited, increase of strain can come on the rigging of an iron mast, wedged at the decks, during any weather at sea, or however much the ship may roll.

Probably no one will deny that wire rope will stretch very considerably before being permanently injured. And here I would remark that I regret much being unable to furnish direct proof of the amount of stretching; still, I have given much attention to the subject, and made rude experiments, which enable me to say that a five-inch wire rope will stretch one foot in 100 feet with the greatest safety, and almost retain its original length.

FIG. 1.

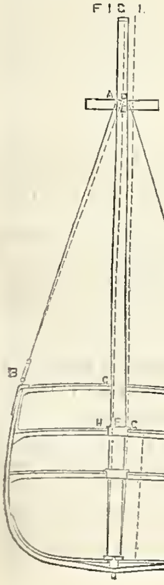
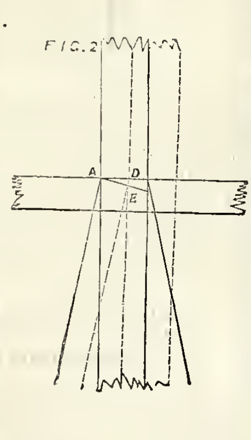


FIG. 2.



In the drawing, I have considered the wind as blowing from the port or left-hand side with a force sufficient to throw the mast into the position of the dotted lines, presuming that it is not wedged. This deviation from the perpendicular may be measured by A D at the hounds equal to nine inches, and such a position would necessitate an increase of length of shroud equal to D E = 2·79 inches, and the length of F G at the middle deck is 2·61 inches; so that in this particular instance, practically, we may say that as the shrouds stretch so will the increase of length almost equal the distance F G at the middle deck if the mast is not wedged at any deck. However, as it is so, it may be considered a rigid, inelastic, unyielding structure, with but an extremely limited room for displacement; and consequently I am at a loss to conceive how any increase of strain can come on the shrouds, however much the pressure exerted by the wind in the direction of the arrow. If my statement of the tension on the shrouds at leaving dock is nearly correct, it will require but a very few tons more strain to stretch the rope 2·79 inches, and the consequence is, the mast is broken off by the first butt above the middle deck long before the rigging is subjected to half the Admiralty test proof of strain. Whereas, had there been no wedges, the mast would have been perfectly safe by the support of the rigging, and infinitely stronger than a wood one.

The fact that so few iron masts have given way is, to me, an incontestible proof that they are immeasurably stronger than wood ones. Let them be fairly and scientifically handled by sailors, and I venture to say that we shall hear no more of the loss of iron masts. If a wedging is desired, let it be made of massive india-rubber, or in a manner similar to the spring piston ring, so familiar to engineers, and then the masts will have play at the decks, and, as a consequence, the ship will be much easier under a press of canvas.

Marine surveyors usually tell us that "you will always find the first signs of weakness in a ship in the wake of the masts," and if you asked, "Why?" will reply, "Because of the strain on the rigging." With all respect and deference to their skill and experience, my opinion is, that if we take away the wedges at the masts, we shall get rid of most of the weakness now so easily observed there even in the best of ships. I believe the practice of wedging to be a barbarous and unscientific custom, as useless as it is injurious.

Captain Selwyn said he knew many surveyors who dealt with iron masts in the same way as they would deal with wooden ones. Masts ought not, if properly proportioned, to require rigging at all, but should be considered as part and parcel of the ship. With regard to iron, no doubt there were difficulties as to elasticity which required experiment, but there was what might be called mild steel, which would enable shipbuilders to put tensile strength, resistance to crushing force, and elasticity where required.

Mr. J. Scott Russell thought great care was necessary to give masts the full benefit of the rigging, and the mode proposed was the right way of accomplishing that object. In setting up the rigging of iron masts, he had used a small double screw by the application of a winch. There should be an equal strain on all the rigging. Iron masts had one great fault, which was their extreme rigidity. Wooden masts would bend three feet at the two ends, but iron masts would not bend more than three inches without being in danger. If the strain upon wooden and iron masts were equal, the wooden mast would gain help from its supports by bending over two feet, or three feet, but the iron mast, not bending more than an inch or two, had not the same advantage, and would be crippled. The cushioning of masts with india-rubber was a very good plan, but required care and judgment in its application. It was desirable to make the masts an integral part of a ship. It was important

that ships of peculiar armament should get rid of numerous odious incumbrances about the edge, which, if the practice of running down were to be adopted, would be very inconvenient and disastrous. He would advise any shipbuilder about to try the experiment to make the base of his mast on a bulkhead.

Captain de Horsey said, throughout his service he had noticed how cruelly wooden masts had been crippled, not only by the slackness of the rigging, but by pulling the mast back from the rigging over the bows by the stays. If that were the case with wooden masts, it would be more so with iron, which was perfectly unsuited to such a strain. Captain Selwyn had suggested that masts should stand without rigging, but it was really not practicable to get a mast without rigging, unless of inconvenient size and enormous weight, which would bear a press of sail. He would like to see a mast treated simply as a derrick, aad supported by good rigging.

Mr. Lamport said he agreed with what had been said as to the folly of making an iron mast rigid at the partners, or indeed anywhere else. A mast of a certain length and size (the calculations of which he had made in a paper at a previous session) if made as a rigid structure and as a lever, the fulcrum of which was attached at the bottom, would break with a strain of seven tons; but if set perfectly free, and dependent altogether upon the sustaining power of the shrouds, the same mast, as a derrick, would support a force of 500 tons. But one of the great disadvantages of making masts integral parts of a ship, where the leverage was very great, was that that leverage exerted a most pernicious effect in the structure of the vessel itself. There was another disadvantage, because if the effect were to throw the elasticity (and there must be some elasticity) upon the structure itself, and not on the toe of the mast, depending upon the shrouds, the result would be that the mast would bend. He agreed with what had been said by Mr. Scott Russell as to the yards, and believed that the mainyards particularly were frequently carried away by the braces at the two ends not sustaining an equal and proper division of labour. They were also carried away by the yards going round when the whole strain was on one side. The simple mode of rectifying that was that which had been mentioned by him in his paper, printed in vol. iv. of the *Transactions*, and he could not tell why it had not been carried out. Making a mast an integral part of a ship might be an advantage in a ship of war, but not in the mercantile marine; and he hoped that the interests of the mercantile marine would not be sacrificed for the exceptional requirements of a ship of war.

Mr. Bramwell said one difficulty occurred to him. A mast was to be prevented from going sideways over the vessel. Mr. Scott Russell had suggested making it a part of the vessel, which would prevent that. On the other hand, it had been suggested to do it by the shrouds, and not to make it part of the vessel, and it was said that would prevent it, and that the one way would produce less strain upon the ship than the other. That was not so, because in whichever way it was done, the strain upon the sides of the ship would be the same.

Mr. Murray said a question had been raised as to whether an iron mast could be made sufficiently strong to support itself without shrouds. Mr. Scott Russell had spoken of a curve. He quite agreed with Mr. Russell, that if such a curve were adopted as was used by engineers in erecting lighthouses, there would be no difficulty, in an engineering point of view, in making a mast of considerable height quite strong enough to support itself without any shrouding. It would be necessary to carry down the foundation of the mast from the deck to the keel of the ship, and it would have to be done on a wide and extended base. He would recommend two bulkheads, one before the other, with partitions between them, so as to form a square in which the mast would rest on the deck.

Mr. Grantham said he was not disposed to approvo of the mast without the rigging, as the rigging appeared to be the simplest mode of gaining strength. It was not at all uncommon to see a ship with three masts, and six or eight shrouds on each side of the masts, with back stays and other things—in fact, a mass of rope, and, very strangely, those had been transferred to an iron ship.

ON THE COMPOUND MARINE STEAM ENGINE.

By Arthur Rigg, Esq.

Compound engines of various kinds have been made ever since Mr. Hornblower took out his patent in 1781, but they differ less in their general principles than in the number and arrangement of the cylinders, and other mechanical details. They were originally used for pumping at the Cornish mines, but experience proving that they possessed no real advantages over single cylinders, they have fallen into disfavour, and gradually into disuse. Indeed, when it is considered that the power of such pumping engines is not expended in raising water in the first instance, but in lifting ponderous rods whose descending weight raises the water, it is obvious that a sudden and very extreme pressure at the beginning, which gradually reduces by the expansion of the steam, is an advantage in the single engine, and not a demerit. For this extreme pressure takes place at the proper moment for overcoming the inertia of the rods; and the space through which they must be raised ought to be completed when the expanding steam has reached the practical limit of its power. Very high degrees of expanson are not advantageous; for more is lost by weakening the engine, extra friction, &c., than is gained by economy of coal, and it seems to be the conclusion of much practical experience that an expansion to about eight times the original volume, with steam of the average pressures, gives the greatest efficiency with the Cornish pumping engines.

When engines are required for marine purposes, this varying pressure upon the pistons becomes an insuperable obstacle to high expansion in one cylinder, for an uniform power is of the utmost value, not only to improve the propelling power, but also to avoid the disastrous consequences of frequent irregular strains upon the machinery.

In order, therefore, to secure the economy resulting from high degrees of expansion, along with a uniform strain upon the machinery and a regular driving power, compound engines are the best for marine purposes, and are rapidly coming into general favour; many old engines are being compounded, and few new ones are constructed on any other principle.

The usual type of compound engine is that represented in the engines of tho screw steamship *Kepier*. These engines are made by Messrs. Richardson and Sons, of Hartlepool, from the designs of Mr. G. W. Jaffrey; and they form one of the best examples of modern practice in this class of compound marine steam-engines.

The high-pressure cylinder is 25 in. diameter, and the low-pressure cylinder 43 in., both having the same stroke, 26 in.; and their cranks are set at 90° with each other. The smaller cylinder is provided with an expansion-valve, by the use of which the best practical degree of expansion can be ascertained. Surrounding this cylinder is a large open space, into which the steam passes on its way to the second cylinder, and is permitted to accumulate until the valve of the low-pressure cylinder opens to admit it therein. Tho capacious character of this receiver exercises a most beneficial influence in preventing back pressure.

In the high-pressure cylinder, steam is cut off by the expansion-valve at points below $22\frac{1}{4}$ in., which is full gear, but in the low-pressure cylinder the expansion

begins invariably at three-fourths of the stroke—the total expansion in both being as 1 to 6·77 times the original volume.

Each piston has two piston-rods, giving great stiffness and a most convenient crosshead.

In order to start this class of engine, it is necessary to admit steam direct from the boiler into the larger cylinder by a pipe, shown on the drawing, and marked "starting valve," and without this arrangement it would not be possible to manage such engines, and even with it there is at times a difficulty in starting some of them.

Another type of compound engines results originally from the conversion of old engines merely by the addition of high-pressure cylinders above the existing cylinders, prolonging the piston and valve-rods, re-arranging the steam passages, and using the original gear. By this system two separate independent compound engines are made, each using the same condenser. One of the original air-pumps is used still for the same purpose, and the other becomes a circulating pump for the surface condenser.

A similar type to the last has only one high-pressure cylinder, and both pistons are on the same piston-rod, and act upon one crank.

For all marine engines of moderate size this would be the cheapest, most compact, and best arrangement; but from the difficulty of starting and reversing consequent upon the dead centres of the single crank, many plans have been tried for overcoming this difficulty, even to the cumbrous one of a large fly-wheel, which is of no use when the crank stands upon its centre. The fly-wheel, too, is a considerable increase to the load a vessel has to bear. First, its actual weight reduces the cargo that might be carried; and, secondly, it offers resistance to the easy motion of the ship.

Such a fly-wheel resembles nothing so closely as an enormous gyroscope, mounted upon an admirable universal joint. It is well known with what energy a little gyroscope resists attempts to change its plane of rotation. So likewise, but on a far vaster scale, the operation of the fly-wheel resists the freedom of pitching, and throws a very heavy strain not only on the bearings of the engine shaft but also upon the ship itself. The resistence to pitching and the strain on the engine shaft and ship framing consume power, and therefore reduce progress. Now, since power is derived from the engine, it may be expressed in terms of the coal consumed. The fly-wheel then, under these circumstances, is an appliance not only imperfect, but actually injurious to the engine, the ship, and the speed.

A method of turning the crank over the dead centre should be light and simple, worked by the usual handles, and provide a store of power that will enable the engine to start from whatever position of the crank it may have come to rest. In short it ought to give to the single-crank compound engine the same uniformity of driving power as may be now obtained by the compound engines above referred to, with the cranks set at right angles to each other. An apparatus of this kind has been contrived and successfully used by Mr. Mac George, of this city, and the author of the present paper, and the principles of its action will be described further on.

The first inquiry of interest will be to ascertain the best grade of expansion to use with steam of the usual pressures, avoiding both extremes, namely, the waste of steam containing useful energy, or the carrying expansion so far as to reduce the power of the engines below that which their size and cast ought to furnish.

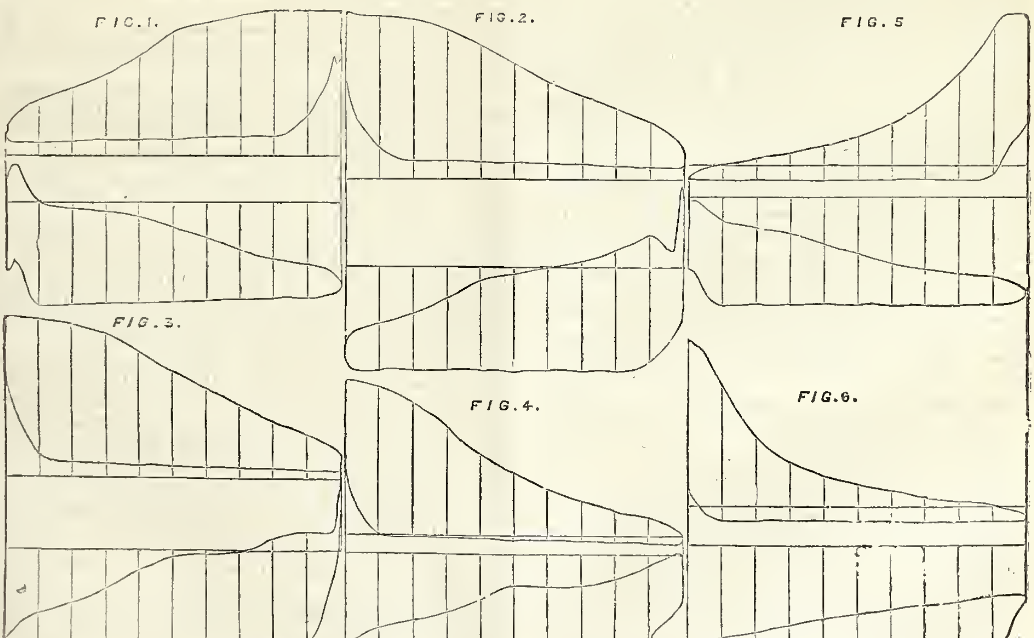
The next inquiry will be to ascertain what influence is exerted by the positions of cranks relative to each other, both as this affects the steam used and the power exerted; and the last inquiry will be, which is the best form of compound engine to adopt, taking the three types into consideration.

The series of diagrams from 1 to 6 elucidate the question of the best degree of expansion, and they are taken from the screw steam-ship *Kepier*.

Scale of indicator diagrams throughout:—

High-pressure cylinders $\frac{1}{30}$ in. 1 = lb.
Low ,, ,, $\frac{1}{10}$ in. = 1 lb.

The first diagram with steam at a pressure of 55 lbs. has the full gear on, and cuts off steam at $22\frac{1}{4}$ in., giving 344·8 h.p., and an expansion to 6·77 times the original volume.



Screw Steam-ship "Kepier."—Engines, Fig. 1. Performance, with different Grades of Expansion. Indicator Diagrams, 1 to 6.

Diagram.	Steam cut off at	Ratio of Expansion.	Initial Pressure (pounds).	Revolutions per Minute.	Steam Gauge (pounds).	Vacuum (inches).	Mean Pressure.		Horse-power.		
							H.P. Cylin.	L.P. Cylin.	H.P. Cylin.	L.P. Cylin.	Total.
1	Full gear, 22¼ inches.	1 to 6·77	47	77	55	26	27·7	7·6	190·3	154·5	344·8
2	20 inches	1 to 7	50	72	57	26	28·8	9·4	185	178·7	363·7
3	17 ,,	1 to 8·4	50	72	55	26	27·7	9·1	178	173	351
4	12 ,,	1 to 12	47	64	50	26·5	33·3	6·25	138	105·8	238·8
5	8 ,,	Omitted on account of the engine priming.									
6	4 ,,	1 to 36 Times original Volume.	53	52	58	25·5	17·1	4·3	79	59	138

The succeeding five sets of diagrams clearly illustrate the effects and power derived from the full gear to where steam is cut off after 4 in. of stroke.

The remainder of Mr. Rigg's paper, which discussed the relative position of cranks, the economy of compound engines, pressure, turning gear, &c., with accompanying tables, will appear in the *Transactions*.

DESCRIPTION OF A SEA-GOING IRONCLAD SHIP OF WAR.

By Ralph Dawson, Esq.

In submitting the accompanying drawings, I beg to state that my only object is to offer to the Association of Naval Architects the opinion of a sailor of some experience, and one who, from his youth to the present time, has taken a great interest in ships of every class. Being much struck with the remarks of the First Lord of the Admiralty, when he declared in the House of Commons, "That it was the intention of the Board to build two ships of a superior class to any yet known, and to send them to sea without masts, as sea-going ships," with only a portion of the prejudices of an old sailor, I at once condemned the scheme, and set to work to make a model that, to my mind, would meet all the requirements of the First Lord, viz.:—"A ship that would carry a battery of heavy guns upon a steady platform, in any weather, and command every point of the compass." Such a ship, in the opinion of the First Lord, could not be obtained with masts and sails, consequently the attempt was to be made to produce sea-going ships without masts. My model represents a ship with a very flat floor, 260 ft. long, 65 ft. beam, and 25 ft. depth of hold; to carry a central battery of sixteen 12½-ton guns, commanding the whole of the horizon, and one mast in the centre of the ship, of the dimensions of a first-rate; to have two screws, and two centre sliding keels, showing 216 ft. (superficial) below the main keel of the ship. These sliding keels answer a double purpose—first, they keep the ship to windward when under canvas, and in a sea-way prevent the ship from rolling, which all practical men will admit is one of the most essential qualities of a ship of war.

As an illustration of this, I may mention an anecdote told me, a few weeks ago, by Captain Morris, late of the Confederate steamer *Florida*. A few years before the war, he commanded a schooner in the coast-guard service on the coast of Florida, fitted with a sliding keel. They anchored near the coast in a calm, with a heavy swell setting in shore. The keel was up, and the vessel rolled so tremendously, that all on board thought she would turn over, when Captain Morris ordered the keel to be let down, and the effect was marvellous; the vessel remained perfectly steady during the remainder of the time at anchor. I have myself attained the same result upon a small scale.

The carrying capacity of such a vessel as my model represents I have no means of ascertaining, but, from my general knowledge of ships, I should say the tonnage would be about 3,400, and the draught of water—fully armour-plated, with guns, coal, and everything on board for a cruise—would not exceed 18 ft. upon an even keel. I may here mention another advantage attached to the two lifting keels. When under sail in a strong breeze, they will almost steer the ship without the assistance of the rudder, by raising one or the other up a little, according to circumstances.

Mr. Galloway said that, in the absence of any other gentleman rising to speak, he wished to say that he was glad, after the lapse of a number of years, the guiding keel, as it was called, and twin screws, had been permanently produced by such parties as had originated the paper. His remarks would be short. He invented twin screws in 1857, and took out a patent for it. He also invented guiding keels, as would be seen by his patent, No. 651 of 1859.

Evening Meeting, Dr. Woolley *in the chair.*

A SIMPLE PLAN OF APPLYING ZINC IN A FLUID STATE TO THE SURFACE OF SHIPS.

By Charles Lamport, Esq.

When at the last session I committed myself to read a paper on a simple means of applying zinc in a fluid state to ships, my authority and authorisation was a communication which I had from abroad. The subject stood over for some time, as I was abroad engaged in other avocations, and when I came to look for that communication I found it was lost, and sufficient time has not intervened to enable me to get from my friend on the Continent a copy of what he sent me. From memory, however, I set to work to test what he stated was the fact, and I found that the experiments did not bear out results which I was led to infer. I had, however, a project of my own, and I communicated with Mr. Merrifield, and asked permission to be allowed to state so much of the project as might afford a hint to any gentleman wishing to test the application of the principle.

Now, the difficulties of applying zinc in a fluid state to the side of a ship appear to rise from two necessary preliminaries, which must be carried out. In the first place, an iron plate, as it proceeds from the roll, is covered over with a thin skin, which is hardened, and undergoes compression, and presents a different surface of iron, and a different composition of iron from that of the body of the plate, and this scale, or surface, or skin,

or whatever term it is technically known by, presents a difficulty to the adhesion of zinc under all circumstances. Another necessary preliminary to the application of zinc is, that the iron plate shall approach very closely, if not quite attain, the temperature of the melted zinc which is to be applied. Now this, of course, anyone will see would be a difficulty on the side of a ship. But the communication which I had from abroad mentioned the use of a flux which was different entirely from that used in this country, and which enabled my friend to apply his fluid in a different way from that practised in this country, namely, by pouring it over the iron to be zinced, and not by the immersion of that which is to be zinced in a bath. Now, the project which I intend is simply this. Over the sides of the ship I propose to suspend a bath, with so much of the furnace attached as will maintain the zinc in a fluid state, and, of course, maintain the temperature at a sufficient height to do so. This bath being in contact with the side of the ship to a certain extent, the plate against which it is placed will become of a temperature, I think, quite sufficient to allow of adhesion if the scale is taken off. Intermediately between the bath and the ship, I propose to have what I may term a mould, which would consist of a steel plate something like a quarter of an inch thick, rolled cold, and a very fine skin put upon it, so that the zinc should have no chance of attaching to it. Then round the edges of this there would be a thin boundary or edging of metal, of the thickness of the plate which I intend to cast on the side of the ship. Preparatory, however, to the suspension of the furnace, and the application of this mould intermediately between the furnace and the side of the ship, over a sufficient portion of the side of the ship to be zinced by each application of the movement of the furnace, I should have to remove the skin to which I have already adverted. My mode of doing that would be this—I should take a wooden mould, or frame of open framework, composed of laths of deal or any other wood, about an inch and a half broad. This would be covered with a substance which would resist, to a certain extent, the action of a strong dilute sulphuric acid, and, after the sulphuric acid had been attached to the frame, and the frame was put against the side of the ship, remaining there long enough to remove the scale, after the application of the ordinary flux by a similar frame, I then conceive that I should have the sides of the ship in a condition to receive a sufficient attachment of the plate of zinc. Then would come the suspension of the furnace over the ship's side, so that the metal mould, of which I have already spoken, should come exactly over, and the outside exactly accord with the wooden framework which I have just mentioned. When the steel plate had sufficient elasticity to allow screws to adjust it tightly to the side of the ship, the upper side being open, I propose to pour over the zinc bath the fluid metal into this mould, allowing it to remain there in contact, and with a free circulation of cold between the mass of the zinc metal in the bath and the thin film which is to form the sheet against the side of the ship. I conceive that by so doing I might, in a short time, bring up the plate to which the bath is attached to a sufficient degree of heat to conform to all the conditions necessary to perform the ordinary process of what is called galvanising. A zinc plate on the side of a ship has a different ratio, and different condition of contraction and expansion under heat from the iron plates of a ship. Provision, therefore, should be made in some degree for buckling, imperceptibly it may be, but quite sufficient to prevent the perfect adhesion of a thick zinc plate over the whole surface of the iron plate which has to be attached. I therefore propose, supposing it were 10ft. long, with a depth of 2ft., to depend more upon the horizontal bands for the attachment of the zinc, leaving the intermediate spaces unattached to the iron, but in close contact with it, allowing a sufficient space, if the contraction were to vary, because the heat brough to bear on the side of a ship in a tropical climate is so great as to cause a troublesome difference of expansion, and that difference of expansion might be accommodated by the unattached portions between the bands. If my idea is a correct one, I should have attached to the side of a ship, by the zincing process, a zinc plate with a number of bands, which practice only could prove to be sufficiently correct, without any injury to the iron, without any expense in the structure of the ship, and which might be renewed by a very easy process, which I need not now explain, when corrosion had taken place to such an extent as to make it necessary to resheath the ship. This, gentlemen, is just an outline of my plan.

ON LIQUID OR CONCENTRATED FUEL.

By Captain J. H. Selwyn, R.N.

In continuing the subject of liquid fuel before the Institution of Naval Architects this year, I wish to draw attention specially to the value of the principle of concentration, which is involved in the use of such a combustible.

I have, therefore, headed the paper with a double title, of which one part refers to the liquid condition of the fuel, the other to the fact of its being highly concentrated, which is most important, as, for steam navigation, no fuel in a less condensed state than that of coal could possibly be used largely for long voyages.

I showed in my last paper that the chemical analysis of the oil used entitled us to expect that its theoretical calorific value, that is, the number of pounds of water 1 lb. of the oil I used might theoretically be expected to evaporate, would be 17·5. I also showed that in a trial at Woolwich in the *Oberon* boiler, in which economy was the sole object, and quantity was ignored for the time, 16·9 lbs. were evaporated; and although the quantity in a boiler of 1,702 square feet of heating surface was then only about 60 cubic feet per hour, I assured you that this was only because no more oil could be burned in that trial, on account of an insufficient supply of steam from the small boiler which served the injectors. The trials were continued, with such alterations as were found to be most productive of good results, from April to July, 1869, and at the latter date we had succeeded, by a gradual amelioration, and by taking the steam for jets from the large boiler itself, in increasing the quantity to 246 cubic feet per hour, with an economy of 14·9, both after deduction of the water or steam used in the jets. But at this point of my observations I must entirely refuse to concur in the propriety of any such deduction being made, and this for two reasons. First, because from the experiments of Bunsen and Fyfe, names which command the highest confidence among chemists of all nations, it appears that red-hot coal and "aqueous vapour mutually decompose each other into hydrogen and carbonic oxide gases with some carbonic acid, both of which, if sufficient oxygen be present, burn with the production of a white heat, to form water and carbonic acid, and that numerous observations showed further that the additional heat evolved more than compensated for the fuel used in producing the vapour." Secondly, because, as you will see from the tabulated form, which is official (except where special figures are shown) at a time when 16·1 lbs. of water were being evaporated by the use of each pound of oil (the theoretic calorific value being 17·5), the temperature of chimney, or that of the escaping gases, was 680° Fahr. Now, according to one of Professor Macquorn Rankine's formulæ, which runs thus:—

$$\text{Loss up chimney} = \frac{1 + A \times T.C.}{4000^\circ \text{ Fahr.}}$$

$1 + A$ is here 16·3, the weight of burnt gas, and T.C. is temperature of chimney. Then 680° Fahr. corresponds to a loss of 2·7 units of heat or pounds of water vaporisable. Now, deducting the evaporation actually obtained, namely, 16·1 from 17·5, the theoretic ultimate calorific effect of the oil, we have 1·4, which might possibly be due to the oil. But how shall we account for the other 1·3 of heat in the escaping gases, unless we allow that

this is a corroboration of Bunsen and Fyfe's observations, and that consequently the water used in jets ought not to be deducted from the total evaporation of water from the constant of 212° feed.

At any rate, I think it fair to show you what would be the results if this be the right view, and you see the special figures showing 254 cubic feet evaporated per hour, at the rate of 16·1 lb. for every pound of fuel consumed. As this is done with a boiler whose total heating surface is 1,702 square feet, it amounts to a cubic foot of water evaporated per 6·7 square feet of heating surface, with an ordinary tubular marine boiler situated on a cold wharf, and only partially lagged or covered with felt. The duty was performed by the boiler with the ordinary arrangements of firebars, ashpit, and fire-doors, and there was nothing to prevent coal from being burned the next hour, or at the same time if desired. The experiments with the firebrick combustion chambers, built in the ashpits, did not turn out to be snperior in results to those arranged as above, and as such an arrangement necessitates the use of a small auxiliary boiler to raise steam in any moderate time, they were discontinued. This, however, might not be the case with a different type of boiler. I am of opinion that the results above described might yet be beaten in the same boiler if a higher class of oil and more steam were used, but as it was I was obliged to be careful, since even with a large steam pipe open, beside the jets, the safety valves were not always able to prevent the pressure rising beyond the 24 lb. at which we were working. It was, of course, necessary then to shut off some of the oil, which is done by a mere touch. It will be remembered that, while with coal no more than a certain number of pounds can be placed on the grate so as to burn, there is no other limit to the quantity of oil that may be burnt than the supply of steam to the injectors, or, in a short boiler, the loss of heat up the funnel.

As regards safety, there is no longer the slightest doubt on the minds of those who use the fuel. The oil only differs from ordinary train oil in this particular, for the reason that train oil would float on, but this oil sinks under, salt water; it is, therefore, less liable to accidental combustion, and more easily put out, should it ever inflame when substances are thrown into it that may act as wicks. A white hot firebrick may be thrown into the oil with the most perfect impunity. If shavings are thrown in and set on fire, these form wicks, and the oil burns as train oil would do, but water will instantly extinguish even this. In short, I confidently state that all idea of danger may be dismissed at once and for ever with an oil whose specific gravity is 1,050 and upwards.

I am satisfied there is an ample supply of material from which the oil can be obtained at a remunerative price, that shipowners can well afford to give from £2 to £3 a ton for it when they know its use thoroughly, and that it is at this moment cheap to use it at the 30s. per ton of 213 gallons which is asked for it, seeing that if 1 ton of it, used without stoking, be it remembered, is equal to 2 tons of coal in evaporative duty, if that ton only takes 36 cubic feet of space instead of 92, which 2 ton of coal would occupy if again every drop of oil does its work, while there is a large proportion of ashes and slag in the coal.

But, of course, I am more especially anxious that our navy should profit by it, and what I now desire is, that having proved so much in a steam launch first, and then in an ordinary marine boiler on the wharf, the next step should be taken of fitting it in a gun-vessel of moderate size, whose performance is already well known, in order to test it fairly at sea, and to estimate accurately what may be the subsidiary economics that attend its use there, in order to know what price can be given for larger quantities when required. Then the condensation of which I spoke will take place as an ordinary fulfilment of the law of supply and demand, the light spirits and other products, including illuminating oils, will find their proper market, and the distiller of such will no longer consider so large a proportion of his distilled products as mere waste, unsaleable at any price.

It is essential to the proper burning of this oil that it should not, while entering into combustion, be cooled down in any way, and a mass of firebrick slag or other rough material on the fire-bars forms a very good heat governor, but the ash-pits and fire-doors ordinarily fitted are decidedly not the best that we could have. Some flame, as a piece of lighted wood or cotton waste, should always be in the furnace when turning the oil on. The existing form of injector can scarcely be improved on, excepting in very large furnaces, where they ought to be double. In some cases, the oil may be sucked up from tanks placed below the boilers by the steam that burns it. The higher the pressure and the drier the steam the better. Superheated steam is always preferable for the jets, and this should be made in the chimney, where the heat passing off is otherwise clear waste. Joints for the oil should be made with lime and glue; no red-lead joint is of any use. As little water as possible should be allowed to mix with the oil, otherwise the fires are soon put out, though the water will always keep at the top of the oil unless much agitated.

The raising of steam in all these last experiments was done as in an ordinary coal boiler, and the steam, when raised, was taken to the injectors from the large boiler itself. No sweeping of tubes or clearing of fires was ever necessary from November, 1868, to July, 1869.

ON STREAM-LINE SURFACES.

By W. J. Macquorn Rankine, C.E., LL.D., F.R.SS. London and Edinburgh.

1. The object of this paper is to place before the Institution a summary of the principal results of a mathematical investigation, of which the details have been communicated to the Royal Society. A stream-line is the path that is traced by a particle in a current of fluid. If the current is steady, each individual stream-line preserves its figure and position unaltered, and marks the track of an elementary stream of fluid. The motions in different parts of a steady current may be represented to the eye and to the mind by means of a group of stream-lines; for the direction of motion of a particle of fluid at a given point is that of a tangent to the stream-line which passes through that point; and when the fluid is a liquid such as water, the comparative velocities of the current at different points are indicated by the comparative closeness of the stream-lines to each other.

2. *A Stream-line Surface* is a surface which traverses an indefinite number of stream-lines, or, in other words, a surface such that every stream-line which traverses a point in that surface is wholly situated in the surface. We may conceive a current to be divided by an indefinitely great number of stream-like surfaces into elementary streams; and then the velocity of the current at different points in the same elementary stream will vary inversely as the area of traverse section of that stream, measured on a surface which cuts the stream-lines at right angles, and the component of that velocity, in a given direction, will vary inversely as the area of a section of the elementary stream made by a plane perpendicular to that direction; also, if the dividing stream-line surfaces be so placed that equal masses of liquid flow in equal times along the elementary streams, the velocities at any two points in the current will be inversely proportional to the areas of transverse section of the elementary streams at these points.

3. When a current is represented on paper by the help of stream lines, the surface of the paper represents one of a set of stream-line surfaces; and the stream lines on the paper represent the trace, on that surface, of a second set of stream-line surfaces, so placed that the two sets of surfaces divide the current into quad-

rangular elementary streams of equal flow. A pair of adjacent surfaces, belonging to the same set, contain between them what may be called an elementary layer of the current, and this is divided into elementary streams by the other set of surfaces. If the layer, of which the paper represents one surface, is of uniform thickness, the velocity at a given point varies simply in the inverse ratio of the distance between the stream line shown on the paper, and such is the case when problems in two dimensions only are considered; when the layer is of unequal thickness, that velocity varies also in the inverse ratio of the thickness of the layer, and such is the case when problems in three dimensions are considered; for example, in problems relating to stream-line surfaces of revolution, a straight line on the paper represents the common axis of a set of such surfaces; the paper represents a plane stream-line surface traversing that axis, and the thickness of the layer at any point is proportional to the distance from the axis.

4. *Straight Currents.*—A straight current of uniform velocity is represented by a set of parallel straight lines. If the layer is of uniform thickness, these lines are equidistant; if its thickness varies, the distance between a pair of adjacent lines varies inversely as the thickness of the layer. A current diverging or converging in straight lines from or towards an axis or a point, is represented by a set of straight lines radiating from or towards the point or the trace of the axis. When the layer is of uniform thickness, those radiating lines make equal angles with each other; when it is contained between two planes cutting each other in an axis, the radiating lines represent the traces of a set of conical surfaces with a common apex, so placed as to cut a spherical surface described about that apex into zones of equal area.

5. *Composition of Stream Lines.*—If two sets of stream lines be drawn so as to represent two different states of current motion in the same layer of liquid, a third set of lines drawn diagonally through the network formed by the first two sets will be the stream lines representing the resultant state of current motion in the same layer, arising from the compounding of the actions which would separately produce the first two states. This proposition is due to Mr. Clerk Maxwell; and by its aid stream lines representing current motions of any degree of complexity may be drawn. Amongst algebraical investigations of the kind of motion which stream lines represent, reference may be specially made to those by Mr. Stokes (*Cambridge Transactions*, 1842 and 1850).

6. *Motion of a Liquid past a Solid.*—If a solid body is of such a figure that a current of liquid flows past it smoothly, without forming eddies (other than those produced by friction), the surface of that body is itself a stream-line surface; and it may be proposed to determine, as a mathematical problem, either what forms of surface possess that property, or whether some given form of surface possesses it, and if so, what are the figures of the stream lines in a current of liquid produced by a solid of that form. The latter problem has long ago been solved for an indefinitely long circular cylinder, with a current flowing past it tranversely; and for a sphere, it was solved by Dr. Hoppe in the *Quarterly Journal of Mathematics* for 1857.

7. *Application of Stream Lines with one pair of foci to forms of Ships.*—If a ship is capable of gliding smoothly through the water without forming eddies, other than those produced by friction, her surface is a stream-line surface. In a paper read to the Royal Society in 1863, and printed in the *Philosophical Transactions*, entitled "On Plane Water Lines in Two Dimensions," the author investigated the figures and properties of a very numerous class of stream lines belonging to the motion of a current in a plane layer of uniform thickness, whose forms closely resemble those of actual ships of a great variety of models and proportions. Elementary rules for drawing such lines are given in a work entitled "Shipbuilding, Theoretical and Practical," published in 1866-7. In a paper read to the British Association, and printed in the *Philosophical Magazine* in 1864, he extended similar methods to stream-line surfaces of revolution. The general nature of the method of finding stream-line surfaces suited for the figures of ships may be summed up as follows:—The ship is conceived to be stationary, and the water to move astern with a velocity whose undisturbed value is equal and opposite to the speed of the ship. The uniform current thus conceived to exist in the water is represented by a series of parallel straight stream lines; then, to represent the disturbance of the water produced by the vessel—which consists in a pushing aside of the water by her fore-body, followed by a closing in of the water behind her after-body—stream lines are drawn, which diverge from a point in the fore-body and converge again towards a point in the after-body. These points are called *foci*. The parallel straight lines representing the uniform current, and the curved lines representing the disturbance, form a network, and through the angles of that network lines are drawn diagonally, which are the traces of the required stream-line surfaces. The lines thus obtained closely resemble the water-lines, riband-lines, and other longitudinal sections of ships of a great variety of forms and proportions; and there is scarcely any known figure of a fair longitudinal line on a skin to which an approximation may not be found amongst them. They have, however, the following defects:—First, amongst each set of stream-lines there is only one that is a continuous closed curve, accurately representing the form of a solid that can glide smoothly through the water; and that one is always a very bluff-ended oval, and therefore suitable only for the lines of a slow vessel. To obtain amongst stream lines, with only one pair of foci, a curve resembling a longitudinal line of a ship of a fine model, suited for high speeds, it is necessary to made use of the middle part only of a stream line which extends in both directions indefinitely far, so that there is discontinuity of form and of motion at both ends of the curve employed. Secondly, stream lines with only one pair of foci are incapable of representing the forms of those models shaped like swimming water birds, from which Mr. Froude lately obtained favourable results in his experiments.

8. *Application of Stream Lines with two or more pairs of foci to Forms of Ships.*—These defects are overcome in the investigation to which the present paper relates, by using two or more pairs of foci of divergence and convergence. By this method can be obtained continuous closed stream-line curves of any required proportion of length to breadth, and of any required degree of fineness at the ends; the only difference between them and the actual longitudinal lines of ships being, that the stem or cut-water is rounded in the theoretical curve instead of being squared off as in the actual lines. The figure shows a few examples of closed stream lines with two pairs of foci, marked 11, 22, 33, 44, 66. The oval LB has one pair of foci only. The figure shows only one focus of each pair maked A, A^1 respectively; A being a focus of the oval LB, and A^1 one of the additional foci of the new curves. By suitably arranging the foci relatively to each other and to the ends of the curve, and by introducing a third pair of foci if necessary, any degree of fineness or bluffness, hollowness, straightness, or convexity may be given to the lines, and any required breadth to the stem.

9. *Empirical Rule for Displacement.*—The following empirical rule for a rough approximation to the displacement of a solid bounded by a stream-line surface, is an extension of a rule first published in the treatise on shipbuilding already referred to. It has been verified by trial on a great variety of figures. Multiply the area of midship section by five-sixths of the longitudinal distance between that pair of cross sections whose areas are each equal to one-third of the area of midship section.

10. *Dynamical Investigations.*—The chief practical use

of investigations of the figures of stream lines is not so much to find methods of drawing these lines for purposes of naval architecture, as to enable rules to be laid down for making dynamical calculations respecting the disturbances in the water produced by vessels to whose figures these lines present approximations. The investigation now referred to shows how to determine the ratio borne by the energy of the disturbance in the water to the energy due to the motion of the vessel, in every case in which a stream-line surface can be determined which sufficiently approximates to the form of the vessel. That ratio is found to range from $\frac{1}{2}$ to 1, and such is the ratio borne to the work employed in producing a given acceleration in a given ship, by the additional work required in order to produce the corresponding acceleration in the disturbance of the water. The dynamical properties of stream lines also enables us to determine the virtual depths to which various parts of the disturbance extend, upon which depths depend the velocities and positions of various series of waves raised by the vessel, and the velocities of gliding of the particles of water over different parts of the ship's skin, upon which depends the friction.

Mr. Froude said that he had studied some of Professor Rankine's earlier investigations with some care, and there were a few points he could explain which might be interesting and instructive. These investigations opened, in a very complete and mathematical way, the laws which expressed the mode in which water was separated by a body moving through it, and he showed distinctly that if water were a perfect fluid, and a body were wholly immersed in an infinitely extended fluid, a blunt-nosed body was best adapted to move the water on one side and let it close up again with the least possible disturbance. That investigation showed that the old mode and the ordinary and popular mode of arriving at the notion of the solid of least resistance was founded on the misconception that the solid which pushed the water aside must have such a shape that it would begin to operate on each part of the water quite gradually, then give it gradual acceleration, and then bring it to rest again. That was what a perfect fluid would do for itself when it was a perfect extended fluid. When a solid was pushed through the fluid, the particles of water separated themselves, and began to move aside in the most gradual manner possible. Another point deserving of attention was the dynamical aspect of the question. A perfect fluid, of which the particles pressed equally in all directions, not only when at rest, but when in motion, and it fully answered to the equations of fluid motion, lost no *vis viva* in its motion; the *vis viva* of its particles became transferred to other particles, and nothing was lost. The old notion of finding the solid of least resistance by finding that body which most easily pushed the particles of the fluid on one side was, for a totally submerged body, a fallacious one. With regard to friction, it arose in two ways. There was, first, the friction produced from the particles of fluid gliding past the sides of the body, and, in the second place, the particles of fluid, *inter se*, underwent contortions, so to speak. But there was another view of the problem of non-resistance, as it might be termed. All the curves into which the water was bent were analogous to wave curves, and just as a wave ran along the sea without losing much energy, so stream-line curves transmitted the *vis viva* from particle to particle. In dealing with a motion of the body on the surface, there was a new set of conditions, for the particles were disturbed downwards, just as they would be in the case of a totally submerged body. At moderate velocities there would be one-half of the stream-line series perfectly developed in all directions, but when the body was compressed a new condition was introduced. There would be the condition of surface waves, which acted according to the law of gravity, and other laws regulating the motion of surface waves, and, where the pressure was a lump of water, would become heaped up, and would spread away in the surrounding water, and run away with a large body of the work. He was only on the threshold of the inquiry, and there was a great deal to learn; but the facts which he had communicated to the meeting were within his own knowledge.

Mr. Thornycroft said Mr. Froude had explained the motion of a solid in water as a perfect fluid, and in that case it appeared that the stream-lines would offer a form of least resistance for a body. But in speaking of a body disturbing the water on the surface, it appeared to him that it would not be quite correct to suppose that the stream-lines would be the same as they were in a perfect fluid, for the friction of the water and the viscosity must, as it affected the resistance, also affect the shape of the stream-lines. He hoped Mr. Froude, or some other gentleman, would be able to explain how the stream-lines might be calculated if the viscosity of the water were known.

Mr. Froude had no doubt that the viscosity and external friction did alter the stream-lines materially. They could only be regarded as approximate estimates, but were a great help.

The Chairman (Dr. Woolley) said he believed that Mr. Froude had stated the exact truth in saying that this class of problem, which Professor Rankine had brought before them, was one of the most difficult which could be attacked; and the further problem in which the dynamical aspect of the question was considered, as to viscosity and friction, was entirely beyond the reach of knowledge at present. He thought they were under a great obligation to Professor Rankine for his paper, in which he had reduced some of the most difficult problems into a tangible form.

ON THE POSITION OF THE CENTRE OF GRAVITY OF THE ARMOUR-CLAD CORVETTE *AVNI ILLAH.*

By G. C. Mackrow.

The session before last I had the honour of reading a paper upon the position of the centre of gravity of the Greek armour-clad *King George*, which I trust was not without some measure of interest to you, and I supplemented the methods adopted in determining that position with a few remarks upon the form of fixed battery I had designed in that vessel, in which I alluded to a further development of the plan in a larger vessel. Such a vessel, the *Avni Illah*, I have had the honour of designing, in my capacity of naval architect to the Thames Iron Works, for His Imperial Majesty the Sultan, who was pleased to choose this form of fixed battery, in preference to two revolving turrets, as proposed by another firm.

I had recourse, when the vessel was completed, to the experiment usually adopted practically to determine the centre of gravity. A mean of four experiments gave the distance, G M, as 1·591, as the mean draught of 13 ft. 2 in. Calculating the alteration in the position by the introduction of the remaining 500 tons, consisting of coals, guns, ammunition, and stores, I found that the distance, G M, was 1·939, or 0·348 difference.

The displacement to the L W L is 2,341 tons; this, multiplied into the distance, G M, gives as the comparative measure of statical stability 4,486·0.

Her behaviour at sea, making as she did an exceedingly good passage in the month of January of the present year, across the Bay of Biscay, out to her destination at Constantinople, is, to me at least, very satisfactory, and she is described as being a most easy and comfortable vessel. In a run round to Plymouth from the Thames, I had an opportunity of forming a slight estimate of her performance, and the result was most satisfactory; her movements were the easiest possible, 11 or 12

seconds being the time of her oscillations in a fore and aft line.

The wind being abeam, I had no opportunity of timing or measuring her oscillations in an athwartship line, or rolling. I am extremely sorry that the captain, who took charge of her on her voyage out to the East did not take the times and angles of her rolling, as it would have added very much to the interest of the paper. A pendulum, as well as a bar instrument, were both provided, and all that was needed was a few minutes' attention to my request; but the captains of our merchant navy, for the most part, place but very little confidence at present in our theoretical investigations and deductions.

I have been thus careful in giving you, as far as lies in my power, the behaviour of this vessel at sea (which I may add, carries four 300-pounder guns, enclosed in 6 and 5 in. armour, having a hurricane deck fore and aft, and with a fair proportion of rig), in order to compare her with the Greek armour-clad corvette, *King George*, which, having the same moment of statical stability, has been found to behave altogether so uneasily, her movements being described as sudden, quick, rapid, violent, terms conveying to my mind evident proof of too great stability. The movements comparative of stability in the two cases are as follow, viz.:—

Avni Illah, displacement $\times$ GM $= 2314{\cdot}0 \times 1{\cdot}939 = 4486$
King George, „ $\times$ „ $= 1774{\cdot}0 \times 2{\cdot}500 = 4435$

Now, I must confess that I was not prepared for so great a difference in the behaviour of those two vessels, seeing the difference between their metacentres and centres of gravity is only ·5 of a foot. But, on further reflection, I was induced to institute a fair comparison between them, by taking into consideration the difference in their displacements. And I did so in the following manner, to determine what the distance G M would be for the *King George*, on the supposition that she was of similar form, size, and construction to the *Avni Illah*. I instituted the rates as $\sqrt[3]{2314} : \sqrt[3]{1774} :: 1{\cdot}939$, the ht. G M for the *King George*, or, $\frac{12.1 \times 1{\cdot}939}{13{\cdot}2} = 1{\cdot}77$ ft., instead of 2·5 ft. as as present, and remembering that the weights are not "winged" in one case more than in the other, these figures are a just measure of the stabilities of the two vessels.

By this it is seen that the stability of the *King George* is half more than that of the *Avni Illah*, and it goes to corroborate on a smaller scale what has been determined by Mr. Reed on a larger scale, that low weights are associated with rapid rolling, as well as deep.

Saturday, April 9th.

Morning Meeting, Sir J. Pakington *in the chair.*

ON THE SMALL FASTENINGS OF WOODEN SHIPS.

By William Poole King, Esq.

The small fastenings of ships are trenails, iron bolts, and copper metal bolts. Each have their advantages and defects.

The trenail, generally an oak bar, of from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. in diameter, is a cheap fastening, apparently strong. It carries no galvanic influence from the outside copper on the bottom of a ship to create rust in the ironwork within, and is vulgarly considered the very stamina and constitution of a ship; still it must strike everyone not blinded by routine that nothing can be more absurd than to prepare oak timbers square, and cut out all the sap from them, at the cost of about a crown per foot cubic, and then drill this expensive timber full of holes from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. wide, in order to drive in trenails, and thus take at least half the strength out of the timber.

About seaports, where old ships are broken up, many old timbers are met with in the fields spotted with two large holes in about every foot of their length; decay will be observed in all these holes, caused by the woody fibre being bruised by trenail driving, for bruised fibre gives nourishment to dry-rot fungus. Trenails having been squeezed in driving, become rotten and weak, cease to hold the planks to the timbers with firmness, get bent, and allow a ship to bend and yield throughout its whole frame—this is called hogging and sagging.

Iron bolts and spikes are the cheapest strength that can be put into a ship. They are the handiest fastening that a workman can use; and a little rusting allows a very small fastening to take a very strong hold; in fact, it is everything that could be wished, did it but last without decay.

In a ship, iron-bolts are always damp and always rust; rust frets away woody fibre. Iron bolts, too, always contain a portion of sulphur, which gets converted into sulphuric acid, which decomposes both the salts always found in oak, and also sea-salt, never absent at sea. A ring of decomposed wood surrounds every bolt; and as the salts and oxide of iron are not prejudicial to fungus growth, dry rot fungus takes possession of the ring of decomposed wood.

Iron bolts are inadmissible in the bottom of ships sheathed with copper; the salt-water acting on so large an extent of copper, sends such quantities of electricity through the iron bolt that the substance of the bolt is carried away, and a vacancy, which lets in leaking water, is left in its place.

Copper bolts and cupreous metal bolts are more expensive and less strong than iron, but, unlike iron bolts, instead of fretting the wood in which they are inserted, actually preserve it, for the verdigris which is formed on the copper bolt poisons the dry rot fungus. But the copper bolt has the serious disadvantage of having little hold in the wood through which it passes, and this little holdfast becomes less after the wood has shrunk with age, so that the only value of the fastening power of copper metal bolts is left in the rivetted ends of the bolt; and when this end breaks off, as it frequently does in nine or ten years, by getting crystallised, the fastening is of no value at all.

Trenails are too cheap and useful, as plugs for keeping out leaking water, to be given up in wooden ship construction; but the disadvantage of their unwieldly size, boring through and destroying everything, should be reduced as much as possible. Trenails should be always of the best materials, creosoted to prevent the introduction of dry rot, kept small in size to prevent their doing immoderate harm to the worthier parts of the ship, and driven short to obviate the destruction of timbers and floors.

It is agreed on all sides that iron bolts must never be used in the wake of copper sheating. Indeed, to insure the durability of the structure of a ship, iron bolts should never be driven at all, except in situations where they can be removed and replaced.

Covering iron bolts with zinc (called galvanising) does not protect the iron from rusting, as the acid of the oak surrounding the bolt soon dissolves off the zinc cover, and corrosion proceeds with all its concomitant evils.

A large quantity of copper metal fastening is now required in first-class ships. It is expensive. Let us inquire how the greatest strength, at the lowest cost, can be got from it.

The screw form, I believe, will be found the strongest and cheapest method for the use of copper metal. This form gives a secure hold, and does not injure the wood if the pitch of the screw be kept high, that is, the threads of the screw be kept far apart. I have been accustomed to use screws 7 in. long instead of trenails.

The bolt is moulded in threads three turns in an inch, cut in a $\frac{3}{4}$-in. bolt of Prince's metal, weighing $13\frac{1}{2}$ oz., and costing 9d. This, screwed through a 3-in. plank,

penetrates the timbers 4 in., and requires no rivet, as I have tried to start a deal end from a 4-in. thick piece of oak secured in this manner, with a strain of 36 cwt. suspended, without having been able to produce the least separation of the deal from the oak. The necessity of a through fastening does not exist, as the timber can be secured to the ceiling by a similar screw to keep it exactly in place; thus, a long length of metal bolt is saved, the timber but slightly wounded, and the strength of the frame immeasurably increased.

For larger fastenings, such as those for securing timbers and floors to iron riders, I have used a thread $\frac{1}{8}$-in. in height, placed round outside a $\frac{7}{8}$-in. Prince's metal bolt, instead of cutting into the body of the bolt, in order to preserve its lateral strength and rigidity. The turns of the screw are three in 2-in.; a length of 14-in. weighs 3 lb., and costs 2s. 6d. I found a strain of 49 cwt. was barely sufficient to tear this screw through a 3-in. deck deal end, and of course a longer length screwed into oak would require a heavier strain for its removal.

Pure copper cannot be cast into a screw form of any strength, and therefore I have used Prince's metal (a mixture of 16-oz. copper, 3-oz. zinc, and $\frac{1}{2}$-oz. tin). This mixture runs into every sinuosity of the casting-mould, is so tough that it will bend more than double cold, and I believe will not crystallise and break when it has grown old.

Mr. Grantham confirmed what Mr. King had stated as to the adoption of screws in preference to rivets, and thought that the substitution would be advantageous.

Sir John Hay said that Mr. King appeared to deprecate the use of iron under certain circumstances; but iron, in whatever form, applied to teak ships, was a perfectly safe mode of construction, and also a cheap one. Iron fastenings could be applied to teak-built ships, and would not suffer the deterioration which they were subjected to from the action of the acid of the water when they were applied to oak and other timbers.

Mr. Lamport said Mr. King had stated that, after the lapse of two or three years, the heads of the copper bolts broke off, because the copper became crystallised. That was entirely contrary to the practical experience of a shipbuilder. Copper would not crystallise, but would last fifty years without undergoing any such structural change as that to which Mr. King had alluded. He thought Mr. King must have used the word copper by mistake, because with the ordinary metal undoubtedly a change took place. It was not to be forgotten that the chief strain to be resisted in the upper part of the ship was a longitudinal one, but he thought that that fact had been overlooked. To use a technical phrase, it was the draw of the planks which they had to resist. If the butts were drawn asunder, there must either be the compression of the hole through which the fastenings passed, or an alteration in the structure of the material. The latter case did not happen, and the cotter or yellow metal bolt passing through in the place of the trenail did not give that area of compressive resistance which was essential. With regard to galvanised bolts, Mr. King had stated that they did not resist the oxidising effect which was constantly going on, arising from the action of the acid upon the oak. He wished to state that he had examined galvanised bolts after they had been in use in a vessel for ten years, and had found them as perfect as when first used. There was one thing which had not been sufficiently noticed by Mr. King, with regard to galvanising his bolts, and that was that the zinc should not be subjected to such a heat as to become practically burnt, otherwise the whole of the useful effect of galvanising was lost, and the zinc became stripped off. But with a properly galvanised bolt nothing of the kind took place; the zinc still existed, and for all practical purposes was a sufficient protection to the iron bolt.

Mr. Galloway said although the ordinary means adopted for the purpose of galvanising tended to make the iron brittle, and had other disadvantages, there was a method by which it could be perfectly coated, so as to resist the action of the sea-water, and so save the expense of using Muntz's metal.

Mr. King said what he wished to lay down was that short screws were the best, and that it was a great waste of valuable material to use long screws when short ones would answer every purpose. The strain a screw would bear in wood was almost incredible. He had had considerable experience and great opportunities of observation, extending over a number of years, and as to copper bolts not becoming crystallised, he had seen many bolts made of pure copper so affected. It might not be generally known that pure copper, after it had been twenty years in its place, crytallised very considerably. He did not propose to use copper screws, because they were weak; but he proposed to use Prince's metal, which was the nearest approach to it, and was considerably stronger. Galvanised bolts had been spoken of, but he did not approve of them. If the damp came to them, they were very much injured. If they were put into ships going to the tropics, dew became deposited upon them, the zinc oxidised, and the result was that they decayed. He did not think that galvanised bolts could be at all relied upon.

PROPOSED NAVIGABLE STEAM-PROPELLED DOCK.

By Vice-Admiral Sir E. Belcher, K.C.B.

The floating dock system has occupied my attention incessantly since 1823, when I first proposed it to Admiral Fahie and Commissioner Sir Thomas Briggs, at Bermuda. Various practicable methods of constructing or improvising lifts presented themselves to my mind; but the delay, the difficulty of properly handling such weighty bodies, of adequately connecting them, so as to insure instant and available resource, even at sea, arrested any such minor applications.

The desideratum, great in importance, could only be obtained by one firm connected structure, totally independent, sound and flat as any steamship, and capable, not only of caring for herself, but perfectly adapted to rescue and safely house at sea, in moderate weather, the largest ironclad we now possess, or may intend to construct.

Engineering friends with whom I consulted and acted, and who fully entered into my views as to the vast range of duties I wished my structure to combine, led to the adoption of one great vessel, of such form and dimensions as would afford on her lower submerged substantial frame all the lifting-power demanded, and yet, by her superimposed upper works, which no lateral strain could affect, such additional amount of cubic contents as would be much in excess of any possible requirement for immersion under the operation of docking our largest ship.

Then, again, as regards the period of immersion, and the time involved in taking the weight of the vessel off her suspension in water, I adopt the action of the turbine, discharging at the rate of 2,000 tons per minute—thus, in that period, relieving any vessel placed on the dock-blocks—absolute security, if in a sinking state; and in twelve minutes lifting any ironclad 3 ft. 6 in. dry beneath her keel, without the necessity of using dock-gates. The apertures proposed are four, each of 3 ft. 6 in., or 12·25 feet area.

The results then terminated in the form now proposed, and which I venture to term "a serviceable, self-reliant ship dock," combining within her own accommodation every requisite to be sought for, not simply in our foreign dockyards, for they are unequal to any important operation, as the return of our war-ships amply prove, but as a practical workman I may affirm, equal, if you give them a proper establishment, to any of our home dockyards. Her dry capacity affords storage and

space for workshops equal to the demands of any fleet, and I am not beyond the mark in assuming a minimum speed of 10 knots under steam alone.

The dimensions proposed were as follows:—Length, 500 ft.; breadth (extreme), 110 ft.; dock sill above keel, 30 ft., being the dock level when free from water and drawing 27 ft. Dock floor, 27 ft.; displacement at 27 ft., 25,000 tons; weight of vessel and engines, 13,000 tons (computed); indicated horse-power, 6,000; speed, 10 knots. Thus we have before us the means of docking vessels requiring repair; of saving the necessity of return to England, or to any place distant to seek for relief if disabled; and finally, in succession, with unexampled power of despatch, of examining, cleaning, and repairing a whole fleet, I would venture to assert, "even at sea in quiet water," but undoubtedly at any safe anchorage throughout the world.

With this navigable dock, with its independent steam propulsion of 10 knots, with the facility of reaching a disabled vessel at sea, and perfect security of immersion, she possesses the capability of dead level immersion to 27 feet. But in a calm position, with the sea tranquil, no danger would attend a further immersion to 30 feet.

The engines, coal, and all other matters relating to the vessel herself are distinctly cut off, and, independent of the air-chambers, to which allusion has been made, are perfectly secure from any intrusion of salt-water during the operation of immersion.

It is proposed that one of these docks, complete with those stores which could not be procured in the markets abroad, should be attached to the principal foreign stations, and especially in positions where a disabled vessel could not reasonably hope to reach a port to windward, or exposed to strong breezes.

As regards the general adaptations of the proposed dock, it may be as well to notice her dry arrangements, and the accommodation available for general purposes. Beyond the spaces set apart for the engines and coals, we have, first, the whole fore section, 60 feet on deck, devoted to the crew, and available for hospital accommodation. Next, 440 feet by 20 feet wide on either side for workshops, stores, and such materials as would be required by a squadron.

Therefore, calculating on an establishment purely of able mechanics, five times the force accorded to our largest ship, controlled by a talented engineer, and commanded by an individual of the class of staff captains; further, aided by the crew and artificers of the ship to be docked or repaired, I feel confident that any operation now executed in our principal dockyards at home could be satisfactorily carried out on board this vessel, thus superseding the extravagant expense of a foreign yard with all its establishment.

ON THE STEERING OF SHIPS IN SPECIAL RELATION TO A NEW FORM OF BALANCED RUDDER.

By C. G. Gumpel, Esq.

Although Mr. Scott Russell had said that it was well known that "if you want good steering power, be careful to make the ship's stern and everything about it strong enough, then put in a rudder big enough, and then put in so much mechanical power as will put over the rudder to the angle it is wanted," still, it is found that the force required to put the helm hard over within a stated time—if at all possible with the means at command—is so enormous, and the risk so very great of depending entirely, at a critical moment, upon either the hydraulic or the steam steering gear, that the balanced or differential rudder has been in many instances applied, whereby the command over the helm is no doubt increased, but the steerage power of the rudder has to a considerable extent been sacrificed. At all events, the balanced rudder is not looked upon with so much favour, and has not given such satisfactory results as was expected. The report on the cruise of the fleet during last autumn gives distinct indications of the inefficiency of the balanced rudder; and from a closer investigation of the action of this form of rudder, it would appear as if the fore part of the rudder acts in the same way as a bow rudder; it impedes the vessel's headway without giving a proportionate lateral thrust for turning the vessel. There is another point deserving attention, namely, that the fore part of the blade, besides projecting on what may be called the wrong side of the keel, or longitudinal midship section, offers its surface at a greater angle to the water than the after part of the rudder blade, owing to the structural form of the latter. But, undoubtedly, by far the greatest defect of the balanced or differential rudder consists in intercepting the current of water on the wrong side of the vessel, forcing it through the opening between the rudder and the dead-wood, and deflecting it in a manner which cannot but be most detrimental, by breaking up that current of water which otherwise would act more effectively on the after-part of the rudder-blade.

All the practical experience gained in the use of the balanced rudder points to the great inefficiency of this after-part, and this seems to be more the case when the ship is under sail than when the screw, acting immediately in front of the rudder, drives the water with sufficient force more or less straight astern, and so diminishes the evil effect of the current deflected from the fore part. As most seriously detracting from the value which may otherwise attach to the balanced rudder, must be mentioned its too rigid attachment to the vessel, exposing it, when struck by a wave, to serious damage.

Mr. Lumley has on two occasions brought his rudder under notice, so that its construction is well known; in fact, in its character and principle, it is not unlike a rudder patented some time before by Mr. Ruthven, who proposed several vertical joints in the blade to produce the curved surface. It is, however, questionable that a rudder of that form should, as Mr. Lumley says, "possess better steering effect, with less power on deck to move the tiller" than the common rudder. Now, what is wanted in a rudder, by exposing its surface to the water, is not to push the latter gradually and gently aside, as a curved surface would do, but to court the water's resistance in the most favourable manner for obtaining and applying a lateral thrust to the aft part of the vessel, which we would do with a straight rudder surface.

After investigating the relative pressure against the rudder surface at various angles, as well as the component pressures, the head resistance, the lateral thrust, and the rough loss of power, by the aid of some explanatory diagrams, Mr. Gumpel said, it will, I think, be an important question, gentlemen, for you to consider how far this is waste of power, and whether, under certain circumstances, such as a ship or a rock ahead, it may not be more effective for avoiding collision or wrecking, instead of keeping the engines going ahead at full speed, and making an attempt at putting the helm hard over, to stop the vessel's headway as quickly as possible, by stopping or reversing the engines, and then (if not already done in the meantime) to put the rudder over to an extent in accordance with the tiller power at command, and set the engines going ahead, to turn the vessel within her own length.

To give great steering efficiency without counteracting the power given off by the screw, it requires large rudder surface; but to put over the ordinary rudder, if made sufficiently large, demands enormous power, the ships of our navy to wit, in which the united effort of from 20 to 60 men at the wheel and the relieving-ropes cannot put the rudder over to more than from 18° in some to 28° or 30° in others. Hence any contrivance in the rudder itself which will lessen the strain on the steering gear, and consequently the force (or, what is equivalent, the

number of men) required at the tiller is deserving of consideration; and I now beg leave to bring under your notice a new form of rudder, to elicit your opinion how far it will effect this object.

The author then proceeded, by means of sketches, models, and a movable diagram, to explain the principle of his new rudder, how he received the thrust of the water against the rudder in such a manner as to lessen the strain on the steering gear, and showed by illustration the ratio of force required at various angles at the tiller of his new rudder.

BALANCED STEERING GEAR.

By Vice-Admiral Sir Edward Belcher, K.C.B.

The importance of a ready and absolute command of the helm, and its guidance by the quick eye and hand of the helmsman, cannot be overrated.

But to the navy—now that it has turned its energies in the direction of the ram mode of attack—exquisite nicety, I may assert, is demanded, either to effect or avoid impingement.

Another very important point is frequently overlooked. I refer to putting over the helm at too sharp an angle, and thus deadening the speed and destroying the ultimate power, as "hard up" or "hard down." A series of experiments tried on H.M. gunboat *Charger*, with the screw attached to and moving with the rudder, showed that, provided the curvature to turn in was immaterial, that a quicker complete revolution was accomplished by turning from full speed with the angles 10° and 20° and 25°, reserving the 25° until head to wind, than was effected by putting down the helm at once to 45°. Cutter sailors are well aware of this, and many never put the helm a-lee at all.

Some years since, I interested myself in this invention of Mr. Ruthven, to which I have now to request your attention—not problematical—but then in action on the *Nautilus* turbine-moved steamer; and at that period Sir Alexander Milne, then at the Admiralty, objected merely to its interference with the guns, and the interruption to deck work. All those difficulties are easily overcome, and, as in former times, it can be boxed in below the beams.

The inventor of this simple piece of additional power—for it remains entirely at rest until called into action—proves that where forty extra men may be demanded to put the helm over, the simple placing in gear of his apparatus gives this power to the one ordinary helmsman.

The plan I will now endeavour to explain to you overcomes all difficulties, and ensures the absolute command of the helm, as absolute and yet as delicate as the tiller in the hand of the keenest yachtsman. No orders to the engine-room, or to any combination of men on deck or below are involved. Those who direct the man at the wheel, when difficulty arises, apply just the power required. The power of the water acting on the rudder is balanced by a weight. This power can be instantly applied and as instantly neutralised, leaving the wheel as free as if the machinery were not connected. It is, indeed, an ingenious application of the lever. As the weight applied to a steelyard varies by its distance from the point, so a weight in excess is overcome or released by the hand of the man who controls it—1 ton or nothing.

The plan before you affords all the power that can be safely applied to the head of the rudder. It is always at command, and can instantly be released. The helm being free flies amidships, and before that could be effected by main force shifting the wheel, the tiller would be hard over in the opposite direction, a power, when in danger of collision, not to be ignored.

The principle of the invention is the balancing the pressure of the water on the rudder, which is effected by a counterpoise of power on the tiller, acting through the medium of certain levers, so that, when steering by the wheel alone, no more force is required than that necessary to overcome the friction of the parts moved. This friction depends greatly, in our large ironclads, on the steering fittings, whether, when at rest in dock, the helm can be put over by one man or four, or, in a gale, by 50. This counterpoise is obtained by the application of a moderate weight, moving vertically in a tube, near the stern or other place most convenient.

The rudder is not held rigid, but yields to an extra force thrown upon it, and thus all danger of breaking down is avoided. It can also be allowed to fly back to the point of neutralisation or amidships with any convenient degree of celerity. And specially as regards sudden stern motion, its rigidity and steadiness are perfect up to the yielding point, but then not spasmodic, but gradually yielding, without the risk of damage to itself, or alarm to those immediately engaged on it. In short, the plan proposed provides the following:—

1. The power to move the rudder to such an angle as not to endanger it, providing a compensation balance to that limit, beyond which it fails to act.

2. Celerity of action—that is, to move the rudder over the greatest angle in fifteen seconds, and in little more than fifteen seconds to its opposite.

3. Obviating the necessity of using more men at the wheel, or any men at relieving tackles below.

4. Perfect safety to the man at the wheel under any circumstances. No men killed or wounded by the tiller throwing over all employed in its management.

Lastly. Under the even power and compensating balance, the man at the wheel may safely quit it for a few moments to aid any motion near him.

Having thus stated the general question and scope of the invention, the author referred to a diagram made to explain and practically prove the nature and effect, in practice, of what he asserted had been attained. This will be published in the *Transactions*.

HYGIENE OF SCHOOLS.

By Professor Rudolph Virchow, of the Berlin University.

The influence of the school system on the health of the pupils has, especially since the end of the last century, attracted the attention of medical men and of all those interested in the education of young people. In whatever way these inquiries have been made, it is certain that works on the subject are very superficial, and have no scientific character. Lorinzer has published an account of short-sightedness and pulmonary complaints, so prevalent in schools, as a thing well known. Ebermaier contradicts these assertions, with little authority. It is, however, only extended statistics, carefully and scientifically examined, which can show light on the subject. A line of demarcation should be drawn between those maladies which directly proceed from these establishments and those where the influence is only secondary. Amongst diseases of the eyes short-sightedness ranks first.

At the beginning of the century, an Englishman named Waze collected statistics to prove that school education had an influence on the development of short-sightedness. Since that time researches have been made, but almost always isolated, and not conclusive. The important work of Dr. Hermann Cohn, of Breslau, must be excepted, who, by the method and accuracy of his observations, has reduced it to a science. Cohn has based his observations on the result of the examination of the pupils of five schools in the village of Langenbielau, of twenty elementary schools, of two girls' schools; of two middle schools, of two *realschulen* (superior commercial and industrial schools), and of two of the Breslau colleges.

Out of 10,060 scholars he himself examined 6,059; the others were examined by the masters, according to his directions. Cohn recently examined the eyes of 410 students of the Breslau University. At the same time, the age of the pupil was taken, the time he had spent at

school, and the time of his leaving. The diseases of the eyes at these different periods were with care noted down, and these details furnished a sure basis for scientific examination. It was found that amongst these 10,060 pupils, 17·1 per cent. had not their normal sight, but this number was very unequally divided, being as follows:—

	Per cent.
In village schools	5·2
Elementary town schools	14·7
Middle schools	19·2
Superior girls' schools	21·9
Superior commercial schools	24·1
In colleges	31·7

Amongst the 410 students examined, 68 per cent. did not possess their normal sight. If the minor diseases of the eyes are omitted, and only short-sightedness noted, 10 per cent. of such cases are found as follows:—

	Per cent.
In village schools	1·4
Elementary town schools	6·7
Superior girls' schools	7·7
Middle schools	10·3
Superior commercial schools	19·7
In colleges	26·2
Amongst the 410 students examined	60·0

This table shows the proportion to be 11·4 per cent. for town schools. Dr. Cohn, justly, does not attribute the enormous proportion of short-sightedness amongst the children educated at schools simply and exclusively to the system of these establishments. A combination of unfavourable circumstances contributes to produce short-sightedness, even at home and beyond school influences; and when we accuse the defective mode of lighting, close type, too small writing, the habit of stooping forward too much when seated, &c., producing disastrous effects on the pupil even at home, we do not lay sufficient stress on the fact of these bad habits originating from schools which not only do not check them in the beginning, but often encourage them.

Besides the natural and artificial lighting of schools, Dr. Cohn has given his attention to the desks and forms, and thinks that their present construction should be changed. They encourage an habitual tendency to make the pupils look at their writing too near, poking their heads forward; from this there arises a greater activity in the muscle for adjusting the eye, which causes a pressure of the fluids on the front portion of the pupil, and produces at the same time a lengthening of the axis of the eye at the back. These two circumstances are quite sufficient to account for short-sightedness. Practically, the fixed position of the desk and form oblige the pupil to bring his eye forward to the object. If he wants to approach the object to his eye he cannot do it. In reading we can, to a certain point, obviate this inconvenience; but in writing, arithmetic, and drawing, this is impossible. Amongst 731 pupils in the Municipal College at Neuchâtel, 296, or more than 40 per cent., suffered often from headache. Young girls suffered more than the boys, the proportion being 50 per cent., whilst amongs the boys it was only 28 per cent. Of the latter, the junior pupils suffered most. Becker examined 3,568 pupils, boys and girls, from all the public schools in Darmstadt and Bessungen, besides three private schools in Darmstadt, and found 974, or 27·3 per cent. who suffered more or less from headache. H. St. Claire-Deville and Troost found that cast-iron, when heated to redness, allows the passage of carbonic oxide. Most schools are heated with cast-iron stoves, which causes headaches, vertigo, shivering, and analogous complaints, from the effect of this dangerous gas even in small quantities. Dr. Oidtmann, who lives in a country where cast-iron stoves are greatly used, does not hesitate to regard as very frequent amongst pupils in schools a chronic poisoning by carbonic oxide.

(*To be continued.*)]

CORRESPONDENCE.

TRAMWAYS AND CONCRETE ROADS.

Sir,—I have attended one of the meetings lately held at the hall of the Society of Arts on Tramways, and have read with great interest the discussions that have recently taken place on the subject. There cannot be a doubt, however, that, unless some new arrangement is made other than that proposed and hitherto adopted in great cities, any such scheme introduced into the narrow and over-crowded thoroughfares of London will have a very disastrous and disturbing effect, in more ways than one, on free locomotion in the streets. As far as we can judge from our present experience, it will establish two separate and independent systems of administration for the repair of the road; it will prevent ready access to the pipes and sewers, which by the present arrangement is necessary; and, as it will occupy some 16 or 18 feet of the centre of every thoroughfare, it will practically force the general traffic to travel on the remaining space on each side—I should think a very serious drawback. I say, such are some of the difficulties which present themselves to the introduction of tramways on the streets of London, not but that some of them may be overcome, although the remedies have not been suggested. The reason for the construction of tramways at all is the imperfection of our present system of road-making and street construction. I need not remark on the sea of slush and mud which the public have to travel through every winter, even on our best constructed and most improved thoroughfares—their condition has simply become intolerable. Now, if we could provide a road or street surface free from mud or dust, and of such smooth and equable bearing as will reduce the traction to one-half that on the best macadamised road, I should imagine we would secure all the benefits of smooth and perfect locomotion without the acknowledged inconvenience and defects attendant on tramways on our crowded streets. I would take the liberty of suggesting such a remedy. I may mention that I have had for many years the charge of the maintenance and repair of the roads and bridges of the seven northern counties of Scotland, and within the last few years have been making experiments, with a view of obviating the defects of our street construction above described. At present, the cementing matter of a macadamised road is mud, as is also the cementing matter of causeways, for, although the stones are laid on lime concrete, and the joints filled with lime grout, the vibratory action of the traffic prevents the lime setting, and it is consequently converted into mud on every shower of rain. Instead of this muddy cementing matter, I have substituted an admixture with Portland cement, which fixes the macadamised road uncrushed; and the consolidated mass is impervious, when set, to the influence either of water or heat; and, as the surface is consequently inflexible and free from hollows, it produces an equable roadway approximating to the smoothness of a railway—hence the easiness of the traction; and where it may be necessary to retain the causeway in consequence of the heavy traffic, I have substituted the Portland cement mixture for fixing the stones.

I have made three experiments. One was not successful. The contractor of the road was crushing a coating of macadamised stone adjoining, and was permitted to pass his roller (three to four tons weight) continually over the new concrete road, thereby destroying the crystalline structure of the cement before it had sufficiently hardened.

The other two experiments have been quite successful. One, at the goods-station approach at Inverness, has been under traffic for 4½ years; the last in Edinburgh, at George IV. bridge, by authority of the City-road Trust, has been under traffic for 3½ years. In neither case has the general surface of these experimental roadways required repair during that time, the wearing not exceeding about a quarter of an inch. The surface

is free from mud and dust, and any mud from the adjoining streets may be cleared off by means of the water-hose; in faet, the street may be washed clean from impurities every morning, and dry in half-an-hour.

In case you may think that I am too sanguine in my expectations (as the projeetors of new conceptions often are), I annex excerpt of a speech on this mode of road-making by Mr. Peddie, W.S., the late chairman of the City-road Trust, in Edinburgh, as an evidenee of his opinion on the subject; and I feel confident it only requires some further experiments to secure for London thoroughfares freedom from mud or dust, with half the present traction, and immeasurably less expense. It might be worth while, therefore, for the vestries of London to try whether this mode of street construetion may not render unnecessary the very questionable plans of tramways now projected. It is my intention to publish, in a week or two, the results of my experience on this subject, which ean be more fully explained than in a letter.—I am, &e.,

W. V. Mitchell.

66, Wimpole-street, Cavendish-square, April 12th, 1870.

Extract from a Speech of Jas. Peddie, Esq., W.S., Chairman of the City-road Trust, Edinburgh, on the occasion of his retiring from the chair in November last.

"I trust your new surveyor will introduee some under-bottoming still more solid than the lime concrete now in use, which, by not setting rapidly, only to a partial extent (in my opinion) answers the purpose desired. I would also earnestly recommend to the board a further trial of the macadamised eoncrete with which a portion of George IV. bridge was laid three years ago. I took a considerable part in urging a trial of this plan, and I think it has proved its good quality by the state in whieh it remains after three years' tear and wear. Being a first experiment, it was not so well laid at the joinings as it might be, and as a little experience would attain, and it had not the advantage of a heavy rolling before hardening. But, notwithstanding, it is as good to-day as it was when first laid, excepting at one or two spots, whieh ean easily be repaired; and I do not think it has lost above a quarter of an inch by friction over the general surfaee. Its freedom from dust in summer and from mire in winter is a great recommendation to it, and earriages running over it produee no more noise than over a well macadamised road in perfect order. Its original cost is not more than causeway with Rath stone or concrete, and less by one-half than with Dalbeattie, and I am satisfied it will last double the time of the former, and if not so long as the latter, it will cost far less to renew it. Mr. Mitehell, of Inverness, to whom we are indebted for the trial, and who is the inventor of the eomposition, has shown that it ean be easily repaired by a little roughening of the surfaee and being overlaid with a coating of two inches or so in depth; and some device will, I doubt not, be found for lessening the trouble in getting at gas and water pipes and drains. I hope the board will test this plan further, as early as a suitable street is ealling for repair; and, should any of the streets at present upheld by the eounty fall under its charge, as they in all probability soon will, either by arrangement or under a new general road act, it appears to me that some of them might very beneficially be laid down in this manner."

MR. HOPE'S PAPER ON SEWAGE.

Sir,—I have no desire to enter into a paper warfare with Mr. Hope on the sewage question, as it is one on the leading principles of which our opinions widely differ. Moreover, I respeet Mr. Hope as a consistent advocate of sewage irrigation, and I only reply to his letter in self-defence. He is quite eorrect in assuring you that I am not a farmer, but his selection of the proof of my ignoranee of agriculture is unfortunate, as it would condemn also ninety-nine per eent. of our best agriculturists, for that proportion at least would prefer "40 tons of farm-yard manure, 10 tons of guano, and 10 cwt. of bones," to "the manurial products of 40 or 45 persons," however these were obtained or applied. And, speaking chemieally, they would be right, for the proportion of phosphates to nitrogen would be better balaneed in the former mixture. The quantity of nitrogen in sewage, if all taken up by the plant, must make it an exhaustive manure, as either phosphates must be removed from the soil by the erop, or some of the nitrogen must pass off in the affluent water. Henee the luxuriant development of foliage so eharaeteristic of sewage farms, and the eomparatively small proportion of dry substance in the crops raised. This is well shown in some of the exhaustive experiments of Messrs. Lawes and Way, published in the third report of the Sewage Commission. At to Dr. Spencer Cobbold's pamphlet, I quoted from it to show that there may be danger to health in irrigated fields, and the views of that eminent authority need no defence from me.

As to the extract from my paper on the eost and produee of irrigation, Mr. Hope merely states that it is "altogether erroneous;" but as he does not point out the error, or specially deny any of its statements, I am unable to answer his objeetion.—I am, &c.,

Edward C. C. Stanford, F.C.S.,
Medallist of the Society of Arts.

Edinbarnet, Dumbartonshire, N.B.,
April 19, 1870.

MEETINGS.

International Money, Weights, and Measures.—The Council have granted the use of the Great Hall to the International Decimal Assoeiation on Friday evening, May 6th, for a Conference. Earl Forteseue will preside, and a full report of the meeting will appear in the *Journal of the Society of Arts.*

OBITUARY.

Mr. Daniel Maclise, Royal Aeademieian, died on Monday afternoon. He was born in Cork, in 1811, but was of a Scottish family, his father having held a commission in the Elgin Fencibles. His passion for art led him, at an early period of his eareer, to give up a situation in a eounting-house in his native city, and eome to London, where he studied for two years at the Royal Academy, and twice in succession took the gold medal. His first-exhibited pietures were painted in his twenty-second year, and were shown at the British Institution in 1833. Two years afterwards, the Royal Academy elected him an associate, and, in 1841, he was eleeted a Royal Aeademician, his age then being thirty. When, in 1866, Sir Edwin Landseer refused the Presideney of the Royal Academy, it was offered to Mr. Maclise, who also declined it. Mr. Maclise took an active interest in the application of art to industry, and designed, for the Society of Arts, the eup which has since been periodieally awarded as a portion of the Swiney prize, and is known as tho Swiney cup.

GENERAL NOTES.

Inerease of Population. — London and Paris have doubled their population sinee 1832, Vienna has witnessed a larger increase still, and Liverpool has almost tripled her inhabitants. But tho inerease at Berlin is stated to be in the ratio of 3·2 now, to one in tho year above named.

Dutch Prizes for Physical Science.—A large number of prizes for investigations in physical science are offered by the Dutch Society of Experimental Science. Particulars may be had by applying to the secretary, Dr. Van der Pant, of Rotterdam.

Muddy Water Cleared by Alum.—A comparatively small quantity of alum will clear muddy water. A piece as small as a hickory nut, or even less, according to the impurity of the water, will precipitate the dirty colouring matter in a pailful of water. It has simply to be dissolved, stirred, and left to settle. This method is frequently adopted along the Missouri and Mississippi rivers. In the manufacture of lakes used in painting, the dissolved colouring matter is precipitated by alum. All this rests upon the peculiar property of alum to combine, when in solution, with the most foreign particles in suspension or even solution.

Artificial Ice in Philadelphia.—The Philadelphians are making large quantities of this ice by means of water, ammonia, steam, and salt. The retort is used to heat the ammonia; a coil of pipe, through which steam passes, winds round the interior. Eight hundred gallons of the ammonia are poured into the retort, and about twenty-four pounds of steam applied. The gas arising from the ammonia is conveyed into a pipe at the top of the retort; the pipe passes into a cooler filled with water, and thence into the liquifier; it is then thoroughly chilled, and becomes a freezing cold liquid. Connected with the condenser is a pipe carrying the liquid into a series of pipes, which diverge through a freezing box; the latter is filled with a strong solution of salt and water, which, with the aid of the liquid ammonia in the pipes, produces an intense cold. Into the freezing-box forty-eight brass boxes are introduced, filled with fresh water, each of them yielding a twenty-four pound slab of ice, 4 in. thick, 2 ft. long, and 1 ft. broad. It takes four hours to freeze the forty-eight boxes. This ice costs fifty per cent. less than the ordinary ice.

Importation of Live Cattle.—Considerable interest has been felt for some time past in the experiments which were being made, with a view to effect the importation of live cattle into this country from the River Plate. Although it has been known that a shipment recently arrived at our ports, but little information has been obtainable in reference thereto. It appears that the attempt has not proved in this instance so successful as was anticipated, but its want of success seems to have been due to absence of proper organisation on the part of those entrusted with the procuring of the cattle. The originators of the scheme proposed to procure the cattle in their native or wild state, and, after driving them to the port of sbipment, to stall—feed them and fit them for life on shipboard. But in this instance the preliminary treatment and preparation of the cattle was neglected. These cattle were driven wild from their native pastures and placed on shipboard at once, being much bruised and injured in so doing. The food provided on shipboard was pressed hay and Indian corn, food which the cattle refused to take for several days after shipment. The cattle shipped numbered about 240 bullocks, 400 sheep, and several horses. Owing to the bruised condition of the bullocks, many had to be slaughtered and thrown overboard, and about 120 only arrived at our ports. Of the sheep nearly the whole were delivered here, but they were in a thin and unsatisfactory condition. It is said that the entire shipment in this instance realised rather less than the freight, but it is right to add that the cattle were sold under unfavourable circumstances. It is the opinion of those who have had opportunity of watching the experiment recently made, that the importation will ultimately be successfully carried out, with considerable advantage to the people of this country; but in order to ensure its success a thoroughly organised system of supply, and much greater care in its shipment, than it has hitherto received, is necessary.

Platinum Light.—M. Schinz states that platinum, at a bright white heat produced by igniting a mixture of hydrogen and carbonic oxide gases, yields a light which, compared with good coal gas, is as 1·24 to 1·0.

The Fairlie System in Russia.—The commission of Russian engineers who lately visited England for the purpose of seeing Mr. Fairlie's narrow gauge railway plant and the Festiniog Railway, where his engines are at work, have, according to the *Iron and Coal Trades Review*, reported strongly in favour of the system. They recommend it to be adopted for a portion of the railway between St. Petersburg and Moscow, and estimate the cost of construction at about £4,500 per mile.

Belfast and North of Ireland Exhibition (in connection with the Workmen's International Exhibition, London, 1870).—The General Committee for Belfast have resolved to hold the local exhibition of arts and manufactures in the Ulster Hall, Belfast, on the 17th of May next, and ten following days. They have appointed an executive committee to adopt such measures as they may deem advisable for procuring contributions in fine arts, natural history, and other objects of interest and instruction, from gentlemen in Belfast and the North of Ireland, in order to supplement the workmen's display, and to carry out the general arrangements of the exhibition.

International Maritime Exhibition at Naples.—The following is the official programme of the International Exhibition which is to be held at Naples from the 1st of September to the 30th of November, 1870:—Group 1. Naval construction. Group 2. Steam-engines. Group 3. Ports, harbours, and marine establishments. Group 4. Timbers, minerals, and fuel. Group 5. General fittings for ships. Group 6. Instruments for navigation, apparatus for saving life at sea, and arms for merchant navy. Group 7. Ships' provisions and seamen's clothing. Group 8. Scientific section. Group 9. Principal articles of export and provisions from Italy. The rewards will consist of gold, silver, and bronze medals.

Conference on International Money, Weights, and Measures.—The Council of the International Decimal Association will hold a conference on international coinage, the introduction of metric weights and measures, and the abolition of troy weights, on Friday, May 6th, at eight o'clock, in the rooms of the Society of Arts, Earl Fortescue in the chair. The Right Hon. Sir Charles Adderley, M.P.; J. B. Smith, M.P.; Sir Thomas Bazley, M.P.; Edward Baines, M.P.; C. R. Graves, M.P.; Dr. Farr, F.R.S.; Sir John Bowring, F.R.S.; Samuel Brown, President of the Institute of Actuaries; Frederick Hendriks, James Yates, F.R.S., Professor Leone Levi, and others will take part in the proceedings. Members of the Society of Arts and others will be admitted on presentation of their cards.

Increase of Coal Consumption in London.—The railways have brought more coal to London during the last quarter than for any corresponding period since the London and North Western line first commenced carrying them in 1845, when the quantity was 8,337 tons. During the first three months of the present year the Great Northern carried 285,317 tons; Midland, 239,020 tons; London and North Western, 233,747 tons; Great Eastern, 132,323 tons; Great Western, 119,562 tons. Total for the quarter being 1,020,320 tons, against 734,517 tons for the first quarter of 1869, showing an increase of 285,803 tons. The Derbyshire Clay Cross Collieries obtained the largest portion of this increase, and now send one-eighth of all the coal that is brought to London. Of the Silkstone coal, much valued in the metropolis, there was only an increase of 485 tons, owing to the dispute at the Thorncliffe Collieries. Seaborne coal has only increased to the extent of 25,272 tons, against the railway increase of 285,803 tons, as already mentioned.

Silk Production.—The Science and Art Department of the South Kensington Museum has placed at the disposal of the Silk Supply Association a room for the purpose of rearing silkworms during the ensuing months of May and June. The association, being possessed of some rare and valuable "grain" (imported by the hon. secretary), expect thus to be enabled to demonstrate, for the information of sericiculturists in this country and in the colonies, the simple practicability of silk production. It being of much importance to obtain regular supplies of proper food for the worms, the association would be obliged to gentlemen having mulberry trees who will occasionally favour them with small quantities of leaves. It is desirable the first supplies should arrive as early in May as possible. The secretary of the association will gladly arrange for periodical receipts of leaves with gentlemen who may be willing to promote this national object, if they will kindly communicate with him at the offices of the association, 65, Moorgate-street.

Society for the Promotion of National Industry.—Partial Italian Exhibition in Turin, May, 1870.—The following notice has been issued by the direction:—1. The government has granted for the use of the exhibition the palace which was formerly the Custom-house. It will be arranged so as to offer every facility for exhibiting specimens of textile manufactures and machinery. 2. The local committees of the various provinces of the kingdom, and the direction at Turin, will begin to receive the articles for exhibition on the 15th instant. 3. In sending goods to the local committees, or to the direction in Turin, the exhibitors should be careful to forward the bill of consignment, showing the nature, number, weight, and value of the articles, according to Article 17 of the regulations for the exhibition. 4. The railways and steamboats have agreed to facilitate the transport of goods, provided the carriage is prepaid. The exhibitors or local committees must therefore prepay the carriage, and on production of the proper vouchers, the expenses of carriage will be reimbursed to them by the society, according to Art. 19 of the regulations. 5. In accordance with Art. 19 of the regulations, cost of transport will not be reimbursed for any goods that arrive after the 15th May. 6. All boxes and cases should be addressed as follows:—"Alla Direzione di Torino per l'Esposizione partiale italiana del 1870." At the same time, the nature of the articles and name of the exhibitor should be notified on the address. 7. Forms for declarations, bills of assignment, and addresses are to be had from the direction at Turin, the chambers of commerce, and from the local committees. 8. In accordance with the programme already published and distributed to all the chambers of commerce of the kingdom, the articles admited for exhibition are divided into the four following classes:—1. *Textile Manufactures.*—Section 1. Raw materials, with the preparations they undergo to render them more saleable.—Wool and hair of sheep, goats, alpaca, &c., raw and thrown silk, cotton, flax, hemp. Section 2. Manufactured products.—Thread and tissues made from wool, silk, cotton, flax, hemp, jute, nettles; processes, machines, and apparatus for spinning and weaving. 2. *Dyes, and Manufactures depending on Dyes.*—Mineral, vegetable, animal, and artificial dyes of various colours; chemical products used as auxiliaries in preparing and dyeing woven goods, skins, paper, &c. Samples of modes of dyeing and printing thread, woven goods, paper, feathers, skins, wood, &c. Processes, machines, and apparatus for bleaching, dyeing, and printing woven goods. 3. *Manufacture of Paper.*—Various kinds of paper and cardboard. Machines and apparatus for preparing the raw materials, &c., for the manufacture of paper. 4. *Instruments of Precision, Instruction, Statistics, History, Hygiene, Books relating to Textile Manufactures and Dyeing.* A future notice will contain a list of the prizes offered by the Minister of Agriculture, Manufactures, and Commerce, by the chambers of commerce, and other public bodies. — For the direction, G. E. Garelli.

The Manufacture of Casks is carried on on a large scale at Gallipoli, and in the five principal manufactories in that town it gives employment to upwards of 400 persons. The casks made at Gallipoli are in great demand throughout the Mediterranean, as from their excellent construction they are adapted for containing oil. During the past year (1869), besides those required for the exportation of 29,664 salmas of oil from this port, 92,428 salmas of empty casks were exported to the following places by 125 vessels:—To the Italian ports, 42,727 salmas; 1,655 to Trieste; 22,105 to the Ionian Islands; 9,625 to Smyrna; 6,987 to Metelino; 5,382 to Candia; 1,822 to Calamata; 1,048 to Adramiti; and 3,147 to the various other ports on the Mediterranean.

Australian Exhibition.—In commemoration of the centenary of the discovery of Australia, a grand Metropolitan International Exhibition will be held in the Prince Alfred-park, Sydney, in August and September next, when medals and prizes will be given for exhibits in the following departments:—First department, live stock, and agricultural and horticultural produce of all kinds, including manures and implements. Second department includes fine arts; apparatus and application of liberal arts; furniture and other objects for the use of dwellings; clothing, including fabrics and other objects worn on the person; products, raw and manufactured, of mining industry, forestry, &c.; apparatus and processes used in the common arts; and food, fresh, preserved, and in various states of preservation. Prize essays are also a feature of the exhibition, as follows:—Lord Belmore offers £5 for the best essay on the exhibition, composed and written by children attending schools under the Board of Education; and for essays showing the best and most economical mode of storing water for pastoral and agricultural purposes, &c., the following gentlemen offer the amounts against their names:—Lord Belmore, 45 guineas; T. S. Mort, Esq., 10 guineas; Hon. T. Holt, 10 guineas; Hon. S. D. Gordon, 10 guineas; Mercantile Bank, 20 guineas; E. H. Woodhouse, 10 guineas; and Agricultural Society, 30 guineas.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Arts, 8. Cantor Lecture. Dr. A. W. Williamson, F.R.S., "On Fermentation."
R. United Service Inst., 8½. Mr. Edwin Chadwick, C.B., "On the Advantage of Introducing Military Drill and Naval Exercises into Schools."
Royal Inst., 2. General Monthly Meeting.
Society of Engineers, 7½. Mr. W. Lloyd Wise, "On the Patent Laws."
Farmers' Club, 5½.
Entomological, 7.
British Architects, 8. Annual Meeting.
Medical, 8.
Asiatic, 3.
Victoria Inst., 8. Mr. E. J. Morshead, "Comparative Psychology."
London Inst., 4.

Tues ...Civil Engineers, 8. Mr. George Berkley, "On the Strength of Iron and Steel; and on the Design of parts of Structures which consist of those Materials."
Pathological, 8.
Anthropological, 8.
Syro-Egyptian, 7½.
Royal Inst., 3. Prof. Blackie, "Moral Philosophy."

Wed ...Society of Arts, 8½. Conversazione at the South Kensington Museum.
Civil Engineers. Annual Dinner.
Obstetrical, 8.

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8.
Chemical, 8. 1. Mr. J. T. Brown, "On Vapour Densities." 2. Professor A. H. Church, "On New Cornish Minerals, No. 7."
Royal Society Club, 6.
Artists and Amateurs, 8.
Royal Inst., 3. Prof. Tyndall, "Electricity."
London Inst., 7½.

Fri ......Geologists' Assoc., 8.
Philological, 8¼.
Royal Inst., 8. Mr. Proctor, "Star Grouping, &c."
Archæological Inst., 4.

Sat......Royal Inst., 3. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, MAY 6, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

May 11.—"On Railways in India." By W. P. Andrew, Esq., Chairman of the Scinde, Delhi, and Punjaub Railways. On this evening the Hon. Arthur Kinnaird, M.P., will preside.

May 18.—"On International Money of Account, independently of International Coinage." By Jacob A. Franklin, Auditor of the Society; in sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1855.

May 25 (At Three o'clock).—"On the New Organ in the Albert Hall of Arts and Sciences, South Kensington." By I. Willis, Esq. At this meeting Sir Michael Costa will preside.

CANTOR LECTURES

The third course of Cantor Lectures for the present Session is by Professor A. W. Williamson, F.R.S. The course consists of four lectures, "On Fermentation." The second lecture was delivered on Monday evening, the 2nd of May; the remaining two will be delivered on the 9th and 16th of May, at 8 o'clock.

Lecture III.—Monday, 9th May.

Propagation of ferments.—Prevention of fermentation.—Germs in air: how removed; how destroyed.—Processes for arresting fermentation.

Lecture IV.—Monday, 16th May.

Wine-making and wine-keeping.—Chemical changes which improve the quality of wine.—Chemical changes which deteriorate the quality of wine.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

INDIA COMMITTEE.

The report of the Conferences on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell and Daldy, price one shilling.

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—
Coventry Institute.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CONVERSAZIONE.

The annual Conversazione of the Society took place at the South Kensington Museum on Wednesday evening, the 4th May.

About six thousand of the members and their friends were present. The company were received from eight till a quarter to ten by Lord Henry Lennox, M.P., Chairman of Council.

At ten o'clock their Royal Highnesses the Prince of Wales, President of the Society, and the Princess of Wales, attended by the Countess of Morton and Colonel Teesdale, arrived at the garden entrance to the Museum, and were received by Lord Henry Lennox, M.P., Chairman of Council, and other Vice-Presidents, members of Council, and officers of the Society.

The Princess, escorted by Lord Henry Lennox, and followed by the Prince, who gave his arm to the Duchess of St. Alban's, then led the procession through the building by way of the South Court, the North Court, the Raphael Cartoon Gallery, the Sheepshanks Galleries, and the Competition Gallery, to the Prince Consort's Gallery, which was especially set apart for their Royal Highnesses and their invited guests, and where they were received by their Serene Highnesses the Prince and Princess Edward of Saxe Weimar.

Their Royal Highnesses having listened to the band from the Florence Gallery, overlooking the North Court, inspected the collection of jewels and some of the pictures, took their departure at twelve o'clock by the same route as that by which they arrived. Among those present were:—The Duchess of Manchester, the Duke of Sutherland, the Marquis and Marchioness of Huntly, the Marquis and Marchioness of Hamilton, the Marquis of Hartington, the Earl and Countess of Londesborough, Earl Roden, Countess of Mayo and the Hon. Henry Bourke, Viscountess Dangan and Lady Féodore Wellesley, Viscountess Dufferin, Viscount and Viscountess Barrington, Lady Diana Beauclerk, Lord Cottenham, Lord De L'Isle and Dudley, Lord Carington, Lord Seaton, Lord and Lady Alexander Gordon Lennox, Lord Ronald Gower, M.P., Lord Richard Grosvenor, M.P., Lord Claud Hamilton, M.P., Lord George Hamilton, M.P., Col. and the Hon. Mrs. Carleton, the Hon. Francis and Mrs. Stonor, Mr. and Lady Violet Greville, Col. and Lady Louisa Tighe, Captain the Hon. and Mrs. Seymour Egerton, Sir A. and Lady Rothschild, General Sir William and Lady Knollys, Miss Knollys and Mr. Francis Knollys, Col. and Lady Emily Kingscote, Major-General Sir A. S. Waugh, K.C.B., Sir William Fergusson, Bart., Sir Joseph Whitworth, Bart., Sir Walter Stirling, Bart., Sir Charles Dilke, Bart, M.P., Sir George Grey, K.C.B., Sir Edwin Landseer, R.A., Sir Michael Costa, Mr. Justice Keating, the Bishop of Carlisle, Dean of Canterbury, the Right Hon. W. E. Forster, M.P., and Mrs. Forster, Mr. Henry Cole, C.B., and Mrs. Cole, Mr. Edwin Chadwick, C.B., and the Misses Chadwick, Mr. and Mrs. Hyde Clarke, Mr. and Mrs. William Hawes, Mr. and Mrs. Seymour Teulon, Mr. John Bell, Mr. E. Carleton Tufnel and Mrs. Tufnel, Mr. Chandos Wren Hoskyns, M.P., and Mrs. Hoskyns, General and Mrs. Eardley-Wilmot and Miss Eardley-Wilmot, Mr. and Mrs. Bartley, Mr. J. A. Franklin, Mr. J. T. Ware, Captain Donnelly, R.E., Mr. Henry Vaughan, and the officers of the Society.

His Highness the Nawab Nazim of Bengal, with his two sons and suite, attended by Colonel and Mrs. Layard, also honoured the Council by their presence.

The band of the Grenadier Guards, under Mr. Dan Godfrey, performed the following selection of music in the north court:—

Overture—" Semiramide" (Rossini).
Fantasia—" Barbe Bleue" (Offenbach). Cornet, Mr. McGrath; Euphonium, Mr. Lawford.
Lieder ohne Wörte—(Mendelssohn).
Valse—" Christine" (D. Godfrey), dedicated to Mdlle. Christine Nilsson.
Selection—" Macbeth" (Verdi).
Concertina Solo—" On Airs from Lurline" (Blagrove), Mr. Roe.
Fantasia—" Zanetta" (Auber). Clarinet, Mr. Spencer; petite clarinette, Mr. Ruston; cornet, Mr. McGrath.
Cornet Solo—" Excelsior" (Frewin), Mr. McGrath.
Selection of Moore's Irish melodies—(Arranged by D. Godfrey).
Galop—" Feldjäger" (Peplow).
" God Save the Queen."

The band of the Royal Marines (Chatham division) also performed as follows in the picture gallery.—

Overture—" Rübezahl " (Carl Oberthür).
Valse—" Wiener " (Gung'l).
Grand selection—" Macbeth " (Verdi).
Polka de concert—" Le premier Amour " (Neumann).
Variations—" Le Carnaval de Venise " (Hauser).
Fastasia (on English airs and glees, with vocal accompaniment)—"Rule Britannia " (Kappey).
Valse—" Morgenblätter " (Strauss).
Overture—" Le jeune Henri Chasse " (Mehul); the " Hunting " Symphony.
Galop—" Berliner Pferde-Eisenbahn " (Arndt).
" God save the Queen."

CANTOR LECTURES.

The fourth of a course of lectures on " The Phenomena of Combustion, and the Chemical and Physical Principles involved in the Use of Fuel, and in the Production of Artificial Light," was delivered by Dr. Benjamin Paul, F.C.S., on Monday, the 28th March, of which the following is an abstract:—

The evolution of light is another effect of combustion which is of practical utility, and it is chiefly by this means that light is produced artificially. The essential particular in which combustion serves as a source of light, consists in the fact that all material substances become luminous when heated to a sufficiently high temperature.

This character of becoming luminous at a high temperature belongs, in the highest degree, to solid substances which are not changed in their nature or condition by mere heat. Liquids also become luminous when heated under such conditions that they are not converted into vapour. Gases and vapour are least of all capable of becoming luminous when heated, partly by reason of their natural tendency to expand under the influence of heat, partly also on account of the heat applied to them being extended or converted into another form of energy in the expansion they undergo. If the expansion of gas be prevented by subjecting it to great pressure, it becomes luminous when sufficiently heated, but the evolution of light from hot gas or vapour is always less than from solid materials, and under ordinary conditions, very intense degrees of heat are required to render it sensible.

The temperature at which a solid begins to be faintly luminous is about 700° F.; at a temperature of about 1000° F., solid and liquid substances emit a reddish light, consequently this degree of heat is commonly termed red heat. This term, however, represents a certain range of temperature, within the limits of which the light given out is brighter in proportion as the temperature is higher. These different degrees of heat are therefore described as bright red heat and dull red heat, or the extremes, sometimes also by terms representing intermediate degrees. At a still higher temperature, substances emit colourless light of great intensity, and this degree of heat is termed white heat.

To obtain light artificially, then, it is necessary to produce a sufficiently high temperature in some substance capable of becoming luminous in that condition. Practically, the temperature requisite for this purpose is generally produced by burning some combustible material, though it is, in the case of the electric light, produced by conversion of electricity into heat.

If hydrogen gas be used as the heating material, the water vapour, which is the sole product of combustion in that case, has such a high degree of tenuity that it gives out barely sufficient light to be visible. There is in this flame no solid material. But if this intensely hot flame be made to impinge upon some solid not liable to change at the high temperature, a most copious evolution of light takes place. If the hydrogen be burnt with oxygen instead of air, so as to produce the greatest degree of heat, and the flame be directed upon a mass of lime, a very intense light is produced, which is known by the name of the lime-light.

However, in the more ordinary production of artificial light by burning some combustible material, the solid substance that is rendered luminous is furnished by that material itself simultaneously with the heat requisite for producing a high temperature. This is the case in burning the metal magnesium, which is thereby converted into an oxide (magnesia), and the finely-divided solid particles of this product become heated sufficiently to evolve intense light. But the use of any material which, like magnesium, is converted by burning into a fixed solid product would be very inconvenient, since the product of combustion would present the form of a cloud of dust. Carbon, however, is a fixed solid substance, which, being also combustible, is capable of becoming luminous when heated, and at the same time burning away gradually into a gas. Hence this substance is especially suited for the production of artificial light, without the disadvantage just mentioned. It is, indeed, in this way that artificial light is produced in burning any ordinary illuminating material. Such materials are in all instances carbonaceous, that is to say, they all contain this substance, carbon, as one of their constituents; and one of the chief features of their applicability for producing artificial light consists in the circumstance that, when burnt, they are decomposed in such a way that carbon is separated within the flame in finely-divided solid particles, which, before being burnt into carbonic acid gas, become intensely heated and luminous.

The change which any illuminating material, such as oil, tallow, wax, or paraffin, &c., undergoes in being burnt as a source of light, consists of several distinct phases. All these materials undergo chemical alteration when they are heated—they are decomposed, as the chemist expresses that alteration—and they furnish at first gases or vapours which are also carbonaceous substances capable of burning. When these gases or vapours burn, the hydrogen they contain combines with atmospheric oxygen more readily than their carbon does, and consequently this carbon is separated in the state of exceedingly minute particles distributed through the flame, there acquiring a high temperature and becoming luminous. The combustion of these particles, however, still goes on, converting the separated carbon into carbonic acid gas, and their place is supplied by fresh particles.

In burning any illuminating material, it is the heat of the flame that determines the decomposition of the carbonaceous vapour first produced, but this is not the only work done by the heat of the flame. The illuminating material must be first converted into vapour, and for that purpose it must be continuously brought in successive small portions into the flame. This is effected by the wick of a lamp or a candle, consisting of a bundle or plait of cotton fibre, through which the oil or melted tallow, &c., rises by capillary action until it reaches the

flame. In burning a combustible gas, no wick is required, since the physical condition of the material provides sufficiently for its continuous supply to the flame. This is one great advantage of gaseous illuminating materials over those which are solid or liquid; but there is another reason why the production of combustible gas must be a distinct operation when certain materials are to be used for illuminating purposes. Oil, tallow, and the various other materials used in lamps and as candles are all susceptible of being vapourised entirely, and without leaving any fixed carbonaceous residue. This is not the case, however, with coal, wood, resin, &c., and consequently these materials cannot be burnt in the same way as candles or oil in lamps.

The vapourisable portion of such materials must be separated by distilling them in retorts, so as to obtain either a combustible gas or an oil that will burn without leaving a fixed coally residue. The former mode of treatment constitutes gas-making; the latter, the manufacture of what is known now under the name of paraffin oil.

But, whichever course be adopted, either with bituminous materials or with oil, tallow, wax, &c., the production of a luminous flame involves the formation of a gas containing carburetted vapours, which deposit carbon in burning. In order that a flame may have a sufficient degree of luminosity, the separation of carbon must take place freely, and at the same time it must not exceed such an amount that there may be perfect combustion. If carbon be separated so copiously that it cannot be entirely burnt, the flame smokes, and a result is produced similar to that obtained in burning magnesium. There is a great difference in this respect between materials capable of being used for illumination, and consequently it is necessary to adapt the conditions under which any particular material is used to its peculiarities.

So far, the phenomena of a luminous flame are simple and easily represented, but there are other circumstances of detail which are less readily appeciable. In the first place, the decomposition of the material burnt, and its conversion into carburetted vapour or gas, is far from being a simple change. It is rather a series of changes, which take place progressively, each step consisting in abstraction of hydrogen from the vapour, and concentration of the carbon, until it is finally separated. This gradual burning out of the hydrogen from a given portion of vapour is a source of heat, which maintains the solid carbon particles already separated in the flame at such a temperature that they are luminous, while, at the same time, it provides a fresh supply of carbon particles to take the place of those which are burnt.

The form of a flame is determined partly by the way in which the combustible gas is supplied, and partly by the mutual reaction of the heated product of combustion and the atmosphere upon each other. In the simplest case of the flame of a candle or plain gas jet, the form of the flame approaches to a cylinder. At the lower end, the expansion of the gas by heat gives the column of flame a width considerably greater than the stream of gas supplied to the flame; and in consequence of the mobility of the expanding gas, the flame presents a rounded outline at this lower end.

The tendency of the heated gas to rise upwards, and the pressure of the atmosphere on all sides of the column, have the effect of gradually contracting the horizontal area of the flame, and eventually reducing it to a point, so that it presents a taper or elongated conical form. Within this pointed cylindrical space all the changes already mentioned take place. It is only at the outer surface that combustion takes place in such a way as to produce carbonic acid gas and water vapour. But in consequence of the tendency which gases have to permeate each other and mix together, there is always a certain amount of air passing into the cylindrical column of heated gas, where it takes part in a partial combustion, converting the carburetted vapour into such a state that, when it comes near to the surface of contact between the flame and the surrounding atmosphere, it is decomposed by the high temperature prevailing there; its carbon is separated and rendered luminous, at first merely the heat, and afterwards by undergoing combustion itself, when it reaches the outer portion of this luminous envelope, and comes into free contact with air. In such a flame these different changes take place as concentric zones; but the shape of a luminous flame may be very different from that of a candle or plain jet of gas. In every case, however, there is the same relative disposition of the zones in which the progressive changes take place. At the outer surface of a flame, the atmospheric air becomes heated, and rises along the sides of the flame, mixing at the same time with the gaseous product of combustion, and removing it.

The chief point to be considered in regard to the utility of any material in the production of light, is the amount of carbon in the vapour or gas it yields, and the proportion of that constituent to hydrogen. The larger the amount of the carbon absolutely and relatively to hydrogen, as well the greater is the capability of producing light. In this respect there are great differences in illuminating materials generally, and it is also the case with gas made from coal. In order to improve the light-giving power of gas, it is sometimes saturated or charged with the vapour of some very volatile and highly carburetted liquid, chiefly benzol or the volatile naphtha, which is a joint product with illuminating gas in the ordinary manufacture of this from coal. In this way, the illuminating power of gas may be very much augmented. But in addition to the influence of composition upon the efficacy of any illuminating material, the adaptation of the conditions under which it is burnt to the special nature of the material is perhaps of as much importance as anything else. Among these conditions, in the case of gas, the kind of burner used is of the first importance, and, by proper arrangements, the amount of light obtained from a given quantity of gas may be as much as double what it is in other cases, where the burner is not calculated to give full advantage to the capability of the gas.

THE HYGIENE OF SCHOOLS.

By Professor Rudolph Virchow, of the Berlin University.

(*Continued from page* 550.)

Bleeding at the nose is reported as frequent. The proportion is larger amongst boys than girls, especially where there is less out-door exercise. Guillaume was the first to observe goître, as a frequent complaint in schools, and calls it school-goître, and says it is known under the name of *gros cou*; according to him, goître is not an endemic disease in Neuchâtel. He says it often disappears during the holidays; it is only later in life it passes into the chronic state. It is seen from the age of eight years amongst young girls, after a year passed at school. It is, however, as well to add, that Guillaume's data stand alone, and it is doubtful if they would be accepted by the generality of medical men. Some medical men attribute epilepsy, St. Vitus' dance, and mental maladies which occur subsequently, to school treatment. Heyer, of Berlin, insists most on this point. But his observations are not strictly scientific, and are not based upon anything certain. Medical men whose attention is directed to the hygiene of schools, and a great number of orthopœdists, attribute the bad deportment which is contracted there as often producing curvature of the spine, which is called "school curvature." Orthopœdists are unanimous in declaring that the generality of "school curvature" occur during the time the pupils are engaged in study. It attacks the female sex in a much greater proportion than the male. Orthopœdists consider it is caused by certain employ-

ments, especially by needlework. If such be the case, home habits should be blamed more than the schools. If statistics show us that the use of books is hurtful to the eyes of boys, and needlework prejudicial to the spines and chests of girls, then very strict rules should be adopted, as the habits contracted there are continued so generally at home. Some orthopœdists, Bouvier amongst others, do not consider that any special occupation or deportment has any influence on the production of "school curvature;" but there is one conclusive circumstance regarding it, namely, that curvature is much more frequent on the right than on the left side; the body is inclined to the right in writing as well as in drawing, or needlework, &c., and the production of "school curvature" can be explained in no other way. In a late notice on the forms used in schools, Meyer is of opinion that high desks distant from the body specially encourage the development of "school curvature," and he thinks there is an urgent demand for changing the arrangement of desks and forms. Prince remarks how forced quiet and sitting still in growing children contributes to make them get into bad positions, which they will always retain. This observation deserves to be taken into serious consideration, especially in girls' schools. Scholars, especially girls, should sit comfortably, and their position on the forms should be carefully attended to. Gymnastic exercises should supply to their limbs the amount of exercise they require. Amongst chest diseases, the organs of breathing are those which suffer most from an ill-regulated hygiene. Pulmonary and scrofulous complaints predominate; Lorinzer and Carmichael, in their works, both speak of their frequency. The latter tells of a parish school which had no playground, where the children were obliged to remain in class all the day. Amongst twenty-four young girls, well-dressed and well-fed, seven became scrofulous. Arnott was commissioned to visit a boys' school, at Norwood, consisting of 600 pupils, where scrofula was very common, and where there was great mortality. This state of things was attributed to unwholesome and insufficient food; Arnott's report showed it was due to bad ventilation. The ventilation was improved, and soon there was a diminution in the symptoms which before existed. Many more examples could be given, but, it must be confessed, statistics on the subject are incomplete. At Berlin, tables have been published on the subject, showing a rapid increase in deaths from pulmonary complaints in the older pupils. If to the victims of pulmonary complaints are added those who die from scrofulous complaints, it gives a result more serious than typhus or cholera at the same ages.

The circumstances specially injurious are—

1. Air vitiated by a great number of children.
2. Frequent chills caused by the variation of the temperature of the place; draughts, causing sore throat and inflammation of the chest.
3. Dust.
4. Difficulty of breathing, occasioned by sitting too long in one position.

Until lately, no clear idea as to the cause of pulmonary complaints existed. They have been confounded with tuberculosis, and classed amongst hereditary maladies, without a known cause. Fresh researches have shown that, under the designation of pulmonary phthisis, different symptoms have been comprised, but all having in common a termination in ulceration of the lungs. Most of them are of inflammatory or catarrhal origin, caused by cold, or by breathing irritating matter, dust, coal, &c. This short account shows how a school with defective arrangements and an insufficient supervision may influence in a dangerous manner children's health, and how much it may be feared that some cases of phthisis which entail the death of pupils are only caused by the school itself, without reckoning the seeds of the malady which are developed later in life. Coughs and throat complaints are very frequent amongst pupils. In Vernois' report on the health of the French Lycées, in the first place he puts diseases of the throat and bronchial tubes. It is easy to understand how, in weak children, want of care in these maladies may cause the most serious consequences.

It is universally allowed that a bad position when one is seated influences the organs of circulation in the abdomen, and, no doubt, produces bad effects on other internal organs affecting the digestion, &c. Measles and scarlet fever, it is well known, principally attack children, and spread rapidly in schools. Small-pox, cholera, and diphtheria find there a favourable field for their development. Typhus and diarrhœa are not so prevalent, for though cases can be named where using bad water has caused epidemics to break out in schools, they are exceptional, and are only in boarding-schools. The law directs certain efficacious regulations against contagious maladies, but it must be observed that their execution is rarely looked after.

Injuries are generally occasioned by the violence of the pupils, or by the masters' chastisements. This latter cause is more frequent than is generally supposed. Accidents, more or less severe, have been occasioned by gymnastic exercises of late years, especially sprains, dislocations, and hernia. No exact statistics at present exist, nevertheless, the fact is without doubt, and the fault arises from want of discipline and proper supervision. If one must allow that discipline and care cannot prevent some of these accidents, still the greater part cannot be set down to chance. These facts, taken as a whole, will show that the observations, ascertained scientifically by statistics, are often at fault. More extended information might perhaps be found in official documents; perhaps, also, there may yet be found in medical literature certain facts which are not here mentioned. But, whatever may be the documents which we could add to those already discussed, it is certain that, at the present time, the pathology of schools is not yet settled. Besides, if one wishes the authorities usefully to fulfil their duty, it is indispensable to bring all facts together, and to arrange them. This desirable object has only been attained in some localities for short-sightedness alone, and that is due to the private efforts of certain medical men. It is, then, the duty of the authorities to collect all the information they can. The principals of establishments should be asked to keep a list of the absent pupils, with an account of their complaints, and cases of death which may occur.

It is indispensable that the care of the public health should be confided to experienced medical men. They should begin by settling the nomenclature of the diseases which are especially prevalent in schools. From the whole of their reports a general idea of the maladies existing in scholastic establishments in the country and different provinces would be seen at a glance. Added to the statistics of the conscription, such as was made in the Statistical Congress (1863), this information will become the basis of the knowledge of the state of physical strength of our nation.

Another essential point is the question of doing away with the uniformity of school forms. Besides, if the forms and desks should be in proportion to the height of the pupils, it is necessary to establish a more exact average of their sizes. It will not do to take as a basis a large city; the average of towns and country should be taken, and observations should be made on the special conditions of certain provinces. Manufacturing districts and agricultural districts do not give the same proportions. It can readily be understood how the difficulty increases, when the arrangement of the forms and desks depends upon the age of the child, and can only be regulated according to statistics.

The report of a certain number of medical men who have undertaken these researches show that they can be made on a great scale. We ask that they should be officially made on a settled system. Such a work would furnish valuable documents to the statistics of the con-

scription. The connexion which exists between certain maladies and school regulations can only be established by such a preparatory work.

To arrive at this result, it will be necessary to form a central commission of teachers and medical men, who will take in hand the carrying out all the necessary measures. Of course, this commission would have to lay down the rules to govern that investigation. The supervision, and in fact the execution of these measures and of these rules would be confided in each district to a scholastic commission, of which, according to the importance of the neighbourhood, one or more medical men would be permanent members.

It is not probable that a close examination of this question will discover other causes of disease. We can then from now fix the number of them; they are, as near as may be, as follows:—

1. The air where the school is situated, on the purity of which will mainly depend the size of the building, the number of pupils, the heating, ventilation, the humidity of the floors, walls, and dust.
2. The lighting of the school, depending on the position of the building, the school-rooms, the size of the windows and their situation in regard to the desks, the colour of the walls, artificial lighting (gas, oil, &c.)
3. The way in which the children are seated in school, especially the proportion of the forms and desks. The width of seats, their arrangements; the time during which the child is seated.
4. Exercises for the body, especially play, gymnastics, the bath, fittings for this purpose, supervision; having regard to the proper time allotted to these, and also that during which the pupil is seated; attending to his intellectual work.
5. The application of the mind, its duration in each individual case, regulations for leave and holidays, home and school work, &c.
6. Punishments, especially corporeal.
7. Drinking water.
8. Closets.
9. The means provided for instruction, especially the choice of school books, size of type, and lesson objects.

Of late years, great attention has been paid to certain points, such as to the forms and school desks. Although, no doubt, short sightedness, congestion of the head, difficult breathing, and curvature of the spine, might often be attributed to their faulty arrangement, still they are not alone in fault. An insufficient light, bad position of the windows, a bad carriage, too small a type in school books, and too small writing, assist more or less in producing short-sightedness. Bad air, defective ventilation, too great a number of pupils, the carbonic acid from stoves, too intense application of the brain, may produce congestion, even when the desks and forms are perfect. Thus, often several causes simultaneously operate, and the result must not be attributed to one of them alone. For all these details the medical man is alone competent. After a searching examination, he should furnish the person charged with the supervision of the schools with the necessary requirements, and submit to him, if necessary, all the alterations he considers useful. A certain number of points are, from their nature, essentially under the jurisdiction of the instructor. What can be exacted from the pupil, the exertions which can be expected from him according to his age, the methods of instruction, the time allowed for gymnastics, and leave, holidays, &c., all this is the affair of the teacher. However, a great number of these questions can only be settled by the knowledge and control of the medical man. It will be necessary to establish an agreement between different views of the subject; teachers and medical men can enlighten and convince each other mutually. It is by the united efforts of competent men that the State can constitute a direction capable of watching over the solution of the great problem of our time, namely, preserving the health of the body and of the mind, and forming the future generation.

OPENING OF THE PARIS FINE ARTS EXHIBITION.

The annual exhibition of pictures, sculpture, and other works of art, opened on the 1st May according to custom, although that day fell on Sunday, and on Sunday the exhibition is always open gratis; the doors were thrown open at ten in the morning, when the public had arrived in such numbers as to form two long lines, two, three, and four deep, extending nearly the whole length of the Palais de l'Industrie. The great central room was filled instantly, and, had the chief pictures been hung there as usual, the crowding would have been excessive; but as this room is, this year, in no way distinguished from the rest, the visitors soon spread over the whole exhibition, and many thousands of persons were able to enjoy it with scarcely any difficulty. The inconvenience of one principal centre of attraction in an exhibition was never so clearly proved by its absence as on this occasion.

The Paris exhibition grows so rapidly that its management is one of great difficulty. In 1853, when the exhibition was biennial, the total number of works shown were only 1,768; in 1864, when it became annual, they reached 3,085; this year, they amount to 5,434. Thus the growth has been in part natural, but it is more marked this year than ever, the increase over last year being 1,204. The jury being for the first time entirely elected by the exhibiting artists themselves, it was understood that the exclusions would be fewer than usual, and it is evident that such has been the case, the number of inferior works forming a large proportion, and certainly detracting from the interest of the exhibition as a whole. In art, more than anything else, quality is everything and quantity valueless, and, although it is pleasing to see an opportunity affording to struggling artists of exhibiting their attempts at art, the public gains nothing by gazing on unfortunate failures.

The pictures in oil number no less than 2,991, and occupy twenty-three rooms (eight more than usual); they are all hung in alphabetical order, with the exception of very large canvasses, which have generally been placed in the three large rooms, and, the catalogue being printed in the same order, the study of the exhibition is rendered as easy as circumstances would admit.

The management of the light is the same as on former occasions. The angles of the ceiling are covered, as it were, with calico screens, and other screens of the same material, about half the area of the ceiling, are suspended at a considerable distance from the glass roof, so as to shade the spectators and throw the light on the pictures; but, although the glass itself is also covered with calico, the amount of light is, in many parts, too great for good effect. Complaints have been made in the London papers of the absence of rails or ropes to keep off pressure from the pictures in the Royal Academy Exhibition, and it may, therefore, be well to mention the mode which has been adopted for years at the Paris exhibition, and which answers its purpose admirably. A narrow table or shelf, breast high, runs round each room, forming the line, and beneath this nothing whatever is hung; the table is about fifteen inches in width, and is supported by brackets or uprights at intervals, the whole being covered to the ground with dark glazed calico, and the space thus formed is made use of for the introduction of fresh air, which filters in through the calico. This arrangement certainly prevents too close crowding round attractive works, while the table is extremely convenient for making notes, to say nothing of the relief it affords visitors who, from duty or inclination, pass long hours in the exhibition. This arrangement has proved, after several years' trial, to be satisfactory in every respect. The greatest relief, however, to be obtained in the exhibition is a visit to the sculpture in the garden.

The central area of the Palais de l'Industrie formed the other day a ride and a drive, with a bank for leaping, for the exhibition of horses; a few weeks previously it was occupied by four rows of stalls for oxen; to-day it is

converted into a charming geometrical garden, filled with masses of brilliant flowers, and splendid palms and other exotics, the sculpture being arranged, the largest specimens and the bronzes in a wide central avenue, and the rest against the sides, just sheltered by the galleries above.

There is this year certainly a paucity of great work; historical and highly imaginative painting has few votaries; too many of the leading French artists are absent altogether, and most of the rest confine their exhibition to portraiture. This is not surprising when we remember how short is the period during which artists enjoy a great reputation; and it is something to notice that one of the most celebrated living artists, who earns a princely income, and cannot accept a third of the commissions offered to him, has found time in the midst of his private and professional duties and occupations to contribute a charming if not very powerful version of the painful story of the "Death of Francesca de Rimini."

If the exhibition is not rich in historical, religious, or poetical works of the highest class, the ill-defined one, known as *genre*, presents immense attractions. The severe critic will find far too much cause for complaint, but the earnest-studied may spend a week in the exhibition and not exhaust the lessons which it offers; he will find a marvellous store of fancy and ingenuity; technical ability, carried to extraordinary perfection; colouring, if rarely brilliant, almost always harmonious; and, lastly, and most important of all, a knowledge of anatomy, and a power of drawing the human figure and every object in nature and art truly and forcibly. The faults of the French school are numerous enough, but they are not of a technical character, the effects not only of art teaching, but of general public education in art, are as evident at this, and, in a less degree, at every exhibition of works of art in France, even in the most remote province, as those of the study and practice of horticulture and the national love for plants and flowers are at the exhibitions of the Horticultural Society or the Botanic Gardens.

PROPOSED LOCAL EXHIBITION IN BRITISH GUIANA, SOUTH AMERICA.

The colony of British Guiana has, from the date of the earliest international exhibitions in Europe, not only contributed specimens of its natural and manufactured products, but has established the practice of affording the local community an opportunity of inspecting the collections so formed previously to their being forwarded to their destinations. The appeals made to the good feeling and public spirit of the various classes of producers, to enable the Committee of Correspondence of the Royal Agricultural Society to carry out the duty they had undertaken, have been found so practically beneficial to the people themselves, by exciting amongst them a spirit of emulation, and creating an appreciation of treasures which had been regarded with the indifference engendered by familiarity, that at the close of the local exhibition held in anticipation of the Exposition Universelle at Paris, in 1867, the committee determined on endeavouring to renew them annually, without especial reference to international gatherings, intending not to restrict them to specimens of local growth or manufacture, but to be open to illustrative articles from any quarter. Another such exhibition was consequently held in 1868, which in the estimation of the public was the most successful of the series. Circumstances, however, precluded a repetition in 1869, and it is now contemplated to have one in the autumn of the present year.

One leading object of the committee in organising this exhibition is, more fully to gratify the curiosity of the varied races inhabiting the colony, who may not enjoy the opportunity of visiting other countries, and thus not merely improve their tastes, but supply suggestive hints to the ingenious and industrious for rendering their talents more practically and extensively available for the benefit of the community of which they are members. In connection with this object, a company, on the limited liability principle, was formed for the erection of a suitable building for a museum, in which samples of every kind possessing more than ephemeral value may be stored for inspection and reference, and this, it may be remarked, was founded by local means exclusively.

The Council desire to give publicity to this scheme, and to recommend it to the notice of such as may have it in their power to help an undertaking so laudable in its object, and creditable to the public spirit of the colonists.

The assembly rooms at Georgetown constitute an admirable hall for the display of works of art, including paintings, sculptures, and engravings; and loans of such treasures as well as gifts will be most thankfully received, and every possible guarantee afforded for their safe transmission to and (if so stipulated) return from the colony, of course without expense to the donors or lenders, as the case may be. The gentlemen who have undertaken the management of this department in London are Mr. E. G. Barr, of 36, Mark-lane (late chairman of the Museum Company), and Mr. William Walker (late Government Secretary of the colony), by whom contributions of money or suitable specimens of whatever kind will be received, and to whom communications may be addressed. There is only to be added, that this seems a good opening for the exhibition of machinery adapted to the manufacture of the staples of the colony, which comprise every kind of product peculiar to the tropics, and that ample space exists for the erection of motive-power to show such machinery in operation.

EDUCATION IN AUSTRIA.

Mr. Lytton, Her Majesty's Secretary of Legation at Vienna, in his report on the condition of the industrial classes in Austria, writes as follows:—

One of the greatest benefits yet conferred upon the working classes of Austria is the General School Bill of the 14th May, 1869, which renders national education compulsory, and greatly elevates the standard of it.

In accordance with this law, compulsory attendance at school begins with every child at the age of six, and is continued uninterruptedly to the age of fourteen. But even then (that is to say, at the end of his fourteenth year), the child is only allowed to leave school on production of certified proof that he has thoroughly acquired the full amount of information which this great law fixes as the *sine qua non* minimum of education for every Austrian citizen. The prescribed educational course comprises reading, writing, and arithmetic; a sound knowledge of the native language; history, chiefly, though not exclusively, that of the native country, embracing the political constitution and general social structure of it; geography, in the same sense; all the more important branches of physical science; geometry (geometrical drawing, &c.); singing; athletic exercises. Children employed in the large factories, or prevented by special circumstances from attending the communal school, may complete or continue their education at any special school supported by their employer; and the employers are authorised to found schools for that purpose. But it is a *sine qua non* condition that all such schools shall provide the full amount and quality of education required by law, and otherwise fulfil all the obligations prescribed by the General School Bill, which subjects every school, whether private or public, to the inspection of the State. In places where a special trade school exists, the employer is bound to send his apprentices to it. In addition to the subjects of instruction above enumerated, every child is simultaneously provided with religious instruction in the creed to which or she is born. The local ecclesiastical authorities or notables of the church or religious com-

munity to which each child belongs are entitled and indeed bound by law to provide competent teachers for this purpose. The free selection of the teachers is left entirely to these religious bodies, subject only to the certified proofs which the State exacts of the teacher's proficiency and general character. It is only in the event of the local religious communities declining to avail themselves of the privilege allotted to them by the law that the State steps in, and undertakes the duty which they refuse to discharge. But this religious instruction, which is altogether denominational and on a footing of impartial equality for all religious sects, is kept by the State carefully apart from the secular education which is in every case obligatory, and which it is in no case allowed to interfere with or attempt to control. Nor are any private schools tolerated by government which do not efficiently provide the prescribed amount of secular instruction; although, so long as this condition be fulfilled, the law imposes no limit to the foundation of private educational establishments.

Such is the education now provided in Austria for every child of the working classes. It is needless, and would be painful, to dwell upon the obvious fact of its immense superiority to anything of the kind which yet exists in England.

THE CEMETERIES OF PARIS.

The government and the municipal authorities are in difficulties about the burial question of the metropolis. Père la Chaise, Montmartre, and the other cemeteries are not only over-crowded, but the extension of the boundaries of the city has brought them within the latter, and thus violated a law of Napoleon I., which is still in operation. It is absolutely necessary that something should be done, and, considering the vast tracts of poor land which lie around Paris, the question would not appear to present many difficulties. But the authorities have a laudable desire to solve the problem in the very best manner for future generations, and, after seeking information on all sides, a specified plan was adopted.

A gentleman was sent to study the cemeteries of London, and, apart from a few observations not in the best taste, and which derived what little comicality they possessed from the reporter's mistakes, made a very favourable report concerning them. The result was, that it was decided that one great cemetery for all Paris should be established, with a special railway for its service. Two thousand acres of ground were purchased for the purpose at Mery-sur-Oise, in the adjoining department of the Seine and Oise, about ten miles from Paris, and the arrangements for the railway were said to be completed when the subject was brought before the Corps Legislatif, in a recent session, and created a very warm discussion, the question being complicated by certain encroachments threatened in the case of the Cemetery of Montmartre, and by a general doubt as to the intentions of the authorities respecting the maintenance of the existing ones. Assurances were given respecting the latter question, the government assuring the Assembly that, although no new vaults or graves would be opened in the old cemeteries after the establishment of the new one, all would be maintained as at present, and inhumation still permitted in family vaults; and as regards Montmartre, the plans were altered, and full explanations given. In addition to this, an assurance was offered by the ministers that nothing more should be done with respect either to the new cemetery or the railway until the plan had received the approval of the Corps Legislatif.

But a new difficulty has arisen; the General Council of the department of the Seine and Oise, within whose territory it is proposed to bury all the dead of Paris, in addition to its own, naturally looks at the subject from a different point of view to that of the authorities of the Seine, and, after mature consideration, has entered a formal protest against anything being done in the matter until a commission shall have inquired into the subject, and the council of the Seine and Oise consulted respecting it; and it must be felt by every one that the representatives of the department ask nothing unreasonable, for the formation of a permanent burial-place for a city whose inhabitants are fast approaching two millions must be a matter of serious import for any locality.

It is evident that the opposition to the project is very strong, for the preliminary inquiry has occupied an unusually long time, and it is said that the documents have been in the hands of the Minister of Public Works ever since the month of January, who has not yet, as far as is known, given his opinion respecting the objections made to the plan as regards the health of the surrounding population, or as to the line of the proposed railway.

It is assumed by the writers who advocate the plan in question, that all other proposed solutions but that adopted by the government are valueless, or, to adopt the expressions of a Paris journalist, "The discussion has brought out the advantages of the proposed combination, and the nullity of all other solutions." Now, this is not the fact; and as the question of the disposal of the dead of a great city like Paris is one of immense importance to all civilised communities, the question deserves to be discussed in the fullest and most impartial manner.

Another solution which will present itself to the mind of any thinking man, is the adoption, on an extended plan, of the old system of the Paris cemeteries, that is to say, the establishment of a number of new cemeteries in the most naturally isolated positions that can be found around the capital.

It is admitted by all parties that, during the great heats of summer, the pestilential emanations from the existing cemeteries are very evident, and must be prejudicial to health; what, then, would be the effect on the department of the Seine and Oise if all the dead of Paris were collected for years within its soil? The question of establishing a ring of new and large cemeteries around Paris has not been publicly examined, and we trust that it may be, in the interest, not only of the inhabitants of the two departments in question, but of all the world.

Many cognate questions are arising out of the subject of the proposed new cemetery. It is objected that the presence of a number of corpses at the terminus of the mortuary railway station might in summer, and when epidemics are prevalent, present serious danger to the health of the inhabitants of the neighbourhood, as well as of the mourners and officials, and the value of various kinds of disinfectants is naturally discussed. The Council of Salubrity has experimented on a number of substances, and phenic acid is said to have yielded the best results; but strong objection is made to the use of this disinfectant, precisely on account of its extraordinary powers of preservation. M. F. Jean, a chemist, writing on the subject, says, that what is wanted is simply a disinfectant acting until the corpse is laid in the ground, and that phenic acid would produce a result that demands attention, namely, that a great number of bodies would be preserved either wholly or partially from decomposition, and that if the *fosse commune* system be continued, which, however, it is to be hoped will not be the case when new and larger cemeteries are provided, when the ground was cleared, these preserved human remains would give rise to universal disgust. Again, it must be asked, he adds, what would become of the vegetation of a soil impregnated by such an energetic anti-putrescent substance which neither the air nor the water would have power to destroy. Dr. Sucquet has published a pamphlet bearing the title "Assainissement des décès et des Convois

Funèbres de la Ville de Paris," in which he proposes the use of lamps charged with chloride of tin, the smoking liquid of Livarius. All that would be necessary, says Dr. Sucquet, would be to put one of the lamps in the coffin at the time it was placed on the bier, the vapours disengaged would produce immediate disinfection, and these ceasing after the body was placed in the ground, decomposition would assume its natural course. By the employment of these lamps, he adds, premature inhumation, so much dreaded, might be entirely obviated, for by placing one of these lamps on the corpse after death has been pronounced, the traces of decomposition might be waited for without danger or inconvenience either to the family or the public health. The action of this disinfectant has the effect of converting all the vapour charged with miasma into a solid form, and destroying that which is condensed.

CORRESPONDENCE.

THE NATIONAL PRINCE CONSORT MEMORIAL: THE PRESENT SCHEME OF ITS FRONTAGE TO THE ROYAL ALBERT HALL, IN REFERENCE TO ROTTON-ROW AND KENSINGTON-GARDENS, COMPARED WITH THAT OF FRONTING THE MEMORIAL TOWARDS LONDON, OVER THE SITE OF THE FIRST GREAT INTERNATIONAL EXHIBITION OF 1851.

Sir,—That the memorial of the Prince Consort should be surrounded by a garden has been long contemplated, and is doubtless appropriate; and if the structure and statue be fronted towards London, no removal or divergence of the roads about it are required, and there is no reason why the whole length of Rotton-row, which, until lately continued along the south boundary of Kensington-gardens up to Queen's-gate, should not be restored to equestrians. For some time past, this part of the ride has been shut off and closed to them, so that the public should become prepared for the loss of right over it, and now it is being broken up by workmen. I have understood that originally £11,000, or thereabouts, was to be asked for from the country for rearranging the roads and spaces in this neighbourhood, and for the invasion of Kensington-gardens to an extent alarming to the lovers of the beauty and seclusion of those charming glades, woods, and flower-walks. Since that time, however, the aspect of this scheme has been softened, as the sum now on the estimates to be asked for this session has been reduced to £5,760. The plan at present proposed is, that an entrance is to be made into Kensington-gardens at a point which, according to the present plan of fronting the memorial to the Royal Albert Hall, will be at the direct back of the statue. A long vista of approach appears intended from this spot across the gardens to Bayswater, so that, according to the plan of a seated statue, the public will have, for all that way, the view of the back of a colossal seat or chair. (Of the two possibilities in this case, it might occur that it would be better to turn the statue quite round, with its back to the Albert Hall, and to face into Kensington-gardens, as the vista in that direction would, at any rate, be uninterupted.) Moreover, the Albert Hall is now built up so close to the Kensington-road, that it will be requisite, for the purpose of giving a better access to that structure, that the road be moved at that part some 30 feet nearer to the memorial. As that will be done by straightening that portion of the road, I see no objection to it, that is, if the memorial and statue be fronted to London; but great objection if the frontage be kept as at present proposed, for as the level of the Kensington-road cannot be raised, it will place the spectator still more under the front of the seated statue, in the visual angle; for the detailed disadvantages of which I would refer to the *Journal* of April 22nd. The Kensington-road in front of the Albert Hall is 14ft. below the level of the foot of the memorial and of the whole range of the park towards London; and therefore, besides its nearness to the memorial, which even now prevents the spectator getting back far enough to see it fairly, the point of sight is 14 ft. lower than in the park towards London, and by so much the worse, more especially if the idea of a seated figure be adhered to. I hope it will not, and I trust that the memorial and statue will eventually front towards London, and look over the site of the first Great International Exhibition of 1851, the propriety and advantages of which formed the subject of my first letter, in your *Journal*, of April 15th. In this case, it would be the side and not the front of the statue which would be presented to the Kensington-road, and the short available distance for regarding it, and the low level of sight would be of far less importance.

Also there is another point. A back of a figure can be but a back of a figure, and, although the back of a kneeling or standing figure is much more agreeable than that of a seated one, yet, even in their case, it is not desirable to emphasise that view. Now, a visit to the spot will readily show that no ingenuity of plan could devise anything better for the back view being thus justly secondary, than the present way in which the existing roads and spaces are disposed round the memorial, that is, if it be fronted towards London, in which change of plan there is no practical difficulty whatever, and it is neither premature to propose nor too late to effect it. I would add that the estimated cost of carrying out the suggestion of my first letter, even if the promenade approach were to extend to Albert-gate, is considerably within the sum now proposed to be asked for.—I am, &c.,

Epsilon.

BALANCED RUDDERS.

Sir,—Referring to the report of Mr. Gumpel's paper, published in the *Journal of the Society of Arts* last week, and read at the meeting of the Naval Architects, permit me, in justice to myself, to mention that the statement, to the effect that the invention, so widely known as the Lumley rudder, is copied from Mr. Ruthven's rudder, was at once contradicted by me in the discussion which followed, and that Mr. Gumpel in his reply apologised for the mis-statement. I further pointed out that the records of the Patent-office show that my patent for rudders preceded Mr. Ruthven's by a long time.—I am, &c.,

Henry Lumley, Assoc. I.N.A.

May 3, 1870.

GENERAL LIFEBOAT SYSTEM.

Sir,—In the *Journal of the Society of Arts*, 25th Feb. last, the Council offer the Society's Gold Medal for a ship's life-boat suitable for the mercantile marine. It is indeed gratifying to find that this subject is at last taking serious hold in the public mind, as one of deepest necessity and importance. Though the National Lifeboat Institution has done much, so far, in starting the work of saving life at sea, it has, nevertheless accomplished but little comparatively.

The time is come when the work of saving life from drowning must be looked at in a broader sense. It is not enough that we have lifeboats on our coasts dotted here and there, on the chance of shipwreck near each place. Such a system is wasteful of valuable means. The subscribing public, taking for granted that the amount of work done is not to be surpassed, build up a wasteful, deceptive system, for it is only good to a certain extent. The calculation is never made how much each life saved costs, nor how many more lives might be saved for the same outlay.

It is not enough to have Acts of Parliament, which prove but too often mere waste-paper (notably so in

matters of mercantile marine), to direct that owners or captains of vessels shall have lifeboats and other appliances for saving life. The human mind naturally prefers risk, and once accustomed to risk, it disregards dangers unseen. To establish a really efficient system for the saving of life from drowning, we must begin rather by a system of prevention of danger in boats wherever used—at sea, in lake, or in river. Let a broad principle be established, to be worked out effectively, that every boat, of whatever make, shape, or use, be constructed with sufficient floating-power, so that when full of water, and with a reasonable crew in her, she will not sink.

If a new plan of lifeboat be introduced, as is now contemplated, it may be asked how can its general use be established? As has often been proved, the cleverest invention would be disregarded, or if pressed by legal enactment, would be evaded. Before attempting the impossible, let us rather try that which is possible; let us utilise the means at hand.

There is nothing more simple than to make an open boat "safe," unsinkable. It is a very cheap process too. Any ships' carpenter could set to work and, in a few days, make the ships' boats "safe." They all know how to do it. They know that if they divide off a small portion of the boat at the bows, and close it tight, with marine glue or other appliances, if they do the same at the stern, the boat will not sink; she is, for general purposes, "safe."

Larger boats can have further wooden tight casings under the thwarts, and in the case of passenger-ships' boats, this plan can be reduced to such a perfect system as almost to defy any loss from swamping of boats on leaving a disabled ship; even should a boat at such a critical moment be "stove in," she must still float, instead of, as at present, going down to the bottom with all hands.

New boats, made on lifeboat principles, are very costly. Open boats converted into "safe boats," cost very little, say from £2 to £4 each. To prove the latter, I had an ordinary-sized boat (16 feet long) made "safe" for the sum of 15s., and proved her afterwards, when full of water, and her crew in her. This experiment was done thus cheaply in the interests of poor fishermen, thousands of whom are almost daily afloat, each perhaps with one assistant, in open unsafe boats, and but too many of whom are every year drowned.

The lives of our coast sailors and fishermen ought surely to claim our attention as much as those of our mercantile marine; therefore the system of "safe boats" should equally embrace both.

If a short simple Act of the Legislature were passed, embodying a practicable cheap plan, which could be easily enforced, to the effect that no owner or user of any open boat should be permitted to take passengers, or even an assistant, without a certificate of "safety," what a wonderful revolution would quickly take place in the matter of boats—what a saving of life.

What is wanting for such a system is the first start, under proper influences; and although the plan proposed is no novelty, and has already been proved, yet will it be necessary to treat it as a novelty—to prove all that is possible as to cheapness, practicability, and efficiency of the system. Under the auspices of intelligent, philanthropic men can such a system be advocated, watched, and pushed forward in the right quarters, to a successful issue.

Assuming the system came out as proposed, we should have, as a consequence, a perfect lifeboat system; not such as we have at present—supported by charitable institutions—but a self-acting one as well as a self-supporting one. Every boat everywhere around our coasts would be a lifeboat, and most of them prepared to contend with any weather, and to render assistance to any disabled vessel.

In the year 1868, the National lifeboats rescued 603 lives, while 259 were saved by open boats belonging to fishermen and others. With such evidence before us, we may safely conclude that fishing and other open boats made "safe," "unsinkable," would very soon prove themselves equal to an amount of success, which we in vain look for at present, in the saving of life as well as prevention from drowning.

There is one other plea for an inclusive system—a selfish one, in a national point of view, it is. That in avoiding so much loss of life amongst our coast and river fishermen, we help to preserve the very nursery which supplies our ships with sailors—we prevent the making of widows and orphans.—I am, &c.,

JOS. ACHESON.

May 2, 1870.

GENERAL NOTES.

Californian Gold.—The richest gold mine in California yielded, last year, a profit of 340,000 dollars.

M. Niepce de St. Victor,—The sudden death of this skilful and indefatigable experimentalist is announced. He was practically the originator of photography on glass plates, though his name will be chiefly associated with the process of photo-engraving.

The Proportion of Telegraph Line, &c., to Population in America and Switzerland.—In the United States, the proportion of miles of telegraph line to population is 1 to 420; of wire, 1 to 238; of offices, 1 to 6,000; and of internal messages, 1 to 3. In Switzerland, the proportion of miles of telegraph line is 1 to 940; of wire, 1 to 448; of offices, 1 to 6,000; and of internal messages, 1 to 31·10.

The Weight of our Sovereign and the Corresponding Coins in Other Countries.—The sovereign of England contains 113 grains of pure metal; the new doubloon of Spain and the half-eagle of the United States 160 grains each; the gold lion of the Netherlands and the double ounce of Sicily, 117 grains each; and the twenty-five franc piece of France, 112 grains.

The Arithmometer.—This instrument has been very much improved of late years. To give some idea of the saving of time effected by this instrument, eight figures (tens of millions) can be multiplied by eight figures in eighteen seconds; sixteen figures be divided by eight figures in twenty seconds; and a square root of sixteen figures be extracted, with the proof, in less than two minutes. It is constructed chiefly of a brass plate, furnished with eight slots; directly under these slots are mounted eight drums, each having nine elongated cog-teeth of successively decreasing length; over each drum, and between it and the slot is mounted a square shaft, on which slides a pinion-wheel, so as to catch any number of teeth on the drum. Each of these pinion-wheels is moved by a button, of which there is one in each slot, the figures at the sides of the slots showing the proper position of each button, for any work to be performed by the instrument. The cogged drums gear by bevil-wheels with a long horizontal shaft, which is also in gear with the vertical shaft, moved by a handle, by which the instrument is worked. In a moveable brass plate, which can turn and slide on a round bar-hinge at the back, there are sixteen holes, under each of which is a moveable disc, numbered from 0 to 9, and arranged so that any one figure of each disc may be brought under its corresponding hole. These discs have bevil-wheels, which gear with bevil-wheels on the before-mentioned square shafts. The moveable plate is also furnished with holes, having discs, numbered from 0 to 9, underneath, and are for showing the number of turns of the handle, giving by this means the quotient in division, and showing the multiplier. Such is the general construction and principle of the machine, which can be seen at the South Kensington Museum, or at the office of Mr. W. A. Gilbee, 4, South-street, Finsbury.

The Amount of Gold in the World.—The amount of gold in existence at the beginning of the Christian era is estimated to be £85,400,000; at the time of the discovery of America it had fallen to £11,400,000; it then gradually increased, and attained, in 1600, to £21,000,000; in 1700, to £70,000,000; in 1800, to £225,000,000; in 1843, to £400,000,000; in 1853 to £600,000,000; whilst the present amount is valued at £1,200,000,000, which, welded into one mass, could be contained in a cube of 26 ft. Of this amount, £800,000,000 are estimated to be coin and bullion, £200,000 in watches, and the remainder in jewellery, plate, &c. A cubic inch of gold is worth (at £3 17s. 10½d. per ounce) £42; a cubic foot, £72,562; a cubic yard, £1,959,552.

The Railway in Japan.—We have already heard from Japan that the telegraph between Yokohama and Yeddo had been completed, the first messages passing on the 7th January. The loan that has been effected for the government by Mr. Lay, for the construction of railways, is so far an accomplished fact, that the first draught, to the amount of 500,000 dollars, has been paid. It is understood that engineers to superintend the works will arrive at Yokohama in a very short time, and that they will commence the necessary surveying, levelling, &c., at once. The line will not be all plain sailing, as there will be at least one mountain range to be crossed, and many large rivers. In fact, the loan of one million pounds sterling will not be anything like sufficient for the work that is to be done. The Japan government have remitted the export duty on native coal shipped in outward-bound steamers, thereby encouraging its consumption.—*Indian Daily Times.*

Gold Coins.—These were first issued in France, by Clovis, A.D. 489. About the same time they were issued in Spain, by Amabric, the Gothic king. In both countries they were called *trienties.* They were first issued in England in 1257, in the shape of a penny, of the value of twenty pence; only two specimens have come down to us. Florins were next issued, in 1344, of the value of six shillings. The noble followed next, of the value of six shillings and eight-pence; being stamped with a rose, it was called the rose noble. Angels, of the same value as the latter, were issued in 1465. The royal followed next, in 1466, of the value of ten shillings. Then came the sovereign of twenty shillings, in 1489. The gold crown, of the value of ten shillings, followed in 1527. Unites and lions were issued in 1603, and exurgats in 1634. The guinea was first issued in 1663, of Guinea gold. In 1733, all the gold coins (except the guinea) were called in, and forbidden to circulate. The present sovereign was first issued in 1817. The American half-eagle was first issued in 1793.

Hexagonal Maps.—A convenient way of marking out distances on the map of a large town would be to describe a hexagon, representing a mile in extent, in some central spot; then round this central six-sided area to lay down six other hexagons, and so on, adding series to series until the whole town had been covered. If, then, each one of these hexagons could be marked out in the town itself by colours and numbers, or other indications on the street lamps, it would be easy for any one to ascertain his distance from the central point, or from one hexagon to another, and also to identify the hexagon in which he might happen to find himself at any moment. Without going into smaller details, this is what has been done for the maps of London and of Paris by Mr. John Leighton, who exhibited his scheme and his method of utilising the gas-lamps at Sir Edward Sabine's recent conversazione. With a small hexagonalised map in his pocket, the traveller on foot or on wheels could always tell his distance to a nicety, and would require no perplexing list of cab-fares; while to the police, the fire-brigade, and to telegraph messengers, such a ready indicator would be exceedingly useful. The scheme appears to be worth a trial, and could perhaps be best tried in in the largest city.

Utilisation of Sewage in Paris.—In a paper addressed to the Academy of Sciences, MM. Mille and Durand Claye discuss the advantages that might accrue to agriculture were the filth of Paris properly employed. All the organic matter which infects the Seine, and is ultimately washed into the sea, annually represents 1,500,000 tons of manure. At present, by a very simple system, between 5,000 and 6,000 cubic metres of the foul waters of the Clichy collector are daily raised and let flow to the beginning of the plain of Genevilliers, where they constantly fertilise about 40 hectares (100 acres) of otherwise unprofitable land.

Railroad Taxation. — With respect to the change which the Budget proposes in this matter; the result to the public purse will be substantially the same as if the present 5 per cent. duty on passenger fares were reduced to 4 per cent; to the companies, the result will be different. Supposing the same traffic as in 1869, the North-Eastern will in future have to bear an increase of taxation to the amount of above £10,000 a-year; the Great-Eastern will have its taxation reduced by above £10,000 a-year. The Caledonian will have its taxation increased by £4,800 a-year; the Midland by £3,770; the Manchester, Sheffield, and Lincolnshire, £3,000. As the total of the taxation is reduced, the gains of course outweigh the losses. The South-Eastern will pay less taxation than at present by £22,000 a-year; the South-Western also £22,000; the London and North-Western and the Brighton above £18,000; the Great Western above £17,000; the Metropolitan, £9,000; the Chatham and Dover, £7,000; the Great Northern, £6,000; and the Bristol and Exeter, £4,000. The total taxation is reduced by rather more than a fifth of its present amount, but while the taxation of the North-Eastern, Caledonian, and Manchester and Sheffield will be increased by more than one-third, that of the South-Western and Brighton will be reduced to less than half its present sum, and of the Metropolitan to less than a third of the amount now paid, and the South-Eastern nearly as much.

MEETINGS FOR THE ENSUING WEEK.

Mon......SOCIETY OF ARTS, 8. Cantor Lecture. Dr. A. W. Williamson, F.R.S., "On Fermentation."
Institution of Surveyors, 8. Discussion on Mr. E. Ryde's paper on "Parochial Assessments."
Social Science Assoc., 8. Dr. Hardwicke, "On Recent Starvation Cases."
Royal Inst., 2. General Monthly Meeting.
London Inst., 4.

Tues ...Civil Engineers, 8. 1. Discussion on "The Strength of Iron and Steel." 2. Mr. E. A. Cowper, "Recent Improvements in Regenerative Hot-blast Stones for Blast Furnaces."
Photographic, 8.
Medical and Chirurgical, 8½.
Ethnological, 8½. (At the Museum of Practical Geology, Jermyn-street.) 1. Opening Address by Prof. Huxley, President. 2. Rev. Dr. Nicholas, "On the Influence of the Norman Conquest on the Ethnology of Britain."
Royal Inst., 3. Prof. Blackie, "Moral Philosophy."
Social Science Assoc., 8. (At the Society of Arts House.) Dr. W. Guy, "On Health and Disease in their Economic Relations."

Wed ...SOCIETY OF ARTS, 8. Mr. W. P. Andrew, "On Railways for India."
Geological, 8. 1. Mr. J. W. Dawson, "On the Structure and Affinities of *Sigillaria*, *Calamites*, and *Calamodendron*." 2. Mr. E. Billings, "On some Lower Silurian Trilobites." 3. Rev. D. Honeyman, "Notes on the Geology of Arisaig, Nova Scotia."
Microscopical, 8.
R. Literary Fund, 3
R. Society of Literature, 4½.
Archæological Assoc., 4½. Annual Meeting.

Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Royal Society Club, 6.
Mathematical, 8.
Royal Inst., 3. Prof. Tyndall, "Electricity."

Fri ......Astronomical, 8.
Royal Inst., 8. Canon Moseley, "Descent of Glaciers."
Quekett Club, 8.
R. United Service Inst., 3. Capt. R. H. Stotherd, "Military Telegraphy and Signalling."

Sat ......R. Botanic, 3¾.
Royal Inst. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, MAY 13, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

May 18.—"On International Money of Account, independently of International Coinage." By Jacob A. Franklin, Auditor of the Society; in sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1855. The chair will be taken by Sir David Salomons, Bart., M.P.

May 25.—The Paper by Mr. Willis, "On the New Organ in the Albert Hall of Arts and Sciences," is postponed.

June 1.—Adjourned discussion on Mr. W. P. Andrew's Paper, "Railways in India."

CANTOR LECTURES.

The third course of Cantor Lectures for the present Session is by Professor A. W. Williamson, F.R.S. The course consists of four lectures, "On Fermentation." The third lecture was delivered on Monday evening, the 9th of May; the concluding one will be delivered on the 16th of May, at 8 o'clock.

Lecture IV.—Monday, 16th May.

Wine-making and wine-keeping.—Chemical changes which improve the quality of wine.—Chemical changes which deteriorate the quality of wine.

These lectures are open to Members, each of whom has the privilege of introducing two friends to each lecture.

THE CONVERSAZIONE.

The Council have the pleasure of announcing that, in addition to a private letter from H.R.H. the Prince of Wales, the Chairman of Council, Lord Henry Lennox, M.P., has received the following letter from General Knollys:—

Marlborough-house, Pall-mall, S.W., 5th May, 1870.

Dear Lord Henry,—I think it will give you pleasure to hear that the Prince and Princess of Wales were very much gratified with all the arrangements connected with their visit to the South Kensington Museum last night.

Perhaps you will kindly inform the members of the Council of their Royal Highnesses' sentiments on the subject, and at the same time assure them that their Royal Highnesses were not only very much interested, but were likewise much amused.

They were particularly struck at the admirable manner in which a passage through the building was kept clear for them, reflecting as much credit on the people themselves as on those who made the arrangements.

Believe me, dear Lord Henry,
Yours sincerely,
Francis Knollys.

INDIA COMMITTEE.

The report of the Conferences on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell and Daldy, price one shilling.

LIBRARY.

The following works have been presented to the Library, and the thanks of the Society have been communicated to the donors:—

Illustrated Public School Speaker and Reader. By A. K. Isbister, M.A. Presented by the author.

Three Pamphlets on English Orthography. Presented by E. J. Ellis, F.R.S.

Report of the Rainfall Committee, 1869.

Some Remarks on the National Education League. By Thomas Howell. Presented by the author.

Report on the Suez Canal. By Captain Richards, R.N., and Lieut.-Col. Clarke, C.B., R.E.

La Pêche du Hareng.

Reports of the Inspectors of Factories for the half-year ending October, 1869.

Universal Catalogue of Books on Art, vol. i., A to K. Presented by the Lords of the Committee of Council on Education.

Instruction in Illumination. By D. L. de Lara. Presented by the author.

Remembrancia Index, vols. ii. to viii. Presented by the Corporation of London.

Zinc, as applied to Roofing Purposes. Presented by F. Braby and Co.

Report on Railways in India, for the years 1868-9. By Juland Danvers.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 11th, 1870; The Hon. Arthur Kinnaird, M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Bailey, Henry J., 134, Kennington-park-road, S.E.
Baruchson, Arnold, Liverpool.
Bewicke, David, Hackney-wick, E.
Bowler, Henry A., 21, Pembroke-square, Kensington, W.
Burn, Robert, jun., 30, Botolph-lane, E.C., and the Terrace, Epsom.
Carr, Jonathan T., the Firs, Lavender-hill, S.W.
Dows, Gustavus Davis, 1, Chandos-street, W.C.
Ell, George, 38, Fitzroy-square, W.
Ellis, Alexander J., F.R.S., 25, Argyll-road, Kensington, W.
Findlater, Joseph, 33, Wellington-street, Strand, W.C.
Fisher, Morton C., 58, Threadneedle-street, E.C.
Fontana, Giovanni, 217, King's-road, Chelsea, S.W.
Fort, Michael, 138, South Lambeth-road, S.W.
Foxon, Foxon, 231, Brompton-road, S.W.
Godden, Henry James, 168, Fenchurch-street, E.C.
Goodchild, John Eastty, 114, Englefield-road, N.
Goldsmid, Augustus, 19, Ryder-street, St. James's, S.W.
Gough, Alexander D., 10, Lancaster-place, W.C.
Gullick, Thomas F., New British Institution, 39, Old Bond-street, W.
Higgins, Thomas, 5, Warrington-gardens, Maida-hill, W.
Hill, Finch, 2, Barnsbury-park, N.
Hill, Robert Gardiner, M.D., Earl's-court-house, Old Brompton, S.W.
Hill, Thomas Daniel, 30, Grosvenor-place, S.W.

Hobhouse, Arthur, Q.C., Endowed Schools Commission, 2, Victoria-street, S.W.
Hodge, Paul Rapsey, C.E., 10, Adam-street, Adelphi, W.C.
Holland, W. H., C.E., 102, St. George's-square, S.W.
Holt, George A. H., 36, Cambridge-terrace, Hyde-park, W.
Holt, Henry F., 6, King's-road, Clapham-park, S.W.
Houghton, Henry George, M.D., 6, Mount-street, W.
Houle, Josiah, 9, Guildford-street, Russell-square, W.C.
Howell, Henry, 151, Old-street, City-road, E.C., and 2, Birnam-villas, Tollington-park, N.
Hutton, T. O., 32, Budge-row, Cannon-street, E.C.
Johnson, Thomas Marr, 22, Great George-street, S.W.
Jones, Rev. William Taylor, jun., Woodside-college, Howard-road, South Norwood, S.E.
Joseph, Felix, 39, Wimpole-street, Cavendish-square, W.
Lockington, William Neale, 34, Coleman-street, E.C.
Locock, Frederick, 9, St. James's-place, St. James's, S.W.
Mackey, John B., 2, Bouverie-street, E.C.
Magnus, Walter Allingham, Cambridge-pk., Twickenham.
Meyrick, William, 5, Talbot-square, Hyde-park, W.
Miller, Captain James Cornwall, Club-chambers, 15, Regent-street, S.W.
Moore, Ira L., M.D., 36, Bedford-place, Bloomsbury-square, W.C.
Murray, Andrew, 5, Merton-villas, Richmond, S.W.
Nightingale, Samuel, Great Yarmouth.
Nisbet, Captain Edward Parry, Hollywood-road, West Brompton, S.W., and Trinity-house, E.C.
Petrie, Captain Francis W. H., 11, Gloucester-terrace, Campden-hill, W.
Phillips, John, 197, Adelaide-road, N.W.
Piper, Thomas, 61, Threadneedle-street, E.C.
Risdon, Robert, 8, Buckingham-gate, S.W.
Roper, Edward, Graphotype Company, 7, Garrick-street, W.C.
Royston-Pigott, George W., M.D., 2, Lansdowne-crescent, W.
Schofield, James, 5, Keppel-street, Russell-square, W.C.
Sirr, Henry Charles, 22, Park-village East, N.W.
Shaw, John, 20, Great Knightrider-street, E.C.
Shea, Charles Edward, 84, Blackfriars-road, S.E.
Stryan, Captain Arthur, 28, Norfolk-crescent, Hyde-park, W.
Thomas, E., M.D., 9, Great Castle-street, Regent-street, W.
Thomas, W. Cave, 49, Torrington-square, W.C.
Thornton, Edward Owen, 12, Wellington-chambers, London-bridge, S.E.
Tilley, Samuel, 70, Union-road, Rotherhithe, S.E.
Verdon, George Frederick, C.B., 8, Victoria-chambers, S.W
Vickers, Austin, 5, Hyde-park-terrace, W.
Welton, Thomas A., 91, Mortimer-road, De Beauvoir-square, N.W.
Westell, Edward, M.D., 28, Holland-villas, Kensington, W.
Whiffin, William Harding, 12, Sandringham-gardens, Ealing, W.
White, John Aubrey, 34, Millman-street, Bedford-row, W.C.
Willis, Henry, 9, Rochester-terrace, Camden-town, N.W.
Willis, Rev. Robert, M.A., F.R.S., 5, Park-terrace, Parker's-piece, Cambridge.
Wilson, Alexander, Enmore-lodge, Jeffries-road, Clapham-rise, S.W.
Withers, Robert J., 51, Doughty-street, W.C.

AND AS HONORARY CORRESPONDING MEMBERS.

Garrubba, Professor Santo, Royal Tullian College, Arpino, Italy.
Mariani, Professor Lewis, Royal Tullian College, Arpino, Italy.
Pallottino, Professor Anthony, Royal Tullian College, Arpino, Italy.

The following candidates were balloted for, and duly elected members of the Society :—

Bullock, William (Mayor of Macclesfield), Cumberland-house, Macclesfield.
Carreras, J. Joaquin, 61, Princes-st., Leicester-sq., W.C.
Downes, Charles, 29, Coleshill-street, Eaton-square, S.W.
Dupré, Dr. Auguste, Westminster-hospital, S.W.
Hanson, Edward, 15, Langham-place, W.
Orr, Peter, 26, Compton-terrace, Edinburgh.
Peters, Gordon Donaldson, 9, Bow-lane, E.C.
Pritchit, John, 2, Chilworth-st., Westbourne-terrace, W.
Rolfe, W. F., Upper Barchester-st., Poplar New-town, E.

The Chairman, in introducing Mr. Andrew, said that when it was considered what had been done for India by private enterprise, and how much yet remained to be done, and when, at the same time, rumours were heard that the system which had apparently worked so well was about to be condemned, it was well to call to mind what really had been done in this way, and to discuss the comparative merits and disadvantages, if there were any, of such a system. He, for one, should certainly much regret anything which would tend to diminish private enterprise in India, and, under the plea of economy, place under the government of that country works which could be much better carried out under private enterprise.

Previous to the reading of the paper,

Mr. Andrew made the following remarks :—I think it a happy augury for India that a member of the House of Commons, so distinguished as yourself, has taken the chair on this occasion, especially as you, sir, have been identified for many years with every measure likely to promote the development of the resources of India, and to elevate its inhabitants in the scale of humanity, by bringing to them the education, the improvements, and the science of the West; I think, sir, it is a happy augury for India that you have, at great personal inconvenience, as I am aware, consented to take the chair to-night, and I cannot but express my individual satisfaction at your kindness. Before the Secretary reads the paper which I have prepared, as he has kindly consented to do, I would beg leave for one moment to call the attention of the meeting to what I think will give enhanced interest to our subject, and that is the map which hangs at the back of the room ; and I would ask the audience to bear in mind that India is as large as the whole of Europe, with the exception of Russia, and that it is inhabited by two hundred millions of industrious people, or nearly one-fifth of the whole population of the globe. Within its borders are included every variety of soil and climate ; it produces everything that is necessary or agreeable for man, but above all, it produces in boundless quantities the staples of our manufactures; and it only requires the application of European science and skill to make that abundance available for the supply, not only of England, but of Europe, with that most important staple, cotton. The commercial relations of India with England are most remarkable, and I should be sorry if you looked upon the question of Indian railways as one which merely affects our Eastern empire. When you consider that we have been for about 17 years constructing railways in India, that we have during that short time sent out 6,000 ships, and nearly 4,000,000 tons of materials from this country, and when you consider what an effect this must have had on the manufacturing industries of this country, that it must have an effect on our shipping, mining, and manufacturing interests of every description, and also on India itself in stimulating the production of the raw material required for manufacture here, and by enabling the population in that country, through the distribution of money in the construction of railways, to purchase our manufactures after we have converted their raw materials into the fabrics best fitted for their use, you will see that the one country has the most intimate relations with the other. I mention this in order that those who may not hitherto have paid much attention to the subject may be induced,

whilst the paper is being read, to consider that this is as much an English as an Indian question. The opinions which I express in the paper about to be read I published twenty-five years ago, so that I have not arrived at them hastily or without consideration, and I state now that these same opinions which I advocated twenty-five years ago have only been confirmed by the long and varied experience I have since had in connection with great works in India. I will not make any further remarks at present, but at the conclusion of the discussion I shall be happy to answer any questions that may be put, and to meet, as far as possible, any objections which may be made.

The Paper read was—

RAILWAYS IN INDIA.

By W. P. Andrew, Esq., F.R.G.S., &c.

The author has much pleasure in responding to the invitation of the Council, and in furnishing the information contained in this paper, in reference to the railway question in India, which is one of the most important of the day, commercially, socially, and politically. He proposes to lay before the Society the results of the introduction of railways into India through the medium of the guaranteed companies, tracing their progress from their inauguration to the present time, and detailing the various extensions proposed to be undertaken by government, to show what works have, during a long course of years, been carried out through the direct agency of government by the Public Works Department, with a view to enabling an opinion to be formed, from the facts adduced, whether or not the government have exercised a wise discretion in taking the construction of future railways into their own hands.

The question of a wide extension of the Indian railway system having engaged the attention both of the home government and the government of India for a considerable time, the Secretary of State for India, in the last session of Parliament, laid before the House the official papers and correspondence connected with the subject.

The railways of India have, as is well known, hitherto been constructed by public companies, under the guarantee of the Indian government; but the late Viceroy, Lord Lawrence, strongly recommended that future extensions should, with some few exceptions, be undertaken and carried out through the direct agency of government, thus doing away with the intervention of companies or contractors; and his lordship's successor, Lord Mayo, on his arrival in India, concurred in this change of policy. The views thus held were urged with great force, and were ultimately adopted by the Secretary of State in Council of India.

The idea of introducing railways into India on an extensive scale originated about the year 1842, and occupied the attention of many persons whose position and experience rendered their opinion of great value. Sir Macdonald Stephenson and the late Mr. John Chapman took a leading and distinguished part in the movement. The author of this paper, having a considerable knowledge of the country, strongly advocated the construction of railways in the three presidencies, and published, in the early part of 1846, his views on the political, military, and commercial importance of railway communication in our Eastern dominions, as affecting the position and future prospects of the empire. Although twenty-five years have since elapsed, he sees little cause to alter the opinions then put forward; and it is a matter of much satisfaction to him to find that they have been extensively adopted.

After considerable public pressure had been brought to bear on the authorities, the Court of Directors of the Honourable East India Company took up the question in an earnest spirit. The court, in the year 1845, addressed a despatch to the Governor-General of India, with a view of eliciting information as to the desirability of providing India with railways; and subsequently the court deputed Mr. Simms, an eminent engineer, to investigate the subject, in conjunction with a commission of military engineers appointed in India, under the orders of the Governor-General in Council. The question was very fully inquired into and ventilated by the most distinguished government authorities on the spot. The report of the commission reached England in the summer of 1846. After considerable delay, and after much negociation, contracts were entered into, in the autumn of 1849, with the East Indian and Great Indian Peninsula Railway companies for the construction of lines in India.

The official inquiries and discussions which led to the sanction of what were then actually considered as experimental lines (as if experiment were necessary under the circumstances), extended over a period of more than four years from the date of the court's despatch to the Governor-General in Council.

But it was not until 1853, when the late Marquis of Dalhousie, then Governor-General of India, sent home his masterly minute on Indian railways, that the subject received from the authorities that consideration which its importance demanded. His lordship, having the views of those who had for many years advocated railways in India before him, dealt with the question in a statesmanlike way. His famous state-paper on the subject compelled attention, and may be taken as the basis of the policy hitherto followed by the government of India in regard to railway construction and management.

Lord Dalhousie, in his minute, entered very fully into the question of the means to be employed in introducing railways into India, and although it had, even then, been proposed to construct them through the agency of government, his lordship was strongly opposed to such a course. Extensive experience of works undertaken by the State, both at home and in India, led him to foresee the evils and delays which must inevitably ensue. The strength of the Public Works Department was at that time hardly equal to the ordinary calls made upon it, and was utterly unequal to meet the demands that would have followed had extensive railway works been confided to it. His lordship recommended that the railways should be allotted to and undertaken by separate companies, under a government guarantee, wisely regarding them, in a great measure, as commercial enterprises, and as such, knowing that they were better in the hands of capitalists in England. It was evident to his lordship that by these means British capital would largely be introduced into India, and that a considerable addition to the European population (which, at that time, was almost exclusively restricted to the officials engaged in the government services) would naturally follow.

Writing in 1846, seven years previously, the author of this paper had predicted, in the pages of the *Old Indian Postmaster*, that a complete system of railway communication was destined to be a new and important element of our power in India, whether for the defence and consolidation of our empire, the opening of its inexhaustible treasures, or the elevating in the scale of humanity its multitudinous people; that vast, and beyond the calculation of the most sanguine, as had been the benefits conferred on this country by railway communication, the introduction of this system of transit into India must lead to results of still greater magnitude and importance. In England, this was only a question of degree; applied to India, it would be one of kind, or a new and vivifying element of social and commercial progression, acting on a population estimated at 150 millions. Capital and enterprise, directed by science, had for ages stimulated the industrial energies of our people and the latent resources of our soil; whilst in the extensive and fertile plains of India, the richest agricultural and mineral products, when remote from river transit, in consequence of the want of roads, remained to rot on the ground which nourished them, or lay

dormant beneath its surface, benumbing the energies and debasing the moral capacities of the inhabitants.

Lord Dalhousie endorsed these views most fully in a second minute, written in the year 1855.

A recent writer, in the *North British Review*,* has well described the means of communication in India as they existed in the year 1852-3. He says:—"In the east, the locomotive is now invading tracts of country where roads, in any fair sense of the word, have hitherto been unknown; where the progress of the traveller was restricted to the walking-pace of himself, his horse, or his draught oxen, and where, indeed, during the annual rainy season, ten miles would have been reckoned a fair day's journey. . . . In Eastern India, the Ganges offered a fair means of water-carriage far along its valley. In Western India, a much less perfect water-way was found in the Indus. Add to these an excellent road leading from Calcutta upwards to the Punjaub, with certain branches of a more or less perfect kind, and a very few hundred miles of fair highways in the neighbourhood of Madras and Bombay, and we exhaust the list of communications which . . . comprised the routes perennially available throughout the great Peninsula. Certain other roads there were, tracts very tolerable during fair weather, but which, during tho annual monsoons, and for some time afterwards, became impassable to all traffic, save, in the best cases, to such exceptional items as a lightly-laden mail-gig or a pack pony, capable of struggling through the quagmire-like consistency which these roads then assumed, but in most instances altogether impracticable even for these. Indeed, those men whom duty or dire necessity occasionally compelled to travel during the rains, found, not unfrequently, that their best chance of progress lay in leaving the line of road, and struggling across the miry land alongside."

Before the introduction of railways, the natives of the lower provinces generally travelled by water, as there was less fatigue attending this mode of transit, but the up-country people generally preferred travelling on horseback or in carriages. An European or a wealthy native going by dâk (post) from Calcutta to Benares, a distance of 428 miles, would incur an expense of one shilling a mile, besides buckshees (presents) to the bearers, about one shilling per stage, making in all about £25 for the journey, which he would occupy five days in accomplishing (exclusive of halts). If by palkee, with eight bearers, going 15 miles per diem, he would have paid £12 10s., besides £2 10s. for a banghy, and would consume nearly a month on the road. This mode of travelling, besides the loss of time, was attended with danger from robbers. The journey was accomplished in 16 days on horseback. By water, by budgerow, the cost was from £15 to £25, and 40 days were occupied on the journey if going up the river. By steamer, the fare would have been much the same as the above, and the time occupied about ten days, for three months in the year, and nearly 20 for the remaining nine months. By gharry (native carriage drawn by oxen), it would have cost £10, and the rate accomplished would be 12 miles per diem. Infantry regiments moved at the rate of ten and a-half miles per diem, halting six days in the month, so that it took about six weeks to move a single corps from Calcutta to Benares.

The author called attention, in 1846, to a striking illustration of the difficulties connected with travelling in India, which occurred during the Sutlej campaign in 1845. When the war broke out, all officers whose regiments were in the field were ordered to join the army. About one hundred engineers, artillery, infantry, and medical officers were required to go from the Bengal presidency, and were sent at the public expense, and with the greatest despatch. It will hardly be credited that the Postmaster-General was only able to send three (!) daily, and, as the journey took 16 days, travelling night and day, few arrived before the war was over. Even this could not have been accomplished in any other period of the year.

How different is the state of intercommunication in India at this time, when about 4,500 miles of railway are completed and in active operation. During the time of the mutiny, in 1857, the march from Calcutta to Delhi would have occupied two months. Now, an army can be moved between these places, ready for action, in as many days. The military importance of railways has been thoroughly recognised by all the most eminent statesmen and soldiers, from the time of Lord Hardinge to the present day, and in March last our Sailor Prince identified himself with these great works by keying-in the last rail to complete the junction between Calcutta and Bombay.

It will now be necessary to consider the means by which the existing railways have been supplied.

Lord Dalhousie's views as to the policy to be pursued, which were ultimately adopted, led to agreements being entered into, during the year 1853, with certain companies, for the construction of railways under the guarantee of the government. The basis of these agreements, which were alike in all cases, may be briefly stated as follows:—

The government guaranteed a minimum rate of interest of five per cent. on the capital for 99 years, with lease of the land necessary for the railway and works for a like period, free of charge. On the opening of a line, all net profits exceeding the rate of interest guaranteed were to be divided, one-half of the surplus going to the shareholders, and the other half to the government, in liquidation of the interest advanced. When all the interest advanced by government had been repaid, the entire surplus profit was to go to the shareholders. The government reserved the right to regulate the trains and fares, and as soon as the dividend exceeded 10 per cent. to lower the fares, but not so as to reduce the profit below that rate. The government also reserved power, after the first 25 or 50 years, to purchase a line at a price equal to the average market value of its shares for the three preceding years. On the other hand, a railway company had the power, at any time after a line or any portion of it had been three months in work, to require the government to take the railway off their hands at six months' notice, and repay the whole of the capital expended. The companies could not borrow on mortgage, but they had the power to issue debentures, the payment of principal and interest being guaranteed by the Secretary of State for India in Council. The government were to approve the route each railway should take, and the nature of the works to be carried out and to control generally all expenditure. The mails were to be carried free of charge, and government troops and stores at a rate below the ordinary tariff. In case of any company failing to fulfil its part of the contract, the government had power to take the works out of its hands, repaying to the company the capital expended.

That the course taken by the government at that time in regard to Indian railways was a wise and politic one, considering how little had been done in the way of roads, and that what roads there were, were without a bridge of any magnitude, needs no argument to prove, the result showing that, by the aid of British capital and British skill and energy, India now possesses a system of railways, incomplete and vastly inadequate to the requirements of the country no doubt, but which could under no other conditions have been furnished to it.

Tho railways entrusted to the guaranteed companies are:—

1. The East Indian Railway, connecting Calcutta with Delhi, with a branch line to Jubbulpore. Length, 1,500 miles, of which 1,354 are open for traffic.

2. Tho Great Indian Peninsula Railway, bringing Bombay into railway communication with Jubbulpore, and thus with Calcutta on the one hand, and Madras, by

* *North British Review*, of December, 1869.

a junction with the Madras Railway, on the other. Length, 1,267 miles, of which 1,192 miles are open for traffic.

3. The Madras Railway, connecting Madras with Bombay by the junction referred to with the Great Indian Peninsula Railway, and with a port, Beypoor, on the Malabar coast of South-western India. Length, 869 miles, of which 677 are open.

4. The Bombay, Baroda, and Central India Railway, starting from Bombay and leading to the province of Guzerat. Length, 310 miles, or thereabouts. The line is open to Ahmedabad.

5. The system of the Scinde Railway Company, comprising the Scinde Railway (109 miles), Indus Steam Flotilla (about 600 miles*), Punjaub Railway (246 miles), and Delhi Railway (314 miles), a total length, by rail and steamer, of 1,270 miles, or thereabouts. The object contemplated in these combined undertakings is the establishment of a sure and speedy means of communication between the port of Kurrachee, in Scinde, and the Punjaub, as well as the connection of Lahore and the north-western frontier of India with Calcutta, in the Bay of Bengal. The Indus steam flotilla has been found totally inadequate to meet the requirements of commerce, and is to be replaced by a railway, the Indus Valley line.

6. The Eastern Bengal Railway, starting from Calcutta, and proceeding in a north-easterly direction. Length, 159 miles, of which 114 are open for traffic.

7. The Calcutta and South-Eastern Railway, now called the Calcutta and Mutlah, a short line, of 29 miles in length. This railway has been taken over by government.

8. The Great Southern of India Railway, connecting Madras with Negapatam. Length, 168 miles. Open throughout.

All these lines were guaranteed under the original terms already alluded to. In the year 1867, a contract was further entered into with the Oudh and Rohilkund Railway Company, previously known as the Indian Branch Railway Company, for the construction of a system of railways through Oudh and Rohilkund, about 672 miles in length, of which 42 miles have been opened; and, very recently, with the Carnatic Railway Company, to take over the light railway of the Indian Tramway Company, which is to be altered to the usual standard, for the construction of a line from Conjeveram to Cuddalore; but although the terms of these contracts have been somewhat modified, the guarantee is substantially the same.

The total amount of capital raised for the Indian railways to the 31st March, 1869, was £82,376,625, of which, to the close of 1868, about £79,569,000 had been expended, nearly the whole of the money being subscribed in this country.†

The amount of interest advanced by government from the commencement of operations to the 31st December, 1868, was £25,751,073, and of this no less a sum than £13,658,753 has been repaid by the companies, leaving £12,092,320 to be repaid out of future excess profits.

It may be remarked, as a most noteworthy fact, that, in the year 1865, the net earnings of the Indian railways exceeded the amount paid for guaranteed interest by about £68,900; and a surplus over and above the five per cent. was subsequently divided by the East Indian and Great Indian Peninsula railways amongst their shareholders, while, in 1866, the sum government was called on to pay out of the revenues of India on account of guaranteed interest was only £616,990, or thereabouts.

In the years 1867 and 1868, the depressed state of trade which prevailed in the United Kingdom extended itself to our Eastern possessions, and caused the returns of the Indian railways to be affected. The government therefore paid a larger proportion of the interest guaranteed, say a sum equal to about £1,373,000 in each year. The returns for 1869 have not yet been officially published, but, as trade had rallied to a great extent, it is believed the charge on the revenues of India during the past year will have been very greatly reduced, and approximate more nearly to that of the year 1866. Supposing, however, that the government again paid a sum of £1,373,000 as guaranteed interest on 4,500 miles of railway, do they not gain a return which far more than compensates for the expenditure involved? As direct gains, may be instanced the free carriage of the mails, and an enormous reduction in the cost of military charges, especially in the transporting troops and government stores; whilst, indirectly, it would hardly be possible to estimate the advantages accruing to the State in the increased security to the empire, afforded by improved means of communication, the impetus given to trade and agriculture, and the general prosperity which has ensued from the introduction of railways.

It would be impossible, within the limits of a paper like the present, to enter in detail upon the benefits thus conferred, but the following figures, in regard to the trade of India, will speak more eloquently than words to the effect railways have had in increasing the prosperity of the empire.

In 1834-5, the trade of India was £14,000,000 sterling; for the following twenty years, this trade increased but very gradually, insomuch as in 1854-5, when India had but about 150 miles of railway open, it had only reached £35,000,000, being an average increase of about one million sterling per annum; whilst during the ensuing eleven years, throughout which time the railways were being energetically pressed forward, the value of the trade of India developed at an average rate of £8,000,000 annually over the entire period. Thus, in 1865-6, it had reached no less a sum than £123,800,000 sterling, or thereabouts.

In the year 1866-7, the depressed condition of commerce, already alluded to, made itself felt, and the trade fell to £86,500,000. During 1867-8 and 1868-9, a better feeling prevailed, and, although the official returns for these years have not yet been published in a complete form, the author is enabled to give an approximate estimate of the value of the trade, which may be taken as, in 1867-8, at £98,760,000, and, in 1868-9, at £104,285,000.

These figures, which show the total value of the imports and exports, including treasure, of British India, from and to foreign countries, will no doubt excite astonishment, but equally surprising are the details from which the results are obtained.

By way of illustration, a few of the larger items of the exports of British India may be given, viz., cotton, jute, rice, opium, and wool.

For five years (ending 30th April in each year), from 1851 to 1855, the average exports per annum were, exclusive of agricultural produce, grains, seeds and fibres, and skins:—Cotton, £3,191,037; raw jute, £186,907; rice, £1,411,910; opium, £6,335,360; wool, £150,784; while for five years, from 1861 to 1865:—Cotton, £21,952,622; raw jute, £902,463; rice, £3,905,034; opium, £10,780,130; wool, £773,221.

These are the mean results of the periods under reference, but in the years ended April 1864 and 1865, the last years embraced by the statistics, the exports of cotton were £35,864,795 and £37,573,637; of jute (raw), £1,507,037 and £1,307,844; and of wool, £995,048 and £1,151,002 respectively. In the year 1866, again, the exports of cotton amounted to £35,587,389; of jute (including in this case jute manufactured), £1,083,522; and of wool, £871,314. In the year 1867 the exports of cotton, for the reason already given, declined seriously, and amounted to £16,458,277 only; but in 1868 and 1869 trade had recovered, and the exports were valued at £18,748,000 and £19,779,000 respectively. The results of the cotton trade are singularly striking, and it cannot

* The distance by the proposed Indus Valley line is about 480 miles.

† Of this amount of £79,569,000, the sum of £31,899,500 was spent in England, and the balance of £47,669,500, in India.

be doubted but that, with increased facilities of transport, the progress of its cultivation and export would become almost incalculable. Not only is the supply larger, but a most marked improvement has taken place in the quality of Indian cotton, which commands a very high price in the market. No other article that India produces approaches cotton in value. The Finance Minister of India, Sir Richard Temple, in his financial statement, delivered on the 6th March, 1869, said:—"The manner in which the exportation of cotton, on which the wealth of Central and Western India so largely depends, has been sustained ever since the close of the American war, is remarkable. Before the war, that is before 1861, India used to send to England not more than one-fourth of the quantity which America sent. During the war, while the American production fell off, India exported as much as a million and a-half of bales a year, and is still sending but little less than that quantity. The American cotton has now of course regained somewhat of its former position, but still the quantity seems hardly to exceed the $1\frac{1}{2}$ or $1\frac{1}{4}$ millions of bales which India now contributes."

The most eminent authorities in this country feel that we must now look principally to India for increased production and regular and adequate supplies of cotton. The quantity received from America is not nearly so large as might be desired, and it is believed that, for many years to come, it is not likely to equal that which immediately preceded the civil war; and not only is the quantity produced more limited, but the consumption in America itself is much larger, thus further limiting our supplies.

When it is considered that India covers an area of about 1,600,000 square miles—that the whole of this vast region is subject either to our rule or influence—and that there is scarcely any part of the country where cotton may not be grown, it is apparent how absolutely inexhaustible is the mine of wealth before us. Experience has borne out a prediction the author ventured to make at a great meeting, held at Liverpool, more than fifteen years ago, viz., that it would be found that India was the proper cotton garden of England, and that she could clothe another Europe. That railways have given a real and permanent impetus to the cotton cultivation of India, is evident from the fact that steam factories for cleaning cotton are springing up, whilst machinery for half-pressing and packing is established in many places. But time will not allow a further consideration of this question at present.

One more testimony to the improved condition of India, and it will be necessary to pass on to the question of the proposals of the government in regard to future extensions of the Indian railway system.

Capt. Edward Davidson, R.E., a distinguished officer of engineers, late Deputy-Consulting Engineer for Railways to the Government of Bengal, in a very able work on the Railways of India, published in 1868, says that:—"While locomotion has improved, India has passed from prevailing sutteeism, gross ignorance, and torpor, to a degree of civilisation, intellectual advancement, and activity, which give bright augury for the future; and from this example solely it will probably be readily admitted that progress in intercommunication is a fair index of advancement in the material prosperity of a nation. Arguments, indeed, are not required to prove that the change in India since the railway era is great and immeasurable . . . . . India in the past has been like a man asleep. India in the present is the same man awake. The powers, the intelligence, the vigour, the health, are alike in either state; but in the one case they are suspended and useless for the time, while in the other the whole energies of the man are available, and in active operation for good, for himself and others."

On the subject of the extension of the Indian railways, it was recommended by Lord Lawrence, the late Governor-General in Council, that such a system should be commenced "as appeared likely to give a tolerably complete network of main lines traversing all parts of India, in which considerations of policy, or the probable requirements of the trade and internal convenience of the country, indicated the utility of opening such lines," whilst giving "sufficient grounds to anticipate the eventual growth of a traffic which would pay the interest on the cost of construction."

The government propose to expend a sum of about £3,500,000 per annum on railways, and to spread the construction of the lines about to be enumerated over a period of from 25 to 30 years, the gross amount proposed to be so spent being £100,000,000. The outlay on the Indian railways by the guaranteed companies, for the past nine years, has averaged £7,000,000 per annum, or twice the amount now proposed to be spent.

The new lines and extensions are—

1. The Indus Valley line, to connect the present Scinde Railway, at Kotree, with the Punjaub Railway, at Mooltan, with a proposed branch to the Bolan Pass. This line is the "missing link" in the Scinde Railway Company's system, designed by that company to supersede the uncertain and inefficient navigation of the Indus, now carried on by the Indus steam flotilla. After the most urgent representations by the directors, a survey was sanctioned and undertaken by the Scinde Railway Company as far back as 1863, and the necessity for the construction of the line has since been repeatedly pressed on the government. When this line is completed, the cost of conveying the same number of passengers and quantity of goods from Kotree to Mooltan and back, will be reduced from £1,500, in the case of a steamer and barges, to £360 in the case of a train, as regards money, while as regards time the average journey will be reduced from thirty to two days.

2. Rajpootana lines, to connect Agra and Delhi with Bombay, by way of Ajmeer and Neemuch, also by Indore.

3. Branches from the Bombay, Baroda, and Central India Railway to Veerungaum and Wudwan, into the province of Kattywar.

4. A West Coast railway to commence at the port of Carwar, to proceed to Hooblee, and then on to join the Madras Railway at Ballary, and northwards to the Great Indian Peninsula Railway, at or near Deeksal.

5. A junction line to connect the north-east and south-east lines of the Great Indian Peninsula Railway above the Ghauts.

6. A line from Kulburga on the Great Indian Peninsula Railway to Hyderabad.

7. Branches to the Madras Railway.

8. An Extension of the Great Southern of India Railway to Tinnevelly and Tuticorin.

9. East Coast lines, between Calcutta and Madras, *viâ* Midnapore, Cuttack, and the port of Caconada, and south of Madras towards Pondicherry.

10. A system of lines for Mysore.

11. A line from the Eastern Bengal Railway at Kooshtea to Darjeeling.

12. A line from Rangoon to Prome.

These proposed lines generally received the approval of the home government in July last, and the immediate commencement of the most important of them was sanctioned by the Secretary of State, viz.:—

1. The Indus Valley Line, 480 miles, to be completed in 15 to 20 years.

2. The Rajpootana lines, 1,700 miles, to be completed in 25 to 30 years.

3. The line from Kulburga to Hyderabad, 116 miles, to be completed in 5 years.

4. The line from Carwar to Hooblee, 95 miles, to be completed within 10 years.

The execution of the works being undertaken by the government.

It may be well to say here that the government had already undertaken the construction of a line from

Lahore to Peshawur, originally designed and surveyed by the Scinde Railway Company, termed the Punjaub Northern State Railway, which will be referred to hereafter.

The following exceptions were made to the new policy:—The extension of the Bombay, Baroda, and Central India Railway to Veerungaum and Wudwan, and of the Great Southern of India Railway to Tuticorin, were entrusted to the companies interested; and the Indian Tramway Company received sanction to extend their line to Cuddalore.

The change in policy, by which it has been decided that the future railways of India shall be constructed by the government, originated, as already stated, with the late Viceroy, Lord Lawrence, and the primary grounds on which this change is based may be said to be a general condemnation of the guarantee system. But, whilst the government were perfectly justified in making alterations, appearing to tend to economy and efficiency, in the principle on which India had hitherto been furnished with railways, it may be confidently asserted that the arguments adduced in support of the new system are utterly untenable.

In the statement regarding the finances of India, laid before the House of Lords on the 23rd July last, it was said in substance, in regard to railways, that it was commonly supposed the lines had hitherto been constructed by private enterprise; but the government hardly thought it could be called so, the money being raised by the credit of the State, on an absolute guarantee of 5 per cent., and under the conditions of which the government took every chance of loss while unable to share in any of the profits, the shareholders sacrificing nothing under this arrangement. That the money was raised at a rate about 1 per cent. higher than that at which the government could borrow by direct loans in the market, and that the government could not see why it should not raise the money directly on its own credit at 4 per cent., instead of 5 per cent., thus saving 1 per cent. That the Council of India, after prolonged discussion, had agreed that the experiment ought to be tried of a less extravagant mode of raising money for Indian railways, and a less extravagant mode of spending it; and that despatches received from the late Governor-General, Lord Lawrence, and the present Governor-General, Lord Mayo, took the same view, urging it with irresistible force. That whether the guaranteed railway companies were regarded as agents for raising money, or as agents for expending it, no advantage was obtained by the government, for they could raise money at least 1 per cent. cheaper. Regarding them as agents for expending the money, it must be remembered that the directors in London were gentlemen who employed contractors to make the lines, or sent out engineers to hire labour. Why could not the government take the same course, contracting when desirable, or employing labour themselves? The government believed that it was unanswerable that it could raise money better, and expend it better than the guaranteed companies. Instances of faulty construction were adduced in some of the railways; the guaranteed system was condemned as a most extravagant one (there being, it was alleged, no incentive to economy), and as leading to great delays; the divided responsibility that existed, as between the companies and the government, was objected to; and finally it was stated that if the government undertook the construction of the lines, single responsibility and single management would be secured, and a considerable reduction in the cost of Indian railways would follow.

The facts contained in this paper go far to show how erroneous these opinions are, but a perfect and consecutive answer could be made to them, did time permit. It will only be necessary, however, in this case, to state that the utter fallacy of the basis of the argument, viz., that the government could raise enormous sums of money for railway works at 4 per cent., whether as regards the past or the future, has been satisfactorily demonstrated by some of the most eminent City authorities; that the allegations made as to the excessive cost of the railways hitherto constructed, the delay in their execution, and the inefficiency of the works, cannot be sustained. There have been occasional shortcomings and mistakes no doubt, for in the execution of vast and costly works how can they be avoided? But practical people will be disposed to look the facts in the face, and to judge from results. If this is done—if consideration is given to the difficulties that have been encountered and successfully overcome, to the energy and capacity displayed by those who have had the administration of our Indian railways, and above all, if figures are consulted and impartially analysed, it will be seen that these lines will bear favourable comparison with similar works in any part of the world.

Captain Davidson, R.E., to whose work on Indian railways reference has already been made, says:—"Many have thought, and still think, it would have been better had railways been constructed on a loan raised by government, by the instrumentality of officers immediately subordinate to itself. It is possible that some improvement in administration and discipline, and perhaps economy, might have been thus secured, but on a review of the whole question, the problematical advantages overweigh the certain disadvantages.

"The great, the immense, advantage which the guarantee to the capital of joint-stock companies has given, has consisted in the ready and unfailing supply of money needed for construction. All government works of utility, such as canals or roads of acknowledged importance, hardly inferior to that of railways, are seldom duly fed, even when Indian finances are prosperous, but are sure to be totally suspended or starved during years of turbulence or of pecuniary pressure. The grant for public works is the first to be reduced, without reference to capital sunk in undertakings that remain unprofitable because unfinished; and had the loan for railways been raised directly by government, it would not have escaped the rapacious hands of some needy Indian Minister of Finance.

"Indian railway joint-stock companies have, for the most part, been able to raise without difficulty, on the faith of the guarantee, sufficient funds, and the money so subscribed, though deposited with government, is still only put in their treasury for a specific purpose, and cannot be touched; and thus it has happened that, even during years of great anxiety and commotion, funds sufficient for the annual outlay on railways have always been forthcoming. This advantage will be acknowledged by all, but can only be fully appreciated by those who have seen with dismay canals almost useless for want of distributing channels, roads entirely so from the absence of bridges over torrents and streams, and buildings half erected falling to ruin for want of a roof. The steady and unfluctuating supply of needful funds is a great and decided benefit, for which Indian railways have to thank the guarantee system. Had they been constructed on funds raised by a direct loan by government, the Indian railway system would not, in all probability, have been half completed by this time, instead of being nearly finished, as it is."

Captain Davidson, of course, refers to the original lines sanctioned.

One very distinguished person, writing recently, considered it desirable that arrangements should be made "for the ultimate transfer to the government of India of the whole of the Indian railways constructed by English capital, with a view to the prevention of a too great investment of such capital in India;" whilst Mr. S. Laing, writing in 1861, when Finance Minister of India, after bringing forward certain objections to the guarantee system, added:—"On the other hand, there are some real advantages in the companies. The greatest is that where the money is raised in shares, with a proper deposit paid at first; you are safe of getting your money as you want it, by making calls. But for this, the

Indian railways must inevitably have been stopped on many occasions, from the sheer inability of the government to find the funds. A government cannot be perpetually raising small loans, and if it can create, through the agency of companies, a share capital of 10 or 20 millions, with 5 millions paid up, and a certainty of getting the other 15 millions by calls just as you want it, and whether the money-market is good or bad, it is an important advantage and worth paying for. Again, I attach considerable importance to having a large body of English shareholders connected with India. A man who holds a share in an Indian railway is far more likely to listen to a prospectus of some other Indian enterprise than an entire stranger. The first instance of decided success, *i.e.*, of earning a dividend far beyond the guarantee, will bring in numbers of subscribers to Indian schemes, and tend to multiply bonds of connection between India and England. I estimate these advantages so highly, that I incline on the whole to think it is worth the sacrifice of, say, the additional 1 per cent. to keep the companies."

It cannot but be regretted, however strongly the government felt the desirability of a change, that little or no credit was given to the guaranteed companies.

In the debate which followed the statement of the Secretary of State for India, however, the Marquis of Salisbury, and Viscount Halifax, former Secretaries of State for India, bore handsome testimony to the value of the work performed by the original companies; and Lord Lawrence, the author of the new system, and its most powerful advocate, frankly stated that "but for the energy and spirit with which the companies took up the subject, the railways would never have been in existence."

In the House of Commons, on the same occasion, Mr. R. W. Crawford, one of the members for the City, and chairman of the East Indian Railway Company, made a spirited defence of the old system, characterised by sound knowledge and judgment. Sir Stafford Northcote, a late Secretary of State for India, endorsing much that had fallen from Mr. Crawford, said that he could not but sympathise in the want of cordiality and generosity displayed by the government towards the companies in the despatches laid before the House, and considering the work done, which had been carried on so successfully, there should have been every acknowledgment of the services rendered by the guaranteed companies.

It has been urged that the experience gained by the companies has not been lost on the government, and it is alleged that from that experience they are now in a position to undertake railway works; but, the author would ask, can the government show us roads, canals, irrigation works, or harbour improvements, rapidly and efficiently executed, as practical arguments in support of this theory?

The history of public works in India furnishes, on the contrary, a stern argument against the new policy. The writer in the *North British Review*, to whose able paper reference has already been made, has said, in regard to necessary works, that "although probably existing in the form of designs of various dates and many shapes, prepared by the Public Works Department, they seem incapable of getting beyond that embryotic stage.

"Engineer officers, overflowing with honest zeal, may have prepared project after project to supply works, whose cost might, in a few years, be recouped out of the increased land revenue they would assuredly bring in. But such well-aimed efforts can seldom survive the deliberations and discussions they have to undergo at the hands of the many authorities whose sanction is required for the funds necessary to carry them out. Stifled soon after their entrance into the region peopled by secretaries and members of council, they find a premature grave in the pigeon-hole of some government office book-case.

"In vertical catacombs of this kind, which garnish the walls of public offices in India, there repose in peace the neatly-labelled remains of projects innumerable; some of them possibly unsound, but many well worthy to be revived and embodied."

The government cannot show a single work of importance that has not occupied the Public Works Department for a score of years or more.

It will be well to inquire what has been done through the direct agency of government during the last century? The one Grand Trunk-road, a great and important work, no doubt, but without a bridge, although operations were commenced (under Lord William Bentinck) forty years ago; the Ganges Canal, which deserves every possible praise; the Jumna Canal; and the works of Major-General Sir Arthur Cotton, in connection with the Godavery Anicut, are almost the only public works of importance which have been carried out under British rule. As regards local or district roads, scarcely anything has been done; and it has been affirmed that they are in a worse condition than when under native rule.

From recent statistics, it has been shown that, in the Bengal district, covering an area of 250,000 square miles, or much more than double that of the United Kingdom, having a population of 40,000,000, paying, moreover, one-third of the whole revenues of India, only 1869 miles of metalled roads exist, while we have in this country 160,000 miles of metalled roads. In Bengal, in addition, there are 6,064 miles of unmetalled, and 6,815 miles of unmetalled and unbridged roads, "mere tracks, passable in the dry season only;" or one mile of track to twenty square miles of country.

Again, as regards irrigation works, Mr. Allan Wilson, M.Inst.C.E., a gentleman of great intelligence and experience, in a paper on "Irrigation in India," read before the Institution of Civil Engineers on the 21st April, 1868, called attention to the fact that the value of artificial means of irrigation was recognised so far back as the middle of the fourteenth century, when canals for this and for navigation purposes were constructed in the Punjaub, whilst in the southern parts of India, where the rainfall was more precarious, and the river supplies less easily available, most extensive works were to be found. It has been estimated that, prior to British rule, there were in fourteen of the principal irrigated districts of the Madras Presidency upwards of 43,000 tanks in repair, besides about 10,000 out of repair, having probably 30,000 miles of embankments and 300,000 separate masonry works. Some of the tanks and reservoirs were on an immense scale, for irrigating many thousand acres, while there were smaller tanks, wells, and springs, watering only a few acres. The Poniary tank, in Trichinopoly, with its embankments 30 miles in length and estimated area of 60 or 80 square miles, is now lost to the community. The Veranum tank, with its 12 miles of embankment and area of 35 miles, is happily still in operation, and secures to the government, after an existence of almost fabulous duration, an annual revenue of £11,450.

Mr. Wilson points out that government have allowed many fine works to fall into decay, without replacing them by others, and he goes on to say, after advocating the repair of all old tanks and channels, that statistics showed, that out of 400 million acres of land which ought to be brought into cultivation, not more than four millions were ever watered by artificial works. He recommends, on the ground of the small extent of the government establishment and the large amount of capital required, that irrigation works should be entrusted to public companies. During a long course of years, government had only expended £4,000,000 sterling in irrigation works, whilst within a few years, up to the date of Mr. Wilson's paper, the guaranteed railway companies had expended £70,000,000 sterling in railways.

In regard to Harbour Works, the author will confine himself to one illustration, which has more immediately come under his notice, in connection with the system of the Scinde Railway Company.

So far back as the year 1856, the government employed the late eminent harbour engineer, Mr. Walker, to examine and report on the capabilities of Kurrachee Harbour, and the recommendations and designs for improving the harbour furnished by him were partially adopted, the works being commenced in 1859. About ix years after, when more than £250,000 had been expended, and the area of the harbour had increased from about 70 to 100 acres, doubts were raised by some of the government military engineers, who may be considered as amateur harbour engineers, as to whether the designs of Mr. Walker were calculated to accomplish the object desired, and all operations were suspended for a time, orders being given for a careful inquiry into the effect of the works that had been carried out. Subsequently, at the beginning of 1868, the works were partially resumed under the able and experienced direction of Mr. William Parkes, Mr. Walker's assistant and successor, and it was determined to proceed with the original designs. Since then, the author believes that the works have again been entirely stopped for financial reasons—that compensation has been paid to the contractors engaged, and that the staff employed has been dispersed. Such delays as these, whilst retarding the prosperity of the port, tend also to enhance seriously the ultimate cost of the works, for that they will eventually be carried out little doubt can exist.

Notwithstanding the vast extent of India, the harbours on its coast are few in number. Kurrachee is obviously destined to take a high rank, from its capabilities and geographical position, and every effort should have been made to complete the improvements recommended by Mr. Walker, which were strenuously advocated by Sir Bartle Frere, when Commissioner in Scinde; Major-General Turner, chief engineer of the province; and other local authorities. As it is, eleven years have passed, and the works are but very partially carried out, and are at present entirely stopped.

It can hardly be said, from the foregoing illustrations, that either canals, roads, irrigation, or harbour works, have progressed satisfactorily under government, but perhaps a case still more in point will be found in the history of the Punjaub Northern State Railway. The construction of this line was determined on by government in 1868, and a staff, under the direction of Mr. Lee Smith, left England in November of that year, but according to recent advices from the spot scarcely a sod has been turned. A large staff of engineers, costing about £60,000 per annum, has been maintained for many months in a position of ease, not to say idleness, under the auspices of a paternal government, whilst a correspondence is carried on as to the desirability of utilising the Grand Trunk road by widening the embankment for the reception of the rails. Now, were this scheme carried out, the saving in expense would be but small, whilst the gradients could not but be very unfavourable. *The Friend of India*, writing on the subject nearly a year ago, expressed a belief that it would be more economical to adopt the route most approved by the engineer, Mr. Lee Smith, but adding that "if railway and road must be near each other, it will be cheaper to move the road to the railway, than the railway to the road."

The total amount spent on railways from their commencement—say from 1853-4 to the close of 1868—was £79,569,000, whilst the total amount expended by government on "public improvements"—which includes roads, canals, irrigation, and harbour works—during the like period, may be stated at about £26,000,000, or one-third. This sum is exclusive of civil and military buildings.

The author has now given the general results of the work accomplished by the guaranteed companies in India in regard to railways, and of the public works carried out by government, and has shown what the intentions of government are as to the extension of the railway system; and he must leave others to judge what probability there is of future lines being prosecuted with that speed and energy which have marked similar works hitherto, and which their importance and the requirements of the country demand. He may, however, add a few words in regard to the government plan of investing 100 millions of money, to be distributed, in what may be termed driblets, over a variety of works. This appears to him most unwise; the more economical system would be to appropriate the total proposed annual expenditure to those works that are most urgently required, so that, instead of having a number of lines partially completed, and as certainly in degree falling into decay, the State would have the same amount of works or length of line completed, and in the same time, and for the same capital expenditure, but with this advantage, that the works first completed would be maintaining themselves, and earning a revenue for the State.

As an illustration, take a line in which the author is more particularly interested, the Indus Valley Railway. Assuming the cost at five millions of money, if carried out on the State plan of an annual appropriation of £250,000 (as it is quite certain the line can make no return whatever till completed throughout), the *real* cost of the line, including interest at 4 per cent., will be seven and a-half millions. If, however, instead of £250,000 per annum, an outlay of £1,000,000 per annum were set aside for this line, the railway would be completed in five years, and the total charge, including interest, would be five and a-half millions only.

It would be a better financial scheme than that proposed by the State if, instead of laying out £250,000 per annum in works yielding no return, the money were invested at 4 per cent. for eleven years, which would raise it to £3,400,000, which, with the further annual outlay of £250,000, would enable the work to be completed in five years from that time at a total cost, including interest, of five millions, or a saving of two and a-half millions in money and four years in time, to say nothing of the fact that work carried on with fair vigour is much more economically executed than when it is either unduly expedited or procrastinated.

Had time permitted, the author would have furnished some particulars of railway enterprise in other parts of the world, but he cannot trespass on the audience further than to give the railway mileage of some of the principal countries:—

	Miles.
United States	43,000
Great Britain and Ireland	14,500
France, &c.	10,200
North Germany	9,000
Austria	5,000
Russia	4,300
India	4,200
Italy	4,000
Spain and Portugal	3,900
Canadian Dominion	2,200
Belgium	1,750

From the foregoing figures, it will be seen how inadequately India is supplied with means of communication, as compared with other countries, and the consequent necessity of an energetic prosecution of the proposed extensions.

It is interesting to know that nearly half of the total amount of capital expended on railways throughout the world has been supplied by British enterprise. Irrespectively of £500,000,000 spent on lines constructed in Great Britain and Ireland, we have provided £150,000,000 for Indian, Canadian, and colonial railways, and are further greatly interested in railway projects in Russia, the United States, Austria, Belgium, Italy, &c.

The author cannot avoid stating, in conclusion, that it appears to him a most inopportune moment for effecting a complete and sudden revolution in an old-established system. At a time when any one of the guaranteed companies could have commanded an efficient staff, available at a moment's notice, and an organisation fostered by the experience of successive years of railway work in

India, the government, without waiting for the result of their experiment on the Punjaub Northern State Railway, without any organised staff, and without any fixed plan of operations laid down, step in and say, we will do this work ourselves, thus imposing a heavy check upon private enterprise and commercial progress.

The government have hitherto taken a broader view than is embraced in the mere question, "Will the construction of a certain line pay an immediate and direct return equal to the five per cent. guarantee?" That all lines selected with judgment and prudently managed will pay eventually, no doubt can be entertained.

It has generally been admitted that, in the material and social advancement of the empire, the government have reaped benefits almost unprecedented. Commerce has steadily improved, education and general enlightenment have been promoted, the value of land and labour have increased enormously, and the unhappy and pernicious barriers of caste are being gradually but surely removed. The author feels, therefore, with deep regret, that the step taken by the government must, in his opinion, to a great extent dwarf the usefulness of the work already accomplished, and lead to a delay that will retard the progress of trade and the social well-being of the empire for many years to come.

DISCUSSION.

Mr. James Macdonald said, as an old Calcutta merchant, who had taken an interest in the railway question in India from the time when the matter was first advocated, he could not refrain from expressing the pleasure with which he had heard the paper, by one who was first known to him as "The Old Indian Postmaster." He well recollected the joyous sensation it occasioned, and the satisfaction with which it was found that at last a man had arisen who knew what the wants of India were, who knew them extensively and accurately, and who was able to enforce them with a force and ability which could not long be resisted. He then felt that the time was near at hand when railways would be established in India. There was one particular in which the paper was somewhat deficient, a particular which could not very well be supplied by the author himself, but which ought to be supplied by those who knew the facts. He referred to the important part which Mr. Andrew himself had taken in the origination of railways in India, and the share which he had in showing what line would be most advantageous. At that early time there was a great contest whether the railway from Calcutta should go straight across the country to Mirzapore, or whether it should go by the line which was at last adopted, hugging the river, and following it up to Rajmahal. His recollection of the Indian postmaster's exposition of the advantages of that line was such that he had ever since regarded him as the real author and designer of that line of railway, and that to him was due the credit of overturning the other project, which would have taken it through a most unproductive district. He laid out the plan of this line in 1846, and though no doubt it was perfectly open to Lord Dalhousie to adopt it, as he did seven years later, he did not think it was done with that acknowledgment of Mr. Andrew's services which was his due. As an old resident, well acquainted with the facts, he thought it only right to mention this matter.

Mr. Wm. Taylor said he feared he might be left in a minority of one in the views he was about to express, but yet every question ought to be discussed from all points of view. He did not in the least dissent from the interesting account which had been given of the state of India, both antecedent and subsequent to the introduction of railways. There was no doubt that of all the animals which the Acclimatisation Society succeeded in introducing, the "iron horse" was the most valuable, and to iron and railways much of the progress in civilisation, education, and destruction of caste was no doubt attributable. India, no doubt, was just awakening, but, like many others, she awoke thirsty, and her one cry was for water. This introduced the subject which he considered of the greatest importance, a subject which had been brought forward by a gentleman of energy, ability, and experience second to none in connection with India, and which he believed ought to be taken in connection with the one under discussion. He would not go into the question whether future railways should be made by the government or by private companies, although his own opinion was strongly in favour of the latter; and, when he looked at the miserable half-finished works, such as the tawdry post-office and wretched attempt at a museum, which were to be seen at Calcutta, he thought few men would be found bold enough to advocate the placing of railways in the hands of the Indian government. He did not, however, intend to go into this question, or to offer any opinion upon the relative expenditure, but rather to say a few words on the great country of India itself. Mr. Andrew had drawn attention to the broad features of that magnificent land, but he had omitted one main point, viz., that vast world of waters which, taking its rise in the everlasting hills, year by year poured down towards the coast, crying out, as if in a diapason to short-sighted mortals, to make use of the inestimable blessings which it was capable of producing. Water was the great want of India. After some further remarks on the value of canals and irrigation, he said his only object in bringing the matter forward now was that, before a vast expenditure was incurred on behalf of a country whose finances were anything but flourishing, the matter should be fully and impartially weighed.

Mr. Juland Danvers said he fully concurred in the great advantages conferred upon India by the system of railways which had been introduced. He also concurred with Mr. Andrew that no better system than the guarantee system could, under the circumstances, have been adopted for introducing railways into India; but the precise meaning of the word "enterprise" should not be forgotten. The term "enterprise" had been used on several occasions during the evening; and in his introductory remarks the chairman seemed to imply that private enterprise in India was about to be crushed. Could they regard as private enterprise a system supported by government, and upon which a certain interest had been guaranteed on the outlay? He could hardly doubt that the government would have been very glad if the projectors of railways in India, and the capitalists of this country, had come forward in the first instance and said, "We have such faith in our projects, so much confidence in the result of our outlay, that we need no guarantee from you; we simply ask for a fair field and no favour, except that we will gladly accept land, if you will give it to us, in consequence of the peculiar circumstances under which land is held in India." That was not the case. The money was not forthcoming in this country for railways in India, and it was essential that government should step in, and make railways, or offer a guarantee, which had been the system adopted. He thought the government of that day ought not to have attempted to make railways themselves. Lord Dalhousie, who considered the matter deliberately, came to the conclusion that the means at the disposal of the government were not adequate for the purpose, and he wisely advised the directors of the East Indian Company to adopt the system of offering a guarantee to private companies. He thought, under the circumstances, no better or wiser system could possibly have been conceived, and that great credit was due, and should be accorded to those now passed away, for the attention they gave to it, and to gentlemen who had been instrumental in carrying out that system, amongst whom he might mention Mr. Crawford, Mr. Walker, Mr. Watt, Mr. Nodo, and Mr. Andrew himself. He believed he was right in coming to the con-

clusion that private enterprise, pure and simple, was not forthcoming for the purposes of railways in India, and therefore it was necessary, under the circumstances, to adopt the somewhat cumbrous system of the guarantee under the control of the government. The result upon the whole had been most successful, and the future was also most promising with regard to guaranteed companies. Since the time, however, that those discussions took place, circumstances had changed, and it was no longer the case that India had no means at her command for carrying out such works. Twenty-five years ago Parliament would not have thought of sanctioning fifty millions being raised for Indian railways, but through the instrumentality of companies the money had been raised, and he did not think for a moment that a single sixpence of that money had been mispent. On the contrary, he believed that every shilling would produce its return, and in time to come nobody would regret what had been done. But now money eould be obtained, labour was at hand, and they had knowledge in India which could be applied to the work, and if the government were of opinion that money could be raised 5s. per cent. cheaper in India, or if they thought that railways could be made £50 a mile cheaper than by companies, they were right in doing it themselves. He saw no reason why they should fail, and under proper management they might succeed. He admitted it was an experiment which wanted watching most carefully, but he did not see why they should not succeed. Instances had been brought forward where the government had failed in carrying out public works, but other instances might be adduced in which they had succeeded. In the course of a year upwards of 4,000 miles of telegraph had been laid down under the supervision of one individual, without any appeal to private enterprise. He could not think that the government ought to be blamed for, on the ground of economy, attempting themselves to introduce a system which would increase the advantages of railway communication if they could do it cheaper and with more advantage.

Mr. William Dent said he could endorse nearly all that had been said by Mr. Danvers. He could not see why, if Russia could come to this country and carry away millions of money, for the purpose of constructing railways to facilitate her intercourse and communication with India, why India, through the Secretary of State, could not borrow all that was required for the construction of railways; and certainly they were not such children that money borrowed for one purpose must necessarily be spent for some other. He perfectly agreed, however, that it was right that private companies should have been encouraged to undertake railways in India; but as to private enterprise, it was a misnomer. As was stated in the speech of the Secretary of State for India, as quoted in the papers, it was not private enterprise which had done it, for there was no risk whatever to anybody who took a share in an Indian railway; he could get rid of it at any time without loss by giving six months' notice, if the railway was found to be a failure, and this had been the case with the small line south of Calcutta—the Mutlah Railway. The shareholders found it did not pay, and they threw it on the hands of the government, who had to deal with it in the best way they could. He could not understand why, when the English Post-office had undertaken, in addition to their own work, the management of the whole of the telegraphs in England, and the whole of the savings banks, establishing one in almost every village in the country, the government of India, with its establishment of engineers, could not undertake the construction of railways. It was all very well to speak of their being military engineers, but they were in fact a corps of civil engineers who had also military experience, and their duties, except in time of war, were entirely those of civil engineers. He happened to be chairman of one of the railways which had been alluded to, one of the lines in Oude, and he trusted that it would be completed without difficulty, or without employing contractors. There was no doubt that where there were contractors there must be a contractors' profit, which amounted to some 20 or 30 per cent. Labour was abundant, and there was no difficulty whatever in getting the works completed almost instantly. But if contractors were necessary, what difficulty was there in the government employing Messrs. Brassey and Hughes, or any others who were quite ready to enter into contracts with the government; and the government were not slow to avail themselves of such services, both in India and England, whenever necessary. He had to look out for a competent person to undertake the management of this line, and was fortunate in finding a gentleman who had lately returned from India, a military engineer, who had been secretary to the Public Works Department. He had also been a director of the Eastern Bengal Railway, in England, and had so obtained English experience. On meeting with him, and asking if he could recommend a gentleman to undertake the management, he eventually undertook the duties himself. He had now been there for three years, and they had every reason to be satisfied with the mode in which he performed his duties. No doubt, under the new system, his intimate acquaintance with government affairs would be a great advantage to the company. With regard to this railway, however, they had a government establishment to look after the work, and see that it was carried out properly and agreeably to the engagements; and it occurred to him that there was no reason why the government, under the new system, should not issue their instructions direct to their agent, and carry out the works themselves through his agency. He could not see any difficulty, after they had raised the money by a loan, in getting a sufficient establishment, and a proper organisation of civil engineers to carry ont the work, just as easily as could be done by any board sitting in England.

Mr. George Bidder said in reference to what had been said, Why could not the government do this and that,—he could only say that they had never done so, and did not do so. With regard to the example which he had taken of the conduct of the electric telegraphs by the post-office, it was as yet but an experiment. He hoped it would be a great success, but he could not yet consider it so, for in one particular locality, which he used to be in the habit of communicating with in twenty minutes' time, at a cost of sixpence, he could not do so now in two hours' time, at a cost of half-a-crown. No doubt that was a temporary defect. But still he did not think the illustration was a very fortunate one. With regard to the question before the meeting, he would not deal with it in any way as engineer to the Scinde Railway, which pecuniarily was no advantage to him whatever, but would rather view it as a citizen of the great English Empire, and with a desire to see how they could best utilise the vast expenditure which had already been incurred, and in what manner future resources could best be laid out, particularly as they were all perfectly aware that the finances of India were not at present in a very flourishing condition. Indeed, this subject caused great anxiety to every one who considered it carefully; and when he saw the way in which the government dealt with the railways, he was not at all surprised at it. The reason, he believed, was that there was no commercial element in the government of India. One gentleman asked—"Why could not government carry out the works themselves?" But he would ask whether by any system you could get men to carry out any enterprise successfully in which they were not personally interested, and to which their undivided attention was not given. They knew perfectly well that there was not a ship built in our arsenals which did not cost more than it would in any private yard. Of course, the answer was that, although they cost more, a better article was produced. Whether that were true or not he would not say, but, if necessary, he would venture even to

deny that. With reference to the lines already made in India, he was bound to bear his personal testimony to the ability of all parties connected with them, whether representing the private companies or the government, and he believed they had all been actuated by one single desire to do the best they could for the interests committed to their charge, and if there were any shortcomings, it was simply owing to the system. They were now arrived at a point when statesmanship ought to come in, and the question was, how best to utilise what had been done; and next, how best to spend money for the future? With regard to the past, he did not see that the government could do better than utilise the machinery they had, by which he meant retaining the able men who had been at the head of affairs so long, and let them continue to supervise the condition of the lines and rolling stock; and, if the lines were let by contract, seeing that the covenants in the contract were properly fulfilled. It was quite within the competence of a board of directors to do this, and by so utilising their experience he believed the government would effect a saving of from 25 to 30 per cent. With regard to the future, Mr. Andrew said, and he did not know that it had been contradicted, that the intention was to provide some three or three and a-half millions a year, which was to be expended in driblets on a number of public works in India, and if that was the statesmanlike idea of going to work, he did not wonder at there being a difficulty in the finances. He quite agreed with Mr. Andrew that it would be better to invest the money at four per cent. until they were in a position to execute the whole work within a reasonable time. In the first place, the work would be done better and more economically; and in the next, they would save a great deal in expensive salaries, and would get the same work done for a much less sum, including interest, which seemed to be altogether lost sight of. He had mentioned that idea to a gentleman who was a member of the Indian Council, who said he could not deny it, but the great difficulty was to know what work to commence with; and, in short, he said there were so many difficulties in the way of doing what was right, that really they seemed insurmountable. He did not consider that as any answer at all, for a statesman ought not to succumb to these fancies or suggestions, but ought to deal with them and surmount them, so as to get the full benefit of the outlay of public money. Taking the instance which had been selected in the paper, the Indus Valley line, it was put down as likely to cost five millions, and to be completed in twenty years, at an expenditure of £250,000 a year; but until the whole railway was completed it would not be worth a rap, and by that time the capital expended, including interest, would amount to seven and a-half millions. But what would be going on in the meantime? Communication must be maintained by means of the Indus flotilla, and, as very properly stated, every trip which was made required ten days, and an expenditure of about £1,500. On the other hand, when the railway was made, the trip would be done in twenty-four hours, at a cost of £400, or less, so that the saving on each journey would be £1,100. Apart from that, and the great commercial advantages which would result from the opening of this line, it must not be forgotten what immense facilities it would afford for the transport of troops landing at Kurrachee, Mooltan, and Central India, and this was a matter of the utmost importance in case of an invasion from the north-western districts. It was absurd to say that it was not of the least importance to be able to concentrate troops on the banks of the Indus; and, in plain terms, it would be a simple act of lunacy to take twenty years to do that, when it might be easily done in four.

Mr. Danvers said he did not think anyone proposed for a moment that so much time should be employed in the construction of such a railway. To show that government could be prompt when necessary, he might mention that a line ten miles long had just been completed and opened in six months.

On the motion of **Mr. Hyde Clarke**, the discussion was then adjourned until Wednesday, June 1st.

INTERNATIONAL DECIMAL ASSOCIATION.

A Conference on international measures, weights, and coins, was held at the Society of Arts on Friday, 6th May, 1870. There was a large attendance, including the Astronomer Royal; Lord Colchester; the Warden of the Standards; Mr. Alderman Salomons, M.P.; Mr. J. B. Smith, M.P.; Mr. Thomson Hankey; Mr. J. G. Hubbard; Sir Charles Adderley; Sir John Bowring, Mr. Edward Baines, M.P.; Mr. C. Rivers Wilson; Dr. Farr, F.R.S.; Mr. Babbage, F.R.S.; and others. The **Right Hon. Earl Fortescue in the Chair.**

Letters were received from Sir Thomas Bazley, M.P., Mr. Samuel R. Graves, M.P., Mr. A. P. Muspratt, of Liverpool, and others, expressing their regret at being unable to be present.

The Chairman said:—Before commencing the proceedings of the Conference, which I am happy to see so many non-members of the International Decimal Association have honoured with their attendance, I may mention that the Association has at this the annual meeting a little business of its own to get through, but which we hope will prove not wholly uninteresting or uninstructive to our other friends here, but which will not admit of that discussion at their hands which we invite on the printed resolutions upon the general question, to be proposed immediately afterwards. Without further preface, I will now call on the Secretary, Professor Leone Levi, to read the report.

Professor Leone Levi read the twelfth annual report of the Council, of which the following is an abstract:—

"In the United Kingdom considerable progress has been made during the last year, the necessity of immediate legislation on the subject of weights and measures being everywhere admitted. The Royal Commissioners appointed to inquire into the condition of the Exchequer—now Board of Trade—standards, recommended the full legalisation of the metric system; the use of the same concurrently with the imperial in the Customs and the Post-office, as well as the abolition of troy weights.

"The question of introducing metric weights and measures in the sale of corn has engaged the attention of the Council. A return has just been issued from the inspectors of corn of the various measures and weights used in the sale of corn, from which it appears that wheat is sold at Barnstaple at 67½ lbs. per bushel; at Totness, at 62½ lbs. per bushel; at Bodmin, by the Cornish bushel; at Launceston, by the bag, wheat and barley of two bushels, and oats of three bushels; at Chester, wheat at 75 lbs., barley at 56 lbs., and oats at 46 lbs. per bushel; at Birmingham, by the bag of three imperial bushels of 62 lbs. each; at Leicester, at 18 stones; at Bedford, by the load of 5 imperial bushels; at Ely, by coombs and quarters; at Wisbeach, by the coomb of 4 imperial bushels; at York, at 4½ stones to the imperial bushel; at Liverpool, by the cental of 100 lbs.; at Wigan, by the windle of 220 lbs.; at Appleby, by the boll; at Denbigh, by the hobbett. Such instances of extreme diversity in the custom of different markets, which might greatly be multiplied, aggravated by the different practice of selling wheat sometimes by measure and sometimes by weight, have often been the subject of great complaint on the part of the agricultural interests of the country, which really suffer from the uncertainty and ignorance of the markets thereby produced. The Chambers of Agriculture in England and Scotland have addressed themselves seriously to remedy this anomaly, and many

of them communicated with the Council on the subject. Your Council are convinced that perfect uniformity in the mode of selling grain throughout the United Kingdom is most essential to the interests both of commerce and agriculture; that legislation on the subject is absolutely needed; and, above all, that no reform can be permanent and satisfactory unless it provide for the same uniformity among all commercial nations. The Devon and the Central Chambers of Agriculture have petitioned for a committee of the House of Commons to inquire into the whole subject, and your Council trust that their demand may be conceded. It should be remembered, however, that every inquiry instituted on the subject, in this as in other countries, has resulted in the adoption of the metric system; and it is worth stating that were the present pound increased to the extent of about 10 per cent., a new cental would be equivalent to 50 kilos.

"The co-operation of the working classes being found very desirable, meetings were held at the Working Men's Club and Institute Union, and at the St. James's Working Men's Club, when the question was discussed, 'Ought the metric system to be substituted for the present weights and measures?' Mr. Edward Baines, M.P., presided over the first of these meetings, and after considerable and intelligent discussion, both clubs decided to petition the House of Commons in favour of the metric system, which was accordingly done. A postal treaty is understood to have been concluded with France, which fixed the minimum weight of letters at 10 grams in France, and $\frac{1}{3}$ of an ounce in this country. Your Council would exceedingly regret were the occasion not seized for introducing the metric weights in the Post-office, as has been repeatedly recommended by the Committee of the Commons and the Standard Commissioners, and they would have more reason to complain of such arrangement, seeing that the third of an ounce is in reality a new weight, and not an aliquot part of the pound avoirdupois. Your Council have united with the Metric Committee of the British Association for the Advancement of Science, in recommending to the Committee of the Privy Council on Education that they should require the teaching of the metric system in the schools supported by them. The Council are glad to learn that the Lords of the Council have decided to renew their instructions on decimals, and to transmit a lettor on the subject from that Committee to all inspectors of training schools.

"The extension of the metric system in India is now fully resolved upon, at least as regards the kilogram, with its divisions and multiples; but your Council regret that no step has as yet been taken in the colonies of the empire, as far as they know, in the same direction. The want of legislation in many of them is very urgent, especially in the Mauritius.

"In foreign countries no essential change has occurred during the year, except that the metric system has now been permissively introduced in all the German states, and will be rendered compulsory from the 1st January, 1872.

"The question of international coinage was brought before the House of Commons by the Chancellor of the Exchequer, on the 6th August, 1869, when Mr. Lowe dwelt on the fact that England is the only nation of the world which circulates coined money at the same value as that of the raw material out of which the coin is made; and having pointed out that this method encourages the exportation of gold coins, and is otherwise inconvenient, he suggested the question—Why should not a mintage rate be imposed so as to indemnify the nation for the expense of maintaining the currency? The charging of the seigniorage, Mr. Lowe contended, would be tantamount to raising the value of the coinage, and after pointing out the difference between the British and foreign systems of coinage, Mr. Lowe, in the following terms, indicated what he conceived might be done to further international coinage:—

'The conditions which I have mentioned are really elementary conditions of the whole question. But I wish here to point out that I believe it is possible for England and France, if they can make up their minds to give up a little of their prejudices for the sake of the great advantage of having an international coinage, to obtain that object, and I will just show the House how that could be done. The French are proposing to coin a 25-franc gold piece, 5 francs more than the napoleon. That would be less in value than the sovereign by 22 centimes, or about 2d. If we were about to impose a seigniorage of about 1 per cent., or ·993 of a grain, and take gold to that amount from the coin, our sovereign would be identical with the 25-franc piece. It would still remain as a current coin in this country of exactly the same value as now, and it would have the additional advantage that it would be identical in value with the 25-franc piece. But, in order that that might be done, France would have to make a sacrifice on her part. I forget the mintage she charges; I believe it is between a fifth and a quarter per cent. If she could be prevailed upon to make it 1 per cent, we should have solved the problem, as far as England and Franco are concerned, of an international coinage. The operation would be performed by modifications of the same principle—France would, as now, take the payment in money, England would deduct from her coin, and thus equality would be obtained. It is singular to remark what a number of coins in the world approach one another in value. The Spanish doubloon, the Prussian Frederick, the half-eagle of America, approach exceedingly near in value to each other, and I think it very possible, if France would meet us in this way—should Parliament be induced to look at the matter from the point of view I have put it—we might come to some arrangement by which we should get the blessing of one coinage throughout Europe, a great step in civilisation.'

"No measure, however, has been introduced on the subject, and it is evident that, before any negotiation can be entered into with France, that nation must determine the preliminary point of adopting one standard only, and that gold. An Imperial Commission is now sitting upon the question of coinage, and it will depend on the report of that commission, on this particular subject, how far it will be possible to advance in the direction of an international coinage. In the United States, a Bill has been introduced, and read a second time, enacting that the gold coins of the United States shall be nine hundred parts fine in one thousand; that the weight of the gold coin of five dollars shall be $124\frac{8}{20}$ troy grains, being the weight of a 25-franc piece; and that the gold coins of any foreign nation which may conform in weight and fineness to the coins thus authorised shall be a legal tender. Your council have had the subject under their consideration on various occasions, but they have seen no reason to alter the resolutions they have arrived at and already reported on the question of international coinage. In view of the interest which still attaches to the general question, the resolutions are now reproduced, as follows:—

"1. That it is advisable for international purposes that a single standard for coins should bo adopted in all countries, and that that standard should be gold.

"2. That, for facilities of exchange, the degree of fineness in the standard should in all countries be nine-tenths.

"3. That considering the extensive and growing use of the decimal system, and the time and labour which it saves in computations of money value, and in all commercial transactions, the unit of money value in every country should be decimally subdivided.

"4. That, in the opinion of this association, the greatest advantages would result to the country if Great Britain were to join the Monetary Convention, concluded the 28th December, 1865, between France, Italy, Switzerland, and Belgium, by Art. 12 of which convention the right of accession is, under certain conditions, reserved for other States.

"5. That, in the opinion of the association, in order to make the sovereign interchangeable for international purposes, it is desirable that the quantity of pure gold contained in it should be reduced to the precise equivalent of the gold piece of 25 francs.

"6. That in order to bring the British system and the system of the convention into closer contact, it is desirable that the sovereign so altered should be divided into 250 new pence.

"7. That whilst recognising the increased facilities which would result by the establishment of a simple and clear relation between such leading units as the sovereign, the dollar reduced to the level of 5 francs, and the franc, the Council of the International Decimal Association, anxious to promote one common universal unit of money, strongly recommend to Her Majesty's government to consider the advantage of adopting the 10-franc piece in gold, consisting of 100 new pence as before defined, as an international unit, and to submit the same for the adoption of the nations parties to the Monetary Convention of December, 1865.

"8. That it be recommended to her Majesty's government to take the necessary steps for convening or joining another international monetary conference for the purpose of settling the details of a complete system of international coinage.

"Your Council are convinced that the establishment of a uniform decimal system of weights and measures based on the metric system, and of a system of coinage likewise simple, decimal, and international, would confer a decided boon on all classes of society; that the economy of time and labour which it would introduce would greatly promote the increase of wealth; whilst any system which shortens the processes of elementary instruction must tend to advance the education of the people, and give greater opportunities for the teaching of physical and natural science in the schools of the United Kingdom. For the last ten years we have seen one country after another introducing measures for realising the desired uniformity in these most practical instruments of exchange; and as it is given to Great Britain to exercise a commanding influence, not only by her internal legislation, but by the action of her colonies and dependencies, your Council earnestly trust that that influence will be exercised in the direction of promoting the object of this association—one uniform decimal system of measures, weights, and coins in all countries."

The report was adopted unanimously, on the motion of **Mr. James Heywood, F.R.S.**, seconded by **Mr. Tito Pagliardini.**

Mr. J. B. Smith, M.P., then moved the following resolution:—"That the thanks of the members are due to James Yates, Esq., for the liberal and enlightened support which he has given to the Association for so many years."

Mr. Chisholm said, although he was not a member of the association, he hoped the Chairman would allow him to second the resolution. He had known Mr. Yates for a long time, and was well aware of the services he had rendered to the association. He had also been of great assistance to him, in his official capacity, as Warden of the Standards, and had given him a great deal of valuable information, in the form of papers which he had in his possession from all parts of Europe, bearing on this subject, and which he freely placed at his disposal.

The resolution was then put and carried unanimously

Sir Charles Adderley, M.P., moved the following resolution:—"That the great inconvenience to agriculture, manufactures and commerce, as well as to science, resulting from the numerous complicated and anomalous weights and measures now in use, whether by law or custom, in the British empire, demands the attention of the legislature at the earliest practicable time, with a view to the establishment of some convenient uniform decimal system throughout the United Kingdom." In doing so, he said he could not but express his intense interest in the great commercial reform for which they were there met. For a great many years he, as a member of Parliament, had taken a very zealous part, however ineffective it may have been, in promoting this great commercial reform, not only in recent years, in connection with his excellent friend, Professor Levi, to whom the cause was greatly indebted, but also in earlier times, when men of such distinction as the late Mr. Hume and Mr. Cobden took a part in promoting this great cause. The use of a single unit of measure for amount, area, and of weight, offered an emancipation to the finance of commerce as steam had offered to locomotion, or electricity to thought. However, in this country we did not generally deal with large, comprehensive schemes. The conservative nature of the English nation was illustrated in no way more than in its readiness still to go out as a great commercial nation in the armour of the middle ages to fight the battles of the nineteenth century. He recollected discussing this subject, with his friends Mr. Smith, Mr. Baines, Mr. Bazley, and others, over and over again in Parliament; and it had been recognised when the attention of Parliament had been drawn to the fact, that not only did the great varieties of weights and measures in use in the various counties of England (for his friend, Mr. Bass, said there were about 20 or 30 in Stafford alone) greatly embarrass the internal trade of England, but that it was a trifling consideration compared with the fact that England, with such a log round her neck, had to contend with other nations in the international commerce of the world. The fact was, the world was becoming every day more cosmopolitan. There was even a sort of *lingua franca* growing up, neither English nor French, but still something by which anybody could get his dinner in any part of the world. He believed at the present moment there was hardly a nation in Europe which had not adopted the metric system; in fact, they were so numerous that the exceptions could much more easily be named. Some, it was true, had only done so permissively, and not to the full extent; and he believed Russia was simply waiting for a correction of the standards, and the result of the international conference upon the subject, to adopt it herself. He could not conceive it possible but that England would seek to share in its five-fold advantages, which were now enjoyed by almost all other nations, rather than still go on encumbered and embarrassed with its old avoirdupois weight, and its tables. The Exhibition of 1851 first called general attention to the subject. Then there was the Select Committee of the House of Commons in 1862, the Permissive Act of 1864, which slightly altered the old Act of William IV., but still was very imperfect, and this was followed by the Standards Commission of 1868, and by international congresses and conferences of all sorts. They had done all they could, and it was rather difficult to see what more could be done. They could not issue orders to the police to compel everybody to use the metric system; they could not issue a ukase, or even a plebiscite, and, in fact, he did not know what could be done, except what the association was about to do, press the subject from time to time upon the notice of the public. They should endeavour to get the Educational Department to have this system taught in schools, and to induce the government to use it wherever possible in the government departments, not only for the sake of the advantages to be derived thereby, but also by way of example. He was delighted to hear that there was a deputation from the Central Chamber of Agriculture attending the meeting, because that showed that the system was beginning to be understood. There was not an interest in the country, from the poor, wretched child who had to learn all sorts of complicated tables in a primary school, to tradesmen and large manufacturers, and even the highest departments of the State, which was not interested in this resolution.

Mr. Edward Baines, M.P., in seconding the resolution, said he agreed with almost every word which had been said by his friend Sir Charles Adderley, excepting the somewhat disheartening view he had taken of their prospects for the future. He felt anything but disheartened when he saw by his side Sir John Bowring, to whom he remembered listening many years ago, before Cobden and Bright were names even heard of, whilst he expounded, with the most perfect and luminous clearness, the principles of free trade and the abolition of the corn laws. Therefore, when he saw him here, and remembered how those principles had triumphed, he did not feel much disheartened at their present position; besides, when he reminded his right hon. friend of the progress that had been already made, he thought they might well take heart for the future. Something had been done by the late alterations in the law, which, though indeed singularly defective, still admitted the principle. Something had been done amongst men of science, many of whom had now come to admit the immense superiority of the decimal and metric system over the old rude, complicated, ill-regulated, and barbarous system of weights, measures, and monies. They had also gained by the international conference upon this subject, which had carried resolutions so clear as those which were described in the report which had been read by the secretary. That, however, which had encouraged him more than anything else was a meeting, to which he had been invited by Professor Leone Levi, at the Union of Working Men's Clubs in the Strand, at which a considerable number of most intelligent working men were present, many of whom had resided in France, and who were able to discuss with singular acuteness the merits and difficulties attending any change. He held in his hand a petition which they passed upon that occasion, and which pointed out the defects of the present system. It showed the deficiencies and anomalies of our existing system, and the immense advantages, the ease, the beauty, the simplicity, the regularity, the proportion, and the symmetry, of the system which it was wished to adopt. It was another illustration of the old saying, "*c'est le premier pas qui coute*," as it had always seemed to him that it was only necessary to understand what the metric system really was in order to approve of it. The difficulty which was most often pressed was that of making the change in the first instance. He had heard of English workmen, employed by engineers and contractors in the south of France, who in the course of two or three weeks found themselves perfectly competent to go into the market and make all their own purchases in the French money, so easily was the metric system learnt. In fact, he believed that no one who had learned it ever abandoned it. There was the evidence of a gentleman who was largely concerned in trade, both in Brussels and in London, who stated that, to keep the same accounts, he was compelled to keep two more clerks in London than he was in Brussels. That showed the serious tax which was imposed upon our merchants by the complicated system. They had the evidence of very able professors and teachers, who stated that the time employed in learning our complicated system of weights, measures, and money was such as to deprive children in the most precious years of life of months and years of time, which they might devote to the study of science, of literature, or of other useful branches of knowledge. Fully believing that, and believing that this reform would be of immense advantage in an educational, commercial, and almost every point of view in which it could be looked at, he begged most heartily to second the resolution.

The Astronomer Royal said he presumed, as this was a conference, that an expression of difference of opinion would not be out of place. He had paid a great deal of attention to this subject for a number of years, probably longer than most other gentlemen present, and it had led him to opinions rather different to those expressed by the International Decimal Association. He would say, in the first place, that an allusion to the numerous complicated and anomalous weights and measures now in use, whether by law or custom, had been made. Now, in his opinion, it was very desirable to separate those two things, and to consider that which was recognised by law only. There always would be usages, whatever the law might attempt to do, in different parts of the country; and it would be perfectly idle to attempt to meddle with them in any way. It was, however, of the utmost importance to consider these anomalies, if such they were, which were recognised by law. To one point in particular he would beg earnestly to call the attention of the meeting, that in all the fundamental existing weights and measures there was a degree of uniformity such as was unknown anywhere else. A pound weight was the same in every county of England, Scotland, Wales, or Ireland, and the fundamental measures, in the same way, were absolutely the same. It was not so in France or North Germany when the metric system was introduced into those countries, and to that, he believed, the change was attributable. Nor was it so in Italy. In point of fact, the moving cause in all those countries, as he believed, which had led to the introduction of the metric system, had been the existing discrepancies amongst the bases of the weights and measures. Putting aside, then, those anomalies which existed in custom, and also the question of bases, he would call attention to those things which appeared to be anomalies in the existing system. In the first place, he would lay down what appeared to him, from careful observation, to be the natural tendency of the human mind, and that was that whatever weight or measure was accepted as the foundation, the tendency was to halve and quarter without limit. Considering that this was the way in which it had grown up everywhere, where a different system had not been enforced by law, it would be striking to see how that was carried out in the English system of weights and measures. Proceeding downwards from the lb. weight, they went on halving and quartering until they came to the $\frac{1}{256}$ part. In the same way, taking the quarter, which was the largest recognised measure, the halving and quartering process went on until the $\frac{1}{512}$ part was reached. There were no other systems so well adapted to human nature in this respect as those, and he for one should be very sorry indeed to see any attempt made to disturb them. There were, however, other things which came in, in this system, which might appear anomalous. For instance, there was a foot and yard as a measure of length, one being a third of the other. The fact was, that it was found necessary to have some convenient measure to be used by the arms, and upon counters in drapers' shops, and so on; and so long as people had counters and arms of the same dimensions, so long would there be a yard measure for measuring drapery goods, and so on, and that, being a simple measure, would have a name of its own, which would be halved and quartered, and was halved and quartered down to the $\frac{1}{16}$ part, without any reference whatever to the foot or inch, or anything else. In fact, to all intents and purposes, it became an independent measure, founded on an independent base. At the same time, the legislature had done wisely in connecting that base, the yard, with another base, the foot, and in determining that the yard should consist of three feet. On the other hand, the yard could not be accepted by carpenters as a convenient measure. Those who had to measure things with great accuracy must have something more convenient, and a foot had been found a convenient measure for them, and this was the basis in such processes, and for similar measures, the inch. The same thing applied to another very remarkable anomaly viz., the stone weight. The history of these things was very obscure, but there was no doubt that the stone existed as an independent standard, until accuracy was given to it by some enactment which connected it with the pound. The parties,

however, who used the stone did not refer to the pound, and there were immense quantities of flour, oatmeal, salt, potatoes, and things of that sort sold by the stone without any reference whatever to the pound. Looking at all these things, it seemed to him it would be a great evil to attempt to interfere with that binary system which existed in greater perfection in England than anywhere else. He believed that those things which were looked upon as anomalies, such as the relation between the foot and the yard and some other measures of length, the pound and the stone, and so on, were, in fact, some of the great conveniences of the English system, and that their removal would cause great embarrassment. Speaking for himself, he must say that the conviction had at last been forced upon him, and he confessed it had been so but slowly, that everything of a scientific and of an international character, as, for instance, the Post-office or the tariff, &c., should be presented in the metric system. It was, however, his firm opinion that the metric system as a whole would never be adopted in the shops of England, although it would be no doubt introduced, and was already, to a certain extent, in delicate mechanical work. It was exceedingly useful for such purposes, but no law was wanted for that purpose. Law was wanted to protect the ignorant and the weak —in fact, to regulate the transactions which were carried on in retail shops; and with regard to them, he was quite satisfied that the shopkeepers themselves and the mass of the people would much prefer matters to remain as they were.

Sir John Bowring said it appeared to him that the progress already made was marvellously great, for this very question, which was only represented years ago by a few of the strongest intellects, did at last influence nations, and two or three hundred millions of men were now only waiting for Great Britain to lead the way in order to adopt the same system. The inconveniences of the present system needed no enumeration. He had seen the advantage of the decimal system in all parts of the world. For some time he lived amongst the Philippine Indians, when the old complicated Spanish money was in use, the dollar being divided into 512 parts, and the real consisting of 34 maravedis. The poor people, when they brought to market their potatoes, tobacco, or maize, were invariably cheated by the brokers and merchants, until the Spanish government had the good sense to introduce the decimal system, and then these poor savages said "God, who gave us ten fingers, enables us now to regulate our accounts." In China, it might be known to many, the decimal system had existed from time immemorial, and the Chinese, thanks to the beauty and simplicity of this system, were the best arithmeticians in the world. A Chinese boy was taught to associate units with his thumb, tens with his forefinger, hundreds with his middle finger, thousands with the next, and tens of thousands with his little finger; the first, second, and third points, on the front, back, and side of the finger representing the nine integers, so that mental arithmetic was carried on with the greatest possible accuracy. In England, on the other hand, a poor person who bought $1\frac{3}{4}$ lbs. of mutton at $7\frac{3}{4}$d. a lb. was entirely at the mercy of the butcher. Reference had been made to India, and he gathered that progress was being made there. It had been said that the decimal system had worked its way, and no doubt it had, though under very great discouragement, but if public opinion were once aroused upon this subject, he had no doubt as to the result. He would beg leave to ask the Astronomer Royal if he recollected the evidence given in the House of Commons as to the sums which had to be worked by the clerks in the bullion office when an ingot of gold was brought in? There were three elements legally necessary to ascertain its value. First, it must have an alloy of 1-12th, 22 parts of pure gold, and 2 of alloy; next it must be weighed by troy weight, lbs., ozs., dwts., and grains; and then came the third element, which Sir Robert Peel's Bill had rendered necessary, that the ounce troy should represent £3 17s. $10\frac{1}{2}$d. Supposing an ingot of gold delivered to the clerks in the bank, weighing 10 lbs., 5 oz., 3 dwts., 2 grs., and $19\frac{5}{8}$ carats fine instead of 22, and that when these elements were reduced to something like order, £3 17s. $10\frac{1}{2}$d. per oz. was to be the test of the value, it could not be a matter of wonder that five out of six clerks were unable to solve the problem correctly. It was within his personal knowledge, and he believed the President of the Society of Actuaries would confirm his statement, that notwithstanding that the pound sterling was legally divided into 960 farthings, yet many of the insurance offices had found it more convenient, and productive of a great saving in labour, to consider the £ as divided into a thousand parts. Already some of the inconveniences and vulgar fractions of the English monetary system had been got rid of, for not a banker in London would admit farthings into his accounts. It was on a motion of his that the florin was coined, and he believed that no half-crowns were now issued; and, in reference to that change, he knew it was looked upon by the clerks in the Bank of England as a step towards getting rid of the pence column. In fact, it was the opinion of the Accountant-General, who, he believed, had stated it in public, that by the introduction of a decimal system, twelve clerks would be able to do the work of thirteen. This subject also had a bearing on the question of employment of women; for it was remarkable how few females were employed in England in matters of accounts compared to the numbers so engaged on the Continent, and he believed this difference was mainly attributable to the much greater complexity of our monetary system. In conclusion, he said he could not agree with the proposal to degrade the pound sterling, for it was perfectly idle to suppose that if money were coined of the value of 25 francs, any foreign nation could be induced to take them at a valuation of 25·25 francs.

The Chairman said he believed there was a deputation from the Central Chamber of Agriculture present, and he felt sure the meeting would be anxious to hear their views on this important question.

Capt. Craigie said he attended with Mr. Algernon Clarke as a deputation from the Central Chamber of Agriculture, and he had to apologise for the absence of the Chairman and Vice-Chairman, which was only caused by very particular business. He believed his principal duty was to state how the Central Chamber of Agriculture had regarded this question, and how they stood in relation to it, rather than to make any remarks of his own. The council of that association, in November last, passed resolutions to the effect that all agricultural productions should be sold by the decimal system, the cental of 100 lbs. being the standard. This resolution had been submitted all over the country to various provincial chambers, from a great many of which replies had been received, stating that they were favourable to such a proposed change; and at the request of the Central Chamber, Colonel Tomline had just presented a petition, praying for a select committee to inquire into the subject. There could be no doubt that throughout the whole of the country the anomalous system of weights and measures employed in the different markets caused so much confusion as to amount to a positive grievance. What the Chamber of Agriculture desired was, that some uniform system should be adopted, without pinning them further to any particular plan.

Mr. J. Algernon Clarke said with regard to the resolution passed last November, he thought it might be assumed that the chambers generally, if not entirely, would approve of the two things which were provided for in that resolution—that all agricultural produce, capable of being so sold, should be sold by weight only; and that a cental of one hundred pounds should be taken as a standard. All that was required was that they should adopt some standard representing one hundred of any pound weight which might be adopted. He did

not see why the present pound should not be increased to the extent of one-tenth, and it would then be equal to half-a-kilogramme. After some little discussion upon the matter, he believed that agriculturists generally would approve of a scale something like this—that ten of the slightly-increased pounds should be a stone, and that ten stones should be a hundred weight, and further, that ten hundred weight should be a ton. He did not think there would be any practical objection found to the use of such measures. But there would be great reluctance on the part of the agricultural classes to adopt the foreign nomenclature of the metric system, for there would be great difficulty in making the rural mind understand the difference between some of the sums. He should be very pleased if the conference enabled them to represent to the Central Chamber, at their next meeting, in what way they could best aid the association in obtaining the decimal system.

Mr. John Bennett said that, though the Astronomer Royal had said that the metric system would never do in the shops of England, it seemed to him that it was the shop-keeping classes who desired to have the decimal system. In his own establishment, he came constantly into contact with workmen, not only English, but Belgian, French, Swiss, and Germans, and he had no difficulty in making a foreigner understand precisely what he wanted, but he never had the same facility with an Englishman, upon our system of measurement. Some years back, he had the pleasure of making many instruments for the Royal Observatory, and he was sure that if he had been living in Switzerland the Astronomer Royal could have easily made him comprehend the exact dimensions of the various parts of the instrument he required. He might mention, as being within his own experience, that it was the custom in Switzerland for a manufacturer to telegraph directions to workmen and workwomen twenty, forty, or a hundred miles away, and so perfectly was the decimal system carried out, that he would receive, in reply to his order, a thousand centre-wheels, it might be from one workman, which when they came to hand would be fit for use directly, and would not have to be cobbled into shape, as was very often the case in England. With regard to the facility of comprehending a new system when introduced, he remembered when the change was effected in some of the Swiss cantons—the French decimal uniform system being imposed upon those who had hitherto held out for their independence—and what was the result? If a woman came to market with a basket of eggs, and the hotel-keeper offered her too little, under the new system she was not ten minutes before she discovered what the decimal system meant, and insisted upon having the full value for her produce. With regard to the farmers, he himself was a little farmer a few miles away, and as to finding a difficulty in the present system of weights and measures, he confessed he gave it up as a bad job altogether. If he could not understand avoirdupois weight for his bar of steel, and troy weight for gold and silver, it was utterly impossible he could understand the curious system of measures with reference to land and other matters when he got down to his farm in the country.

Mr. Fellowes said the remarks of Professor Airey were certainly very thoughtful, and deserving of attention. There was no doubt that the Arabic system of arithmetic, having a single sign for figures from one to nine, and then proceeding by tens, was not so perfect as a duodecimal system would have been, or one proceeding by eights or sixteens; but as the decimal system of notation was in universal use, and he believed it was utterly utopian to expect it to be altered, he could only come to the conclusion that any proper system of weights, measures, and coins should be constructed in accordance with it. There was no doubt that the pound avoirdupois, divided into sixteen ounces, was very convenient in practice, more so than if it were divided decimally, but he saw no difficulty in taking a small unit, such as an ounce, and proceeding upwards, making 10 ozs. a pound, and 100 ozs. something else, and then price small articles by the ounce instead of by the pound. With regard to the yard measure, which had been spoken of as so convenient, it did not differ very much from the metre, which was about $39\frac{1}{3}$ inches. With regard to the stone, he had shown, in a paper which he read some time ago before the Society of Arts, that it represented an endless number of different weights, there being no less than three used in weighing iron. For cast-iron, or iron in mass, 14 lbs. was the stone; iron wire up to 20 guage was $10\frac{1}{3}$ lbs. to the stone, and iron wire above 20 guage was only 14 lbs. to the stone. There were other stones of 5, 8, 14, and even 26 lbs., though the normal weight was $10\frac{1}{2}$ or 14 lbs.; and there were no less than sixty-three different kinds of bushel. Of course, anything might be decimalised, but the great advantage of the metric system was, that it was decimal and something more. As Professor Airey had said, a yard might be divided into 100 parts, but these parts would have no decimal relation to the inch, or to the pound weight, or to the pint measure; but in the metric system any decimal part of a metre had a decimal relation to every French measure, either of weight, length, capacity, area, or solidity. And this was not a mere theoretical idea; there were great practical advantages connected with it, of which he might be permitted to give an illustration. If you had a mass of iron, say, one metre in length, two in breadth, and three in thickness, of which you wanted to know the weight, you could tell it in a moment if you knew its specific gravity. A cubic metre of water at a certain temperature weighed exactly a metric ton, and a cubic centimetre would exactly weigh a gramme. Therefore, $1 \times 2 \times 3 = 6$ cubic metres or 600 centimetres of iron, and supposing its specific gravity to be 8, $600 \times 8 = 4{,}800$ cubic centimetres or grammes, 4,800 kilogrammes. In the same way with excavators' work, a mass of rock five metres long, two in width, and two in height, would represent twenty cubic metres, or if it were water, twenty cubic tons. Suppose the specific gravity to be two, it would fill twenty kilogrammes. Under the English system, a long and complicated calculation would be necessary to arrive at this result. In fact, he believed that in this kind of operation the amount of calculation now required was five times as much as if the metric system were introduced.

Mr. Hyde Clarke said he agreed with the views expressed by the Astronomer Royal, and he should give his vote on the same side. He had had some experience on the subject, having been on the Continent at the time when the change was still in progress, and from what he there saw he was convinced that the revolution could only be carried out in England with what might be called considerable violence, and very vexatious police interference. His objection to the resolution was, that it called upon the conference to express its approbation of the establishment "of some convenient uniform decimal system throughout the United Kingdom," whereas, as Professor Airey had shown, it proposed the establishment of a system which would be anything but convenient. He would humbly suggest that it would be more straightforward to propose the adoption of the metric system.

The Chairman said that, in opening the proceedings, he had refrained from occupying the time of the meeting with the remarks which he had himself prepared, as there were so many other speakers; but before putting the resolution, he might be excused for saying a word or two, his interest in the subject being hereditary, as his father had not only been vice-president of the International Decimal Association until the day of his death, but had been the originator of the British branch. The scientific point of view was not the least important amongst the many from which

this great subject might be regarded, and upon this point Professor Airey had made a considerable concession. He had himself heard Professor Owen and others speak of the great extent to which the labours, experiments, and researches of philosophers in this country were a sealed book to those on the Continent, simply from want of leisure to make the necessary calculations for reducing the weights, measures, and quantities to a common standard, and thus one-half of the knowledge which was so arduously acquired was concealed from those who would gladly imbibe it. With regard to the educational part of the question, he had been recently informed by a schoolmaster that, after a quarter of an hour's explanation of the metric system, he found that his boys could work sums in it with more ease than they could in the imperial weights and measures after months of hard work. It was with great satisfaction that he welcomed the deputation from the Central Chamber of Agriculture, and in confirmation of what had been said by Capt. Craigie, he might refer to a report which he held in his hand from a farmers' club in Devonshire, referring to the great varieties of weights and measures in use at the different markets even in the same county and neighbourhood, in consequence of which the farmers there had presented a petition not only in favour of a decimal system, but of the metric decimal system. It was very gratifying to find that the agricultural mind was thus awake to the importance of the subject. There was no need to dwell upon the immense variety of bushels, coombs, lasts, and other measures in use in different localities; but as coming within his own observation, he might mention that in his own neighbourhood, if he sent his cart in two different directions for lime, he got, from places about equidistant, two different quantities as representing a bushel. His own opinion was that, far from meeting with opposition from the agricultural and commercial classes they were every day becoming more and more alive to the disadvantages under which they laboured, and to the great waste of time and money occasioned by what, in spite of the high authority of the Astronomer Royal, he must be allowed to call their complicated and anomalous systems—or rather sets, for there was no system in them—of imperial weights and measures. The value of independent bases had been referred to, but it was exactly the number of independent bases in France, Germany, and other countries, each locality setting up its own basis, which had led to the introduction of the metric system.

The resolution was then put and carried.

Professor Redwood said the resolution which he had to submit was one which had for its object the gradual adoption or introduction of the metrical system into this country. It was proposed to do this by the abolition of the use of troy weight, substituting for it the metrical system. This had been strongly advocated by the late Master of tho Mint, and it was a measure which he had much satisfaction in speaking to, because it afforded him an opportunity of referring to what had been done in connection with the department with which he was especially associated, namely, pharmacy, in which, some few years ago, troy weight as well as avoirdupois weight was exploded. In 1864, it was decided by the Medical Council to abolish the use of troy weight, and substitute for it avoirdupois; and it was certainly much to bo regretted that upon that occasion it was not thought expedient to substitute the metrical system for troy weight. If that change were now made, it would affect only some two or three heads of commercial transaction, such as those carried on by the banker, bullion dealer, and jeweller, and he could not conceive that there could be any difficulty at all in going so far. But, with regard to its introduction into pharmacy, a greater difficulty had been felt to apply, and he might refer to the statement made by the Medical Council, upon the publication of the latest edition of the *Pharmacopœia*, which was now the official guide for all pharmacists throughout the country. In it they recognised the great importance of an uniform system of weights and measures throughout the world, but at the same time they felt that securing accuracy in the dispensing of medicine was of such paramount importance, that they could not risk the liability to error which might arise from the sudden adoption of a system with which those engaged in the practice of pharmacy were not yet sufficiently familiar. It was considered that the large proportion of those practically engaged in medicine could not safely at once substitute the metrical system for English weights and measures, but that the change might be made gradually with great advantage. He had, therefore, strongly advocated the change which was proposed with regard to bullion dealers and jewellers, as it would tend to make the public in some degree better acquainted with the metrical system. He thought it much to be regretted that something was not done in this direction with regard to the weights used by the Post-office, for one of the best means of making the public practically acquainted with the values of the integers used in the metrical system would be to have such weights employed, not only for foreign postage, but throughout the country. The only thing required was to make the public better acquainted with the merits of the system; and, even with regard to pharmacy, he thought there would be no difficulty in the case of the present generation of educated men. But it was felt that they could not put such a system into the hands of the 8,000 or 9,000 men now in business who received a very imperfect education many years ago. He would conclude by moving very cordially the following resolution:—"That the Standard Commissioners having recommended the abolition of troy weights, this conference is of opinion that all those who now use the same should substitute for them, not the lb. avoirdupois, but the kilogram, with its divisions and multiples, by which another practical step will be made towards the complete adoption of the metric system throughout the British empire, which, in the opinion of this meeting, is an object of the highest importance."

Mr. Ralph Heaton, in seconding the resolution, said he had taken considerable trouble to collect the opinions of people who used troy weight in his neighbourhood, and they were very desirous that, if the change were to take place, as in all probability it would, they should at once go to the metrical system, and not to avoirdupois weight for the present, and then change again in the course of a few years. He found very few indeed who objected to it at all, and even those who did so were generally convinced in the course of about five minutes' conversation. It had been his lot, during the last 18 years, to be mixed up with the metrical system of weights, measures, and moneys, as well as with the more complicated English method, which was anything but methodical. He very heartily supported the resolution.

The resolution was carried unanimously.

Mr. George Gladstone said he had much pleasure, on the part of the British and Foreign Schools Society, in moving the next resolution, because it afforded him an opportunity of stating the opinion of the society which he represented. The society had two training colleges in London and one in Wales; in the two former there were about 200 students, and on an average about 100 masters and mistresses were sent out every year. Both in the men's and women's training colleges the decimal system was thoroughly taught, because it was considered that masters ought to be able to teach it thoroughly. Tho metric system, however, was not taught, because it had not been considered necessary, in the present state of affairs, to do so. They would be perfectly willing and delighted to teach it, but there were so many other things which they must teach, that they must make a selection, and choose that which appeared most useful. The Committee of Council ignored the decimal system, and, as there was a remuneration, in the shape of marks, attached to the teaching of

certain subjects, the teachers would always choose those particular subjects which would enable them at the examinations to gain the greatest number of marks. For this reason the committee of the society did not think it necessary to teach the metric system. He would suggest that, if possible, some pressure should be brought to bear on the Committee of Council on this subject, for the society with which he was connected would only be too glad to teach and examine children upon these points. He had much pleasure, therefore, in moving:—"That in order to facilitate the speedy introduction of metric weights and measures and an international coinage, this Conference deems it highly desirable that decimal arithmetic, with the specialities of the metric system, should be taught in all the schools in the United Kingdom."

Mr. Isbister, M.A., said, as a practical educator, he thoroughly concurred in what had been said on the educational aspect of this question. The advantages of the metric system in simplifying the teaching of arithmetic in schools were so patent that he need not dwell upon them, and the association might rest assured that in the important labours in which they were engaged they would have the cordial support of all teachers. They must not forget, however, that in introducing this great change, the public must precede the schoolmasters, whose great aim it must be to fit their pupils for the duties of life as they existed. He sincerely hoped, therefore, that this association would not relax its efforts to enlighten the public upon the advantages, and to impress upon the government the necessity of adopting the metric system. The difficulty, after all, was not an educational, but a practical one, that of overcoming the prejudice and resistance to change which arose from long use and habit. This association had been, and was doing a great work in enlightening and stimulating the public on this important question; and in attending on behalf of the College of Preceptors to express the best wishes of the council for their success, he could only repeat that no one would be more ready to rejoice than the very large body of middle-class schoolmasters which that college represented.

The resolution was then put and carried unanimously.

Professor Leone Levi thought it would be well if the conference appointed a deputation to wait upon Mr. Forster, and urge upon him the importance of introducing a study of decimals and of the metric system in all the schools throughout the country.

Mr. J. B. Smith, M.P., said the resolution he had to propose was as follows:—"That the introduction of a universal system of weights and measures would not be complete without a corresponding system of international coinage, the same being based on a gold standard of the fineness of $\frac{9}{10}$, with $\frac{1}{10}$ alloy; a decimal division, and identical mint regulations in all countries." There could not be a doubt that if an international system of weights and measures were introduced, they must also have an international system of coinage, and there was at present a great concurrence of circumstances favourable to the introduction of that system. In 1865, France entered into a convention with Belgium, Switzerland, and Italy for an international coinage. It happened that these countries also used the metric weights and measures, and therefore it could not but be desired that there should be extended throughout all the world an international system of monies, weight, and measures. The conveniences which these countries found from the adoption of this system led France, in 1867, to invite a congress of nations, to take into consideration the question of extending the same system to other parts of the world. That conference met, and agreed unanimously that it was expedient that there should be one standard, and that that standard should be gold. They also agreed that there should be the same alloy, which should be $\frac{1}{10}$. A Royal Commission was appointed to examine into this question, and there was a concurrence of circumstances which rendered it very likely that this would be carried into effect immediately. First of all, it was found that our own coinage was in a very bad condition, there being a large amount of light coin in circulation; and if the government decided upon re-coining this money, it would be very desirable that they should adopt such a system as should be universal. On the other hand, America for the last ten years had had a system of paper money, which had been forced upon them owing to the late wars, but the time was now arriving when it would be necessary for them to re-construct their gold coinage, and the question would naturally arise whether in so doing they would not adopt an international system. If an international system were adopted, the important question of mintage came up, for it was quite clear they must have an identical mintage. It seemed to him they must have an international system, and that it must be a decimal one.

Dr. Farr cordially seconded the resolution. He was glad to see that the authorities of this country were disposed to support a proposition affirmed in the resolution, for even the Standard Commission, in the last report, suggested "that as there is a relation between the coinage and weights and measures, particularly in its uniform decimal scale, they are of opinion that even if the difficulties of establishing an international coinage cannot at present be overcome, yet the decimalisation of our system of coinage, which is in the power of the government, would be very useful to the public." He was somewhat surprised, and yet scarcely regretted that they had not hitherto had the decimal system; which had been proposed by his excellent friend Mr. Hubbard, Lord Overstone, and other eminent authorities. He did not regret it, because he thought they should now get a better system even than that. The necessity for having a decimal system of money in England was very evident. If they agreed that there should be a decimal system, the next question was, what should be the unit. The franc had been suggested as one basis; and another had been proposed by M. Chevalier, which he (Dr. Farr) considered the best, and the adoption of which he had moved at the Congress at the Hague, at which most of the nations of Europe were represented. They all agreed to represent the values in grams, after which he moved a resolution that the value should be represented in decagrams. A ten-gram piece would be just equal to 25s., so that our sovereign would be exactly eight grams. If this piece of ten grams were divided into ten, they would represent half-crowns, a tenth of which again would be 3d. That would form a scientific unit of account in gold, and he believed would form the basis of a most perfect decimal system.

Mr. Samuel Brown, President of the Institute of Actuaries, Mr. Frederick Hendriks, Mr. Hubbard, Mr. Ernest Seyd, and others, were prepared to take part in the discussion, but, owing to the lateness of the hour, it was agreed to postpone the further consideration of the subject to an adjourned meeting of the Conference.

On the motion of **Professor Leone Levi**, seconded by **Mr. William Botly**, it was resolved that a deputation from this conference should wait on the Right Hon. W. E. Forster, Vice-President of the Committee of Council on Education, on the introduction of decimals and the metric system in schools; and, after a cordial vote of thanks to the Chairman, the meeting was adjourned.

EDUCATIONAL NOTES.

A special meeting of the London Council of the League was held on the 10th inst., to receive a deputation specially authorised to represent the views of the National Education League for Ireland, which has been recently established expressly to maintain non-sectarian education in that country, to further develop the non-

sectarian principle, and to oppose any change in the existing national system interfering with that principle. The chair was occupied by Mr. F. Pennington, and among those present were, Sir Charles Wentworth Dilke, M.P., Mr. George Dixon, M.P., Mr. Fawcett, M.P., &c. After considerable discussion, Sir C. W. Dilke proposed a resolution expressing sympathy with the above mentioned body "upon its efforts to prevent the infliction upon Ireland of a denominational system of education." Mr. Lloyd Jones, in seconding the resolution, remarked that the postponement of the Bill for another year, in order to allow further discussion upon it, would be attended with excellent results. The resolution was carried.

League meetings have been held at Manchester, Sheffield, and Birmingham, but the proceedings were of the usual character.

An important meeting of schoolmasters, at which Lord Frederick Cavendish, M.P., the Rt. Hon. W. Cowper-Temple, M.P., Messrs. Whitwell, M.P., J. Kay Shuttleworth, M.P., E. Baines, M.P., J. W. Pease, M.P., and J. D. Dent, M.P., were present, was held on the 7th inst., at the Palace-hotel, to discuss the time-table conscience clause. A report drawn up by a sub-committee of teachers was read, which pointed out objections to the time-table conscience clause as explained by the League, stating that "it would be very undesirable to have a rigid rule laid down by Parliament as to the time when any particular lesson is to be given. In many schools it would be extremely inconvenient, if not impossible, from various causes, to give religious instruction to the whole school at the same hour. To excuse some children from attendance at school during Scripture lessons would be a standing temptation to the other children to urge their parents to claim exemption for them; and would further be likely to induce careless or indulgent parents to keep their children at home from other than conscientious motives." After some discussion, the following resolutions, suggested by Mr. Pease, were agreed to:—

"That it is essential that all the children attending a school, whether attending religious instruction or not, should assemble at the same time."

"That all children not attending the religious instruction should be employed in some other school work during the time of religious instruction."

"That the time for religious instruction in any school or to any scholars shall be plainly set forth on the walls of the schoolroom in which such instruction takes place; such times for religious teaching to be approved by the Education Department."

"Should the schoolmaster ascertain, or should he receive notice from any parent or guardian, either orally or in writing, that such parent or guardian objects to a scholar being present at the time of religious instruction in use at the school, the master shall enter such objection in the register of the school."

A deputation, consisting of members of Camberwell and Newington Vestries, waited upon Mr. Forster, at the Privy Council-office, on the 7th inst. The principal points urged were—the entire separation of children of self-supporting parents from pauper children, by taking the election of school boards out of the hands of guardians (as at present provided for in the Bill) and placing it in the hands of vestries or of the public; the absence of anything like sectarian teaching in the rate-supported schools, while the reading of the Bible should not be excluded; and the propriety of making the charge local, by paying the expense out of the vestry general rate, or a local special rate. In the course of his reply, Mr. Forster said that nothing they could do would entirely remove the religious difficulty. After all others there would still remain the choice of a master. The disappearance of the difficulty must be left to their own common sense and the common sense of their constituents. What he wanted was to have as little of the sectarian question as possible, but, at the same time, he did not want to discourage religious teaching. He could not agree with the suggestion of reading the Bible without note or comment. The plan of reading the Bible, and not allowing it to be used as any other book and explained, seemed to him to be impracticable.

Earl Russell, in a recent speech at the annual meeting of the British and Foreign School Society, deprecated the use of catechisms and formularies in schools, but spoke in favour of religious teaching founded upon the Bible. Respecting Mr. Forster's Bill, his lordship said that the three tests which he should personally apply to it would be, that there should be a convenient distribution of school districts on the plan he had adopted in his Act for the registration of births, deaths, and marriages; that no tax should be levied without the consent of the people's local or imperial representatives; and that the teaching imparted should be thoroughly unsectarian. If it did not comply with these conditions, he should enter his solemn protest against its becoming law. He added, however, that he had full confidence in the government and Mr. Forster, and did not believe that they would be parties to any measure of education that would in its working violate the consciences of the people.

At a recent meeting of the committee appointed by the Wesleyan Conference to watch the education question, it was resolved that the Wesleyan body would oppose the teaching of any catechism, formulary, or dogma; but that it would equally insist upon the reading of the Bible in schools and on a Bible lesson by the teacher.

Lord Shaftesbury, in presiding at the annual meeting of the Ragged School Union, at Exeter Hall, spoke of Mr. Forster's Education Bill as one of the noblest measures that had ever been brought forward, and he trusted all the friends of education would give him their energetic support. He protested against the exclusion of the Bible from schools.

At a conference of members of Parliament, representing metropolitan boroughs, held on the 9th inst., it was resolved that the government should be urged to assent to an elected school board, to whom should be entrusted the management of the elementary schools of the metropolitan districts.

THE ENDOWED SCHOOLS COMMISSION.

All who are interested in education, and especially those connected, however remotely, with the administration of educational endowments, will watch with much interest the mode in which the commissioners who have been intrusted with the responsible task of modifying and reforming the endowed schools of this country, discharge their important duties. A paper recently submitted by them to the Bristol Charity Trustees will therefore be worth consideration, as an example of the attitude in which they intend to approach bodies of that character, and as showing the nature of the schemes of reform which they propose to submit for adoption. This paper is too long to give *in extenso*, but the principal points in it may be touched upon.

The commissioners begin by drawing attention to the fact that the Endowed Schools Act, 1869, refers to the report of the Schools Inquiry Commission as expressing the objects to be aimed at, and they have accordingly taken this report as their principal guide on those points on which the Act itself does not speak. It will be their duty to see how far and in what mode the principles laid down in that report are applicable to the actually existing state of facts, and to devise the best methods of applying them in each case.

But before they can frame any general system for a large district, or even a single scheme for any particular foundation, they desire to communicate freely with the persons most interested in the schools, and to ascertain the needs, resources, wishes, and feelings of the various communities; so that they may work in harmony with

those who are to use and with those who are to manage the schools.

The commissioners, therefore, submit to the school authorities an outline of the general principles by which they propose to be guided as far as possible, and lay before them the first sketch of the plan upon which, subject to correction and revision, they contemplate the organisation of the endowed schools of the district; and they invite all those who possess special knowledge of the district at large, or of individual cases, to point out where the contemplated arrangements appear to them defective, and in what mode they can be amended.

One of the most important points insisted on by the commissioners is a classification of the schools of the district, in reference to which they say:—"It will be borne in mind that the different classes of schools are intended to meet the differing demands for education existing in society. These demands vary in respect of the time for which the education is to continue, and the length of time affects the character of the education. Those who demand school education up to the period of manhood are comparatively few, and their wants should be met by a few schools of the first grade, the main feature of which is, that they are adapted to those who are intended to receive general culture at least up to the age of 19, and who will probably go on to the University, or into learned professions. A more numerous class demand school education up to the age of 16 or 17, and then desire to pass into practical life. For these a larger number of second grade schools should be established. The most numerous endowments will be applied either to the establishment of third grade schools, in which the course of study will be confined within narrower limits, and adapted to a still shorter term of school life, or will be used to work in with and assist the primary or elementary schools of the locality."

In their attempt to classify the schools, the Commissioners explain that they have been guided principally by two considerations, the magnitude of endowments existing in the respective localities, and the numbers and occupations of their inhabitants.

They do not propose any rigid or direct system of affiliating lower grade schools to higher ones. The first principle of grouping is so to place schools of different grades that, as far as the endowments suffice, all persons may have fairly within their reach some school of that grade which they desire. The second is the establishment of exhibitions (generally open ones) by which the most promising boys of the lower schools may continually be drawn to the higher.

"If this system succeeds," say the commissioners, "it will do that which is one of the principal requirements in organised education—it will provide the means by which the more gifted and industrious among the poor may rise in the scale of education, and play in society the part for which their talents fit them."

With respect to the governing bodies, at all events of the larger foundations, the commissioners think they should be composed of various elements, combining, as far as possible, local knowledge and interests with freedom from local prejudices and influences, and stability, experience, and permanence, with freshness of ideas and sympathy with the feelings of the community among whom the foundation works. Hence the commissioners wish, whenever it can be done, to introduce and combine in one body "official, representative, and co-optative members." To provide, however, what is best adapted for each foundation is a most difficult task, and one in which they desire to rely most on the advice, information, and assistance they receive upon the spot.

These governing bodies should, besides the management of the property, have power to decide, within certain limits, the main direction of the studies, the limits of age, fees, &c. They should have the appointment and dismissal of the head-master, subject to such restrictions (if any) as each scheme may provide.

The head-master should be supreme within the precincts of the school, and to him should belong the power of appointing and dismissing the under-masters, and regulating all the methods and details of study. His remuneration should be so arranged that only a small proportion of it should be fixed, while the remainder should be made to depend on the growth and success of the school.

On one point especially the commissioners express their opinion very emphatically, namely, the ill effect of gratuitous education independent of merit. "In primary schools, payment by the parent has been generally reckoned very important on principles which apply also to schools of a higher class; and there are modes in which indiscriminate freedom of admission injures schools of a higher class more than the lower ones. The commissioners are aware that this is one of the points on which sound principle appears to conflict with the pecuniary interest of individuals; they say 'appears' because the conflict is not a real one; for nothing can be worse economy than to waste early life in a school rendered worthless by the practice of indiscriminate free admissions." The commissioners "avow their intention of laying the greatest stress on the eventual prevalence of the maxim that there should be no gratuitous education except as the reward of merit. At the same time, they will do their utmost to avoid any hardship which might be occasioned by too sudden or abrupt a change, and to take care that the privilege shall be placed within reach of those who deserve and can advantageously use it."

With regard to scholarships and exhibitions, the commissioners are of opinion that they should generally be open, and that those carried from any school should be tenable at any suitable place of education.

With regard to the subjects of instruction in the different grades of schools, they think it would be very unwise to attempt, in the proposed schemes, a rigid curriculum of teaching. All that the scheme can do is to assign limits, the passing of which would alter the character and grade of the school; but the limits should be wide, and should afford room for expansion and adaptation to new and ever-changing conditions.

The commissioners think that in all schools it will be found expedient to teach physical science and drawing, and probably also the elements of Latin, as being the key to modern languages.

In first grade schools, the Greek and Latin languages, with mathematics, will generally be the main instruments of culture. But it may be found possible and desirable to establish schools of the same grade, but of another type, in which modern languages and science, physical and moral, shall take the lead, instead of classical studies.

In second grade schools, and still more in those of the third grade, the course of instruction, while providing for general culture, will take a specially practical turn. Mathematics, French and German, English language and literature, history, physical and political geography, the elements of political economy, will, with the elementary subjects above mentioned, furnish materials out of which the authorities will have to construct the course of study.

In reference to technical education, the commissioners say:—"There is another kind of school, not falling within any of the three grades, but differing in kind, viz., schools for teaching some special art or science, and frequently called by the name of technical schools. It is not likely that many places exist in which there is at the same time a want of special in preference to more general education, and an endowment to meet that want. It may, however, be found, for example, that in some centre of manufacture there is great need for a school of chemistry, or in a seaport for a school of navigation, and that there are endowments suitable for the object."

The paper concludes by pointing out that good buildings are among the first requisites of a good school.

In every scheme, therefore, for the establishment of a school of any grade this will be provided for; and in making provision for it, the commissioners will take into account not only the extent of accommodation, but the situation, sanitary conditions, playgrounds, and surroundings. Where there are not already suitable buildings, they think no better use can be made of the endowment than to charge it with the outlay necessary for providing them, assisted by the voluntary contributions of those persons in the neighbourhood who are interested in the work of education.

Such is an outline of this important paper, the principles laid down in which are, as will be seen, applicable not merely to the district referred to, but generally. Considerable additional light is thrown on the subject in a letter addressed by Mr. J. G. Fitch, one of the assistant commissioners, to the trustees, extracts from which will be given in a future number of the *Journal*.

CORRESPONDENCE.

THE GRAND PROMENADE APPROACH FROM LONDON TO THE NATIONAL PRINCE CONSORT MEMORIAL IN HYDE-PARK, OVER THE SITE OF THE FIRST INTERNATIONAL EXHIBITION OF 1851.

Sir,—To do justice to this proposal, it is requisite to visit the site. The access would be afforded by Albert-gate, but, for the present purpose, it is sufficient to contemplate the effect from a somewhat less distance. In Hyde-park, opposite the Knightsbridge-barracks, in the centre of the green sward between the Drive and Rotton-row, stands a fine old elm tree with a railing round it. From this point, looking westward, the eye has presented to it one of the most picturesque views around London. On the left is the Drive, fringed with trees; on the right, Rotton-row, similarly adorned, up to the graceful groves of Kensington-gardens in the distance. Before the sight, up to the Prince Consort Memorial, now partly concealed by scaffolding, extends an uninterrupted breadth of green sward of nearly a mile in length. In looking up this, the eye traverses the whole area once occupied by the first Great Exhibition building of 1851. If, from this point, near the tree by which we are standing, a grand promenade of 50 feet wide be imagined up to the memorial, it will pass exactly over the course of the main avenue of the Exhibition, which it will recall to the minds of those who are old enough to recollect it, and, to those who are not, it will serve to indicate the site of that great peaceful achievement. Passing up this for two or three furlongs we arrive between two trees, near Prince's-gate, which to the right-hand and left still point out the site of the transept, of which indeed they were the cause. There we may rest awhile, not only to indulge lang-syne recollections, some pleasant, some sad, but because no spot is more suitable from which to contemplate the memorial of the good Prince, which, so justly, has taken the form of a religious edifice. From this point, a further advance of three or four more furlongs will bring us up to the road that crosses to Alexandra-gate. The passage of the promenade here is easily provided for, either by harbours of refuge, or subways (which, by-the-bye, will soon have to be adopted in other parts of the parks and metropolis), and here will commence the garden round the memorial, where also, as dear good General Grey told me, sacred music will probably occasionally be performed; and what will have a more touching interest with the public than the beautiful Chorale composed by the Prince himself, or other of his compositions, as "Yonder shalt thou find the blessing."

At a time when we are doing so much that is worthy and noble in the way of embankment by the sides of the Thames, I trust that the West-end, and the Court and Art suburb will not lag behind, but will take advantage of one of the finest opportunities that have ever occurred in the close neighbourhood of any city, inspired as the treatment should be by so high a theme as the recollection of one who adorned the highest station with a truly good life, the widest beneficence, and all the graces of refinement and good taste.—I am, &c.,

Epsilon.

NEW HOUSE FOR THE SOCIETY.

Sir,—Understanding that a movement has been set on foot by a number of the smaller scientific societies of London, for the purpose of obtaining mutual accommodation in a central position at an economic rate, and having on a former occasion advocated in the *Journal* the formation of a building fund to enable the Society to obtain a larger house than the one it now occupies, but which it has outgrown, I venture to offer a suggestion to the effect that it might be possible to negociate with the societies I have mentioned, with a view to the disposal of the Society of Arts' house to them. I believe there would be ample accommodation for them, and the money thus raised would be a handsome addition to the Society's building fund, to which I hear contributions, have already been received.—I am, &c.,

A New Member.

May 10th, 1870.

HYGIENE OF SCHOOLS.

Sir,—The general health of children would be much promoted by the practice of learning to write by forming the letters of the alphabet at arm's length, standing upright, with hard chalk, upon the blackboard, or rather slate slabs, which should cover most of the lower part of the walls of the schoolroom. After such drilling, the use of the pen would be very quickly acquired, and with less injury, as the children would have gained strength during the previous period. Arithmetic, geography, drawing, and perhaps other matters might also be taught on the large scale in the same way. The practice of setting children to write copies in large round hand, with their short fingers, their backs crouched down, and their nose almost upon the desk, must be a long protracted process, very injurious to health. The benches or forms, the usual furniture of schools, are without backs, and, if you look along a row of boys sitting on them, you will see all their backs crooked into a semi-circle, than which nothing can be more injurious to young, growing children. I do not hold with the idea that shortsightedness is brought on or much increased by attendance at school—it prevails to a very great extent among all classes, both rich and poor. It is true that sailors are reputed for having long sight, but that circumstance may arise from two causes—first, selection, for a short-sighted seaman with spectacles would be out of place on board a ship; and secondly, that, by long habit, they may be able to decipher what may be a mere speck to a landsman. I saw a poor woman in the street the other day, apparently of gipsy extraction, who had evidently had no schooling, endeavouring to make out a piece of printed paper she had found, and placed the paper so near her eye as actually to touch her nose—a very extreme case of short-sight.

It is quite time that some method be adopted for shortening the time of schooling and the labour of teaching—independent of hygienic considerations.—I am, &c.,

Henry W. Reveley.

MEETINGS.

This evening, Friday, May 13th, a meeting will be held in the Great Room, by permission of the Council, by the East India Association, when Miss Mary Carpenter will give some account of her work of education in India. The meeting will commence at 8 o'clock.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

On Tuesday next, the 17th inst., a meeting of the representatives of the woollen and worsted trades will take place in the great hall of the Society of Arts. The chair will be taken by the Viscount Halifax, at twelve o'clock.

OBITUARY.

Jules Tarlier, President of the Council of Education in Belgium, was born at Brussels, on the 9th of March, 1825. He became, at the early age of twenty, a doctor of philosophy and of literature, and at the expiration of two years more was nominated Associate of the University, having previously published a valuable work on the study of the pronunciation of Greek and Latin. The next year, he became Professor-Extraordinary, after the publication of another treatise in the shape of a bibliographical notice of the translations of the Satires of Persius. In 1853, he was appointed Professor in Ordinary, and was several times elected President of the Faculty of Philosophy, and delegate of the Council of Administration. As a professor, he displayed a peculiar aptitude for the discharge of his literary, archœological, and scientific labours, and with singular tact and success lectured on the Latin language and modern geography. It was at this period that he published, in a popular encyclopædia, a geographical description of Belgium, and a general atlas of modern geography, in both of which works he proved himself to be an exact and conscientious writer, and added greatly to his reputation, although, so far as he was himself concerned, every selfish thought was lost in his desire to raise a lasting monument to the glory of his native country. It was this spirit that induced him, in conjunction with M. Alphonse Wauters, to commence a gigantic work, entitled "The Geography and History of the Communes of Belgium." Between the years 1859 and 1865, he gave to the world five books on the cantons of Gemappe, Nivelles, Wavre, Perwez, and the town of Nivelles, but, unhappily, this task was interrupted, although his efforts may well serve as a model for future generations. As an administrator, he manifested great wisdom and discernment, more especially in connection with the commune of Villers la Ville and the University of Brussels. During this part of his career, he published his critical observations on the project of the law of the Councils of Examiners, in which he maintains that the principle of liberty in education cannot be reconciled with the system of compelling candidates for the legal or medical profession to undergo such tests; but yet in the interests of learning, he admits the importance of State interference in the present day, and regards with favour the functions of a central council in this matter. As a citizen, circumstances alone prevented him from attaining the very highest position. He was valued far beyond his own estimate of his worth, and was honoured by receiving from the government several applications for his counsel. As a member of the Central Commission on Statistics, he took a prominent part in the census of 1866; and as belonging to the Royal Commission on Monuments for the province of Brabant, he produced several learned archæological reports. His work on the ruins of the Abbey of Villers presents us with evidence of his singular talent in this direction. Even beyond his means he undertook the cause of his fellow-men, and devoted himself with rare energy to the interests of civilisation, the education of the people, and the important question of liberty of conscience. At the foundation of the Education League in December, 1864, he was unanimously chosen its first president, and five times since then have the members of the League ratified their choice at their annual assembly, finding in him the man who was best fitted to conduct their councils with wisdom, and carry out their programme with success. He died, on the 21st of February last, amidst the lamentations of all who knew him. His funeral, which took place on the 24th of February, was attended, in spite of the inclement weather, by large deputations from all the societies with which he had been connected. Funeral orations were delivered over his remains, the first being from the lips of M. Tiberghien, Professor of Philosophy at the Free University. He dwelt chiefly on his literary excellence and great intellectual power. He was followed by M. Henau, burgomaster of Villers la Ville, who apostrophised the departed with a warm tribute of gratitude for his labours, and regrets at his premature decease. The next speaker was M. Charles Buls, Secretary-General of the Council of Education, who alluded to his great exertions and self-denying devotion in the cause of literature. M. Picard, President of the Community of Ancient Students, then gave a description of his wonderful capacity as an instructor, and drew a picture of the affection which subsisted between his pupils and himself. M. Scailquin, delegate of the lodge of Philanthropic Friends, followed with a discourse upon the dignity, justice, and toleration of Freemasonry, as manifested in this great man's career, and, disclaiming all vain eulogies, pronounced him to be one who manfully made the straight line his constant aim, and ever acted as he thought. The last oration was delivered by M. N. Goffin, President of Free-thought, who, in affirming that freedom of thought was the true source of the Education League, pointed out the fine part which Tarlier filled in the formation and development of this important scheme. On the field of work he, whose death has caused such profound sorrow, fell, and, in honour to his memory, the Council, over which he had so long presided with consummate ability and striking success, decided, at their next meeting, on the 15th of March, to leave his chair unfilled until the end of the year. His successor will not therefore be elected before the annual meeting of the assembly, in the month of September.

GENERAL NOTES.

Land in Great Britain under Crop.—Out of the total area of Great Britain, 56,964,000 acres, 30,339,000, or 53 per cent. were under crop at the time tho last return was made.

Glycerine in Paper.—Small quantities of glycerine are added to paper stock, to give the paper greater flexibility, and especially to give copying paper the quality of taking up colour readily.

Tea Plants in California.—These plants, already numbering 300,000, are doing well. One of the clearest burning oils, China oil, is extracted from the tea nut, and enhances the profits of tea-culture.

The Relative Value of Gold and Silver.—In the days of Abraham this was as 1 to 8; at B.C. 1000, 1 to 12; B.C. 500, 1 to 13; at the beginning of the Christian era, 1 to 9; A.D. 500, 1 to 18; A.D. 1100, 1 to 8; A.D. 1400, 1 to 11; A.D. 1613, 1 to 15½; and this last rate, with only slight variation, it has maintained to the present day.

The late George Cattermole.—It is proposed to raise some simple monument to the memory of this eminent painter of our water-colour school, as a tribute of regard for his kindly nature and sterling qualities in all the social relations of life, and to mark the high estimation in which he was held for the sake of his art by his brother artists.

Porcelain Factories.—Porcelain factories were erected in Vienna in 1720; in Berlin, in 1751; near Munich, in 1755; in Sèvres, France, famous for the most beautiful specimens in the world, in 1765; in St. Petersburg, in 1795; at a still later date in England; and in New York, in 1830.

Materials for Making Paper.—Wood seems more likely to be used now as a substitute for rags in making paper, since it has been found that the chemicals needful for preparing it are not more than are required for other materials in use. Cotton-seed husk, a material ready to hand, as being a refuse in abundance from another manufacture, has also been converted into paper at one of the Lancashire mills.

Post-office Savings Banks.—The Post-office savings bank business increases rapidly. There was not a Post-office bank in the United Kingdom until the 16th of September, 1861, and at the end of the year 1869 there was £13,524,209 due to depositors. The interest paid to depositors, or added to the credit side of their accounts, now exceeds £300,000 a year. The amount paid in and the amount drawn out in the course of a year are very large; in the year 1869, £5,787,218 was received from depositors, and £4,227,656 was paid to depositors. The charges of management and expenses incurred in the year 1869 amounted to £62,060.

The Influence of the Sun upon Glass.—M. Bontemps, managing director of the famous glass works at Choisey-le-Roi, states that the best and whitest glass made at St. Gobaix turns to a distinct yellow after three months' exposure to the sun. Extra white glass (peculiarly manufactured) has become even more yellow, and gradually assumes a colour known as *pelure d'oignon;* glass containing five per cent. of litharge was also affected, though far less perceptibly; crystal glass, made with carbonate of potassa, litharge, and silica was not at all affected (the other varieties referred to contain carbonate of soda); English plate-glass, from the British Plate Glass Company, of a distinctly azure blue tinge, also remained unaffected. The coloration, which begins with yellow, and gradually turns to violet, passing through *pelure d'oignon*, is attributed to the oxidising effects of the sun's rays upon the protoxides of iron and manganese contained in glass.

The Sulphur Beds of California.—Sulphur has been chiefly supplied from the sides of Mount Etna, in Sicily, but the works on the shore of Clear Lake produce now 4 tons a-day. The Sicilian brimstone costs in California 4 cents. per pound, but the domestic article is sold for 3½ cents. Clear Lake occupies the crater of an extinct volcano, and the evidences of volcanic action abound in the vicinity. Within a triangle of about twenty-five miles to the side there are volcanic scoria, trap, lava, obsidian, tufa, warm springs, and other remains of eruptions, with signs of subterranean heat not far from the surface. The sulphur bed of Clear Lake consists of a bank resembling ashes, containing numerous alkaline and sulphur springs with vent holes from which sulphurous fumes escape. Pure sulphur crystals deposited from the fumes surround these holes. The earth containing about 50 per cent. of sulphur, is placed in an iron retort heated to a high temperature, so that the sulphur is driven off in fumes into a receiver, where it settles in a liquid form, and runs out into pine boxes 2 ft. long, and 1 ft. square. The lump sulphur is used chiefly for making powder and sulphuric acid, which last is employed in making blue-stone, giant powder, nitric acid, and muriatic acid, and in refining gold and silver. The consumption of sulphuric, nitric, and muriatic acids on the coasts amounts to 2,000,000 lbs., and the entire demand is supplied by home manufacture. Flowers of sulphur have also been produced at Clear Lake. The fumes passing off from the retort are, in this case, led into a large cool chamber, where they condense into a flaky snow-like condition.

Indian Cotton Statistics.—The quantity of cotton exported from the stations of the Great Indian Peninsula Railway in the central provinces and the Berars, during 1869-70, as compared with 1868-69, is given in the following figures:—1868-69—Full pressed, 38,499; half-pressed, 107,387; dottras, 13,284; total, 159,170 bales. 1869-70—Full pressed, 34,380; half-pressed, 32,208; dottras, 3,669; total, 70,257 bales. Decrease this season, 88,913 bales.

Railway Iron.—During the first two months of the present year, railway iron has been exported from the United Kingdom to the amount of 142,041 tons, as compared with 80,439 tons in the corresponding period of 1869, and 74,853 tons in the first two months of 1868. The exports to the United States reached 57,567 tons, against 42,360 tons, and 32,942 tons for the same period of 1869 and 1868 respectively. To British India the exports have been 40,960 tons from the commencement of the year to February, as compared with 7,678 tons during the same time in 1869, and 15,732 tons in the first two months of 1868. The value of railway iron exported this year, to the end of the second month, amounted to £1,119,504, as compared with £615,043, and £585,817 in the corresponding periods of 1869 and 1868.

Proposed New Minister.—If we had a Minister of Agriculture, the reclamation of wastes or enclosure of commons would have proceeded with more order; earlier provisions would have been made for the drainage of settled estates; but, above all, had there been such a minister, it would have been impossible that in the last twenty years manure sufficient to grow 400 million quartern loaves could have been consigned to pollute the rivers and waste in the sea. Such a minister, with a few clerks, would have looked after these and other matters. He could also have inquired into the cattle plague; and he would long ago have organised an agricultural census. His small yearly blue-book on the state of agriculture would let us know, step by step, how far we were right, or how much we could rely upon; and more than that, it would have enforced on us our deficiencies. It is not an expensive administrative staff which necessarily follows from the establishment of a ministry—it may be a small staff—but it is the constant and organised supervision, and the adequate enforcement of responsibility, which does the effective work.—*Food Journal.*

MEETINGS FOR THE ENSUING WEEK.

Mon......SOCIETY OF ARTS, 8. Cantor Lecture. Professor A. W. Williamson, F.R.S., "On Fermentation."
Social Science Assoc., 8. Mr. George Harris, "On Certain Special Defects in our Educational Policy."
R. United Service Inst., 8½. Col. R. Michael Laffan, "The Suez Canal, especially with reference to its Strategical and Political Aspects."
British Architects, 8.
London Inst., 4.

Tues ...Civil Engineers, 8.
Royal Inst., 3. Prof. Blackie, "Moral Philosophy."
Statistical, 8. Prof. J. E. Thorold Rogers, "On the Incidence of Local Taxation in the United Kingdom."
Pathological, 8.
Anthropological, 8.

Wed ...SOCIETY OF ARTS, 8. Mr. J. A. Franklin, "On International Money of Accounts, independently of International Coinage."
Pharmaceutical, 11. Annual Meeting.

Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 4.
Chemical, 8. Mr. W. H. Perkin, "On some Bromine Derivatives of Coumarin."
Numismatic, 7.
London Inst., 7½.
Royal Inst., 3. Prof. Tyndall, "Electricity."

Fri ......Philological, 8. Annual Meeting.
Royal Inst., 8. Prof. Williamson, "Atoms."

Sat ......Royal Inst., 3. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, MAY 20, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

May 25.—"On Gold Mining and its Prospects in Nova Scotia; embodying the Results of Geological Surveys of the Districts of Waverley and Sherbrooke, for the Provincial Government." By Henry Youle Hind, M.A.

June 1.—*No Meeting.*

The date of the adjourned discussion on Mr. W. P. Andrew's Paper on "Railways in India," will be announced in a future number of the *Journal.*

COMMITTEE TO CONSIDER THE RELATIONS BETWEEN GOVERNMENT AND INVENTORS.

The Council have appointed a Committee to "report whether there is good foundation for the statement that reasonable dissatisfaction exists respecting the manner in which inventions are examined and dealt with by Government, and, if such be the case, whether any practical remedy can be suggested," and the following gentlemen have consented to serve upon it:—

F. J. Bramwell; Hyde Clarke; Henry Cole, C.B.; Warren de la Rue, F.R.S.; Major Dyer, R.A.; Captain Donnelly, R.E.; John Fowler; Lord Richard Grosvenor, M.P.; Admiral Halstead, R.N.; Thomas Hawksley; Admiral Sir J. D. Hay, Bart, M.P.; C. W. Merrifield, F.R.S.; Professor W. A. Miller, F.R.S.; John Penn; J. Ramsbottom; Alderman Sir W. Rose, Bart.; Admiral Ryder, R.N.; Captain Scott, R.N.; C. W. Siemens, F.R.S.; Captain Tyler; Thomas Webster, Q.C., F.R.S.; Sir Joseph Whitworth, Bart., F.R.S.

DRILL REVIEW.

The Review of Schools will take place on June the 21st, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and Her Royal Highness the Princess Mary of Teck.

INDIA COMMITTEE.

The Council, last July, offered the silver medal of the Society for the best treatise on the profitable production of tea. Competing treatises must be sent in to the Secretary of the Society of Arts, on or before June 1st, 1870. Each treatise must bear a distinguishing motto, and be accompanied by a sealed envelope, containing the name and address of the writer, with a corresponding motto on the outside.

The report of the Conferences on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell and Daldy, price one shilling.

NEW AGRICULTURAL PROCESS.

The following letter has been received from Mr. Hyde Clarke, and the Secretary will be glad to furnish to any member applying for them, some of the seeds for experiment:—

Dear Sir,—I send for distribution, under the auspices of the Society, to public institutions and to individuals able to make the suitable experiments, a number of boxes of seeds, each embedded in manure, according to a process belonging to Mr. Wm. Rée, of Hamburgh, and which, in the last season, produced good plants on the barren heaths and sands in the wilds of Germany. There are two boxes of peas, two of barley, two of oats, two of clover, one of lentils, one of vetches, one of pearl beans, one of champion peas.—Yours faithfully,

Hyde Clarke.

32, St. George's-square.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 18th, 1870; Alderman Sir David Salomons, Bart., M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Baillie, Thomas, 118, Wardour-street, W.
Cather, Rev. Robert G., 8, Old Jewry, E.C.
Hodgson, Edmund Dorman, 5, Paper-buildings, Temple, E.C.
Noel, Albert Leland, 41, Onslow-gardens, S.W.
Reed, E. J., C.B., Admiralty, Whitehall, S.W.
Warren, James, Capel-house, Waltham-cross, S.W.
Whitworth, B., 11, Holland-park, Notting-hill, W.

The following candidates were balloted for, and duly elected members of the Society:—

Barr, Edward George, 76, Holland-park, Kensington, W., and 36, Mark-lane, E.C.
Harding, George Edward, New York, and 98, Newgate-street, E.C.
Johnson, John Henry, St. Osyth-priory, near Colchester, and 29, Portland-place, W.
Merriam, L. P., 6, Claremont-villas, Tollington-park, N.
Newdigate, Albert L., M.A., Mount-lodge, Blackheath-hill, S.E.
Taylor, Richard, 26, Clarence-terrace, Seven Sisters'-road, Holloway, N.
Tennant, Sanderson, 3, Stanford-road, Kensington, W.
White, Charles, 262, Kennington-road, Lambeth, S.E.
Whittet, James, 41, Charlwood-street, Warwick-square, S.W.
Wilks, George, Boston-spa, Tadcaster, Yorkshire.
Wright, Herbert Montague, 4, Addison-gardens South, W.

The Paper read was—

ON INTERNATIONAL MONEY OF ACCOUNT, INDEPENDENTLY OF INTERNATIONAL COINAGE.

By Jacob A. Franklin, Auditor of the Society.

In sequence to his paper on "The Decimalisation of Existing Standards," printed in the *Journal of the Society of Arts*, 16th February, 1855.

The reference made in the title of my present paper to the much more elaborate one that I had the honour to deliver before this Society on the 14th February, 1855, will spare my present auditory the repetition of a mass of details. That paper was "On the Expediency of at once Decimalising English Moneys and Weights." A cursory review of it, as found in No. 117 of the Society's *Journal*, shows what was then the state of the question which remains, to some extent, still at issue, between those who would decimalise but nevertheless maintain the integrity of our own standards of value, dimension, &c., and those who would uproot those standards for the sake of a decimal metrology. We are asked to make sacrifices in order to obtain what is called "*The* Metrical System"—say rather *a* metrical system, established during the great French Revolution, as a happy expedient whereby to impose uniformities in substitution for disparities pretending to be identities, then abounding even in France itself, not to speak of dependent states subjected to the propagandism of *Egalité* and *Fraternité*.

Sir John Herschel, with all the force that belongs to his authority, contends that the French metre, having been since its adoption proved short measure, has no claims to supplant a more convenient unit, namely, the 500 millionth part of the earth's diameter, corresponding within a hair's breadth to the inch established in Great Britain and her dependencies in America, and, through the Sagène, with Russia. Professor Piazzi Smith maintains that the geometrical inch of the Pyramids is as much an inspiration as the cestus of mother earth, a quarter of which was measured by the French *savans*.

I do not contest that men count naturally by their ten fingers, although ancient history and modern travel establish the fact that some tribes have used other scales of numeration. The metrical system of the Bible is decimal and binary, hence the shekel, both weight and coin, of twenty (a score of) gerahs, and the half-shekel of ten gerahs, called also bekah, signifying split or cleft; moreover, the Hebrew alphabet, always and continuously down to our own day, has served for decimal notation. The first nine letters represent from 1 to 9; the following nine from 10 to 90; and the remaining four from 100 to 400. In like manner the so-called Arabic numerals, or, more significantly, "digits," symbolise counting by the fingers. But do not let that one patent fact blind us to the perception of another, namely, that although men are habituated to aggregate decimally, they find it more convenient to segregate binarily; indeed, duality in nature is a child's first idea of numbers; hence units, whether of value or dimension, have been in all times found divisible into halves, quarters, eighths, sixteenths, and so on. It is, moreover, noteworthy that the sixteenth of our pound of 7,000 grains is its ounce nominally, notwithstanding that "ounce" is etymologically a twelfth, not a sixteenth part. We are reminded how nations of antiquity recognised the convenience of duodecimal subdivision, and provided submultiples of 2, 3, 4, and 6. The letters £ *s. d.*, which we read pounds, shillings, and pence, used to express *Libri*, *Soldi*, *Denari*, Gallicised into *Livres*, *Sols*, *Déniers*, always available for partition of a unit into twenty dozens. We are also reminded how many other monetary systems have divided the unit duodecimally, *e.g.*, the florin of five dozen kreutzers; the thaler of half that number of groschen. We see also that, even where decimal, centesimal, or even millesimal subdivision has been longest in use—sometimes imposed under penalty—commerce continues persistently to reckon by halves, quarters, even by eighths of units, though legally divisible into tenths or hundredths only.

Thus the market quotations in America are not continuously decimal expressions, but are rounded off binarily, in order to split the difference as is convenient to chaffering. So are the quotations of the French exchange for bills. Proofs abound of the tenacity with which the French adhere to their monetary sous, and to what they call *usuel* measures and weights. A learned *savan* testified before one of our committees of inquiry, that his father had been obliged, in a retail trade, to employ the old weights and measures, notwithstanding that they had been interdicted. He remembers how such had to be hidden from the gensdarmes and inspectors. In 1812, an Imperial decree had to be issued, allowing binary as well as decimal subdivision, and in 1816 another decree still more retrogressive.

Statesmanship, properly so-called, will never disregard habitual methods of estimating, comparing, and computing values, weights, or dimensions. Our English notions of freedom in such matters is to tolerate—even to facilitate—alternative methods of quantitative expression. Thus, our pound sterling unit has, for computation, been subdivided decimally to its thousandth part from comparatively remote times. My former paper, in 1855, traced the origin and history of successive proposals to decimalise coinage as well as account. In 1853, Messrs. Letts and Son published a small book of tables constructed by me, entitled "The Decimal System Facilitated." Excuse my reading the title page, as the readiest exposition of its scope and purpose:—"The Decimal System facilitated and adapted intermediately to the routine methods of account, money, and the precious metals, with tables for converting at sight moneys, weights, and assays, into their decimal equivalents; also tables showing the value of gold and silver of all assays, and expediting computations thereby; introduced by a familiar exposition of the decimal notation generally, and by facts and data explanatory of the currency."

It was easy for me to demonstrate, in the introduction to those tables, that already every current English coin, seven in number, down to the half-shilling or sixpenny piece inclusive, is available for decimal coinage, and that only minor coins below the half-shilling are inexpressible as decimal aliquots of the pound unit; inasmuch as a farthing is the 960th part of that unit, and a thousandth part, so that the half-shilling is either 24 farthings or 25 thousandths.

In the evidence which, since 1853, I have had the honour to be called upon to give before Parliamentary committees, to a Royal Commission, and on various other occasions of discussing the decimal question, I have never contemplated abolition of what exists in money, weight, or measure as a sacrifice to simplification, but always advocated, as I continue to do, the granting of additional facilities. Opportunity to choose, not compulsion to surrender, is in matters such as these the true policy of constitutional administration. On the other hand, my opponents in 1855 foresaw no chance of supplanting our British standards except by obstructing a decimalisation of them, a fact of pregnant significance; whereas my humble advocacy has never been withheld from movements in recognition of the kilogramme and the mètre Français, so long as their use might be permissive, not obligatory.

I have now before me a pamphlet report of proceedings of the Decimal Association, formed in June, 1854. The perspicuous introduction, written by one of its most eminent members, Professor de Morgan, exposes the characteristic fact that the association sought to harmonise, not to overturn, our monetary system. Looking back to the number and importance of those who had signified their adhesion to the objects of that association, one wonders at the slowness of progress achieved in the direction indicated. This Society having, in 1855, lent its theatre as the arena for controversy between the association and its opponents, I had the honour to bear its standard, and do battle for integrity of our pound sterling. Against us were arrayed the quasi-democratic flag of "The poor

man's penny," with its motto, "Penny wise, pound foolish;" also the gonfalon of the communistic franc—a silver piece of five grammes, nine-tenths fine, intended to annihilate both pound and penny. The lists on that occasion were presided over by Professor Airy, our accomplished Astronomer-Royal, whose flattering acknowledgment of my advocacy of his own views—views which his position in the chair precluded him from supporting—I have preserved with pride. It is sad to miss on this occasion the philanthropic Sir William Brown, and another of my colleagues, the earnest, well-informed William Miller. Thanks to their aid, the penny seems since then reconciled to its due place, subordinate to the pound sterling, of which it is but an aliquot part. The Little-endians, as the penny champions were named, after Swift, have common interests with the Big-endians, and their unit could not at the same time be one-twentyfourth and one-twentyfifth of £1. The other combatants in that so-called "battle of the standards," *i.e.*, the advocates of the franc, remain still antagonistic, but they have necessarily changed their front. As I had ventured to predict, in terms then apparently over-confident, the coined franc has now passed out of existence, or rather been degraded to a mere token of inferior value and unsymmetrical assay, just like our own shilling. The International Decimal Association still hanker after the franc, but, unlike the Sybil of old, they retract and reduce their demands progressively, and approximate more and more nearly to our own terms—those were, and still are—a gold basis—the largest unit available—and concerted relations with other monetary bases, past, present, or in prospect.*

I desire once again to plead for forbearance from those who, in their eagerness for international standards, risk subversion of other standards upon which existing contracts and obligations are based. As heretofore, they are entreated not to obstruct the decimalisation of English moneys and weights, even as an intermediate measure, and to avoid tampering with the fundamental units of our own metrical system. We could always better than they afford to trust to time, and to wait an education of the common mind to the elegant simplicity of decimals progressively applied. By favour of Sir John Herschel, then Master of the Mint, of the then chiefs of the bullion and cashier departments of the Bank of England, and of the organ of the Goldsmiths' Company, opportunity was afforded to me to induce Mr. Cardwell, then President of the Board of Trade, to express, by hall-marks decimally, certain assays of manufactured gold. Recently, the Bank itself, which had long dispensed with other than decimal multiples and submultiples of the unit of weight, has abandoned all but decimal assays. The desirability of this recent concession had been illustrated, and its attainment facilitated by my tables, constructed and published in 1853, as already cited. Here is the assay book just issued from the Bank, naturally less elaborate than my own, because it is no longer needful to represent equivalents in the old assay, expressed by carats, grains, and eighths of grains. My own early labours are forgotten, while another has been scolding the Bank into sacrifice of certain pecuniary advantages derived from the carat assay; but I can rest content with the decimal progress attained, and leave the laurels to be bestowed elsewhere.

This occasion seems an appropriate one to suggest the next step available in the same direction—no less a step than to dispense with tables altogether. The new bank tables serve, after the manner of a ready-reckoner, whence to deduce the equivalent weight in standard or 11-12th gold for any weight of bullion of any quality. Having so deduced the standard weights, still another process is needful for computation of its value at either mint rate, 77s. 10½d. per ounce, or at bank-rate, 77s. 9d. per ounce. My old Table E gave the figures whereby to compute the value by a single process, dispensing with the intermediate conversion, or so-called standarding. Now, if fine gold be taken at £4·25 per ounce, *i.e.*, twopence and an eighth per grain, that rate is an excess over mint-rate of precisely a halfpenny per ounce standard, or 1 in 1869, a rate of excess that may be impressed on the memory by its obvious correspondence with the relation of the current year, 1869, to that appointed for the first of our series of Annual International Exhibitions, *i.e.*, 1870. The excess over bank-rate, 77s. 9d., is consequently 4 in 1870. Under a system of international account, based on a normal weight of fine gold bullion, such as I shall presently propose, those fluctuations of exchange, which could not possibly be avoided, even were the same coin legal tender internationally, would, as in other countries, be expressed decimally. Thus, the gross weight of a bar or ingot of gold being multiplied by its titre or decimal expression of fineness, and also by 4¼, would show its value at 77s. 11d. per ounce standard, or eighty-five shillings per ounce fine; that is about ½ per mil over mint-rate, or 2 per mil over bank-rate. What more convenient than that the market price of importable or exportable gold bullion should, as in France, be quoted at per mil discount from an artificial par of £4·25 per ounce troy.

If troy weight be superseded by coin weight, say that of the sovereign, with its decimal multiples and submultiples, then computations would indeed be simplified. Be it observed that coin weights have always been in use for testing purposes, and that bankers have long employed decimally graduated weights of 50, 100, 200 sovereigns, &c., as a means to spare the risk and tedium of telling or counting money at the counter so called.*

Permit here a digression, needful to illustrate the incontestible fact that even between places where (near or far off) the same coinage is legal tender, there will always be needed a rate of exchange. That fact was circumstantially illustrated in my former paper. Then, a merchant in Australia had to give 105 Australian sovereigns for a bill or engagement to pay to his credit in London £100. Since that day, sovereigns, whether minted here or in an Australian colony, are become legal tenders in both places; nevertheless, the rate of exchange between the same places is commonly "1 per cent. premium to 1 per cent. discount," a quotation which signifies that if you hold here a claim for £100 on Melbourne, a bank will give you £99 only for it, deducting the other pound for costs of collection, loss of time, risk, and remuneration. If you have to remit to Melbourne a draft for £100 receivable thero, you will have to pay here £101, for converse reasons. The charge for a post-office order, and bankers' commission for a draft payable somewhere in the provinces, are both in the nature of a rate of exchange. On French promissory notes or drafts payable in minor cities a discount called perte is a thing of course. It will presently be needful to revert to this subject in its relation to international money of account, and to the cheapness of circular letters of credit in contrast with specie for expenditure by tourists.

When reading my former paper, I challenged my opponents to test the capacity of schoolboys to save arithmetical labour, by decimalising pounds, shillings, and pence at sight, instead of by reduction into and from the lowest denomination. Gradation of money, weight, quantity, dimension, is, so to speak, their grammar, and there is nothing which so much as a common grammar facilitates translation, commensuration, interchange, or analogous processes. Because Latin was supposed to be fitting for an international language, its grammar is found imposed upon languages for the flexions of which it is needlessly ponderous, yet deficient—witness the (so-called)

* The Association, recently represented by Professor Leoni Levi at Paris, publish here the scheme of their distinguished member, Mr. James Yates. I am prepared to demonstrate the impracticability of such schemes if called upon so to do.

* Another mode of eliminating the troy ounce would be to reckon 100,000 grains of fine gold at £885. The French might find 5 grains of gold, 9-10ths fine, a closer approximation to a decimal franc than 8 grammes for 25 francs.

English grammar books of our school-days. On the other hand, the first and indispensable process for exchange with foreign money of our pounds, shillings, and pence, is to decimalise both, and thereby to construe them by a universal grammar.

It is needless to dilate on the educational advantages of decimal computations. Champions of a decimal system seem to overlook the fact that it is taught first and always in our schools, for is not our notation system decimal? The chapter entitled "Decimal fractions," at the end of our school books, is simply a pointing out of the application of common arithmetic to processes which the learner has been performing by compound arithmetic. Vulgar fractions, in the sense of common or familiar partition of whole numbers, are less simple than decimal fractions.

International postal weights, once adjusted, could be represented by attested copies distributed everywhere, without continuous occasion to refer to their equivalents either in grammes or grains. A normal weight might readily be based upon 8·1 grammes = 125 grains = $\frac{4}{7}$ of our postal half-ounce.

A recent publication by Mr. Ansell, a *ci-devant* employé of our Royal Mint, suggests how it has happened that our gold coinage, although in modern times faithfully up to the mark both in weight and quality in the aggregate, has nevertheless in detail been so uneven as to make it profitable for foreigners to garble the over-weighted coins and melt them down. It is satisfactory to observe that greater uniformity and narrower limits of tolerance have been insisted upon by an Act just passed. Time does not permit me even to summarise the incidents and effects of this creditable reform. It does not, however, remove all inducements to foreigners to palter with our coinage. Inasmuch as the absence of seignorage, brassage, mint charges, &c., warrants our throwing upon holders of light coin the loss involved in that lightness, it is obvious that the costs of wear and tear fall upon ourselves distributively, if not upon our national exchequer collectively. Surely, then, that cost is heavy enough, without encouraging foreigners to use our coin abroad until it become deteriorated by that use, and then returned upon our hands craftily. Such is literally the case now, as is sufficiently notorious. Have the English champions for international coins estimated the penalties likely to result from pushing our sovereigns into universal currency, *i.e.*, rendering acceptance of them not simply optional, as heretofore, but obligatory as legal tender everywhere. Will no ingenious manipulator abroad be tempted to clip or sweat the coin so fabricated, disseminated and maintained in integrity at our expense? Worse and worse would be the imposition upon us of coins fabricated abroad, and insinuated into our own currency despite ourselves. We are tolerably familiar with our own coinage, nevertheless, ingenious rogues manage to dissolve off some shillings' worth from the pound and then pass the coin. Witness the recent conviction for such practices. When, by proclamation, light sovereigns were last eliminated from currency, a cheap sort of guage was in vogue that tested weight, diameter, and thickness all at once. There are, unfortunately, frauds not even so to be detected, for I have here a doubloon which has been split, in order that platina, a heavier but cheaper metal, might be substituted for a large proportion of gold scraped out of the interior of the coin, then put together again, and fobbed off on the unwary. Here are also illustrations of other frauds of which we could be victims. This 5-franc piece has a silver shell or envelope; the inside is all copper. Readers of sensational novels need not be reminded of the French prisoner who sawed off his irons by means of a watch-spring with serrated edges, coiled up in a sous-piece hollowed out as a box. That fiction is founded on fact, and I have handled a German thaler scooped out for reception of a large number of paper discs. Is it not, then, safer to bide by our domestic ills than to attract foreign *chevaliers d'industrie* to misuse opportunities such as this richer country would afford in the compulsion of our tradesmen to accept foreign coins? Great ills could befal us, even though all the states concerned in a monetary convention would keep faith in the quality, weight, and proportions of their several mintages. But history shows that monetary conventions have been tried before, and broken down from absence of international faith. I must refer you to my former paper for details.* The tables and diagrams now on the walls are almost all remanets from that paper, but I must not trespass by retracing my steps. Wherever what are now exhibited do not tell their own tale, I will afford explanation after the close of my paper, if called upon so to do. I regret, however, the absence to-night of the collection of coinage in series, nationally grouped, including convention coins, wherewith the kindness of my friends enabled me to illustrate my former paper. Need we, however, recapitulate abandoned conventions of former days in presence of the serious disagreement just exposed between Rome, France, and other states, parties to the most recent monetary convention, that into which it is sought to entangle us. The *Times* of 9th March, 1870, tells the tale graphically:—

"However successful Pius IX. may eventually be in establishing his claims to infallibility, it is not likely that his exemption from error will extend to his master of the mint. The latter seems, indeed, to have committed a mistake in the discharge of his duties, yet what, we have little doubt, is considered at Rome a clever mistake, which turns out very much to his Sovereign's advantage, and by which France declares that she has been swindled out of two or three millions of francs. It is worth while to inquire by what subtle device the Court of Rome has managed thus to mulct the eldest daughter of the Church, in return for the sacrifices in men and money France has been for so many years making in behalf of the Holy See, and for the kind offices by which she is, even at this moment, endeavouring to enforce upon the Italian Government the payment of its share of the Pontifical Debt.

"About five years since, as our readers may be aware, four of the Continental States—France, Belgium, Switzerland, and Italy—considering the mutual advantages accruing to neighbouring nations from the adoption of a uniform standard of coins, weights, and measures, entered into a convention, by which they agreed upon the French decimal system, establishing perfect reciprocity in the currency of the four countries, and giving the franc, livre, or lira, the monetary unit of each of them, as well as its multiples or fractions in gold or silver, the same course and value throughout the extent of their respective territories. Among the conditions of this monetary league, it was stipulated that for the larger silver currency — the five-franc pieces — the standard should be fixed at 900 parts of pure silver per 1,000; but it was agreed, as a matter of common convenience, that for the minor coin, which they called 'divisionaire,' or fractionary—the pieces of two francs, one franc, and half-franc—the intrinsic value should be only of 835 per 1,000, instead of 900; so that a sum, for instance, of 1,000 francs in five-franc-pieces would contain a quantity of pure silver greater by 65 francs than the same sum in the smaller, or 'functionary,' coin. It was, however, determined that the issue of this minor coin should be limited in each of the contracting States to the proportion of six francs for every inhabitant, and that each of the four States could, whenever it deemed it expedient, demand of any other State the withdrawal of its smaller coin, insisting upon repayment in money of the higher standard—*i.e.*, in five-franc pieces at par. The object of all these precautions, as

* Happening to be in Frankfort some years ago, our minister, Sir Alex. Malet, called my attention to a sudden scarcity of coin there, attributed to operations by other German States in monetary convention. The head of the house of Rothschild in that city was good enough to give me copies of letters which he had published on the subject of a gold currency—bar silver being then in demand at a price higher than could be coined therewith.

may be easily perceived, was to prevent the issue of too large a quantity of this base alloy, by which any State could easily swamp the currency of its neighbours.

"It seemed natural that the Pope—placed as he is at the head of a shrunken State, scarcely numbering 600,000 or 700,000 inhabitants, shut in on all sides by land by the kingdom of Italy, and carrying on its chief maritime intercourse with France—should consult his subjects' interest by joining the league of the four States, submitting, of course, to their conditions. Negotiations have been, in fact, carried on to that effect for these last five years, between the Court of Rome on one side and that of the Tuileries, acting in behalf of the league, on the other, but hitherto with no success, partly owing to the unconscionable delays of the Papal government in all deliberations, but chiefly to its invincible reluctance to recognise the kingdom of Italy. The Papal government, however, although they would not sign the convention, were determined to reap all its advantages without bearing its burdens, and, on the strength of the negotiations in progress, they issued their own decimal coin, bearing a close resemblance to that of the four leagued States, but inferior in intrinsic value to the common standard of their smaller coin, as the Roman pieces contained only a fraction above 831 parts of silver, instead of 835 per 1,000. This difference of something more than three *millièmes* would have been a matter of little moment, but the Pope, not having signed the convention, conceived himself entitled to disregard the condition respecting the proportions to be observed by the contracting States in the issue of their smaller coin, and, as an independent potentate, he took upon himself to throw as much of the coin bearing his effigy into circulation as seemed good to himself, and as his mint could produce. He made such good use of this sovereign prerogative that, instead of the issue of 3,000,000 or 4,000,000 francs, which would have borne the proportion of six francs per head of the population of his State, he sent forth his doubly base coin with so free a hand as to inundate France alone to the amount of from 20,000,000 to 30,000,000 francs. It is impossible to say how much further he might have followed up his advantage had not the French government, alarmed by the sudden influx of a coin which soon fell into discredit, published an official declaration to the effect that, as the Pope had never acceded to the Monetary League, the Papal money had no legal course in France; consequently, that it would not be received at the public offices after the end of April, and even then it would only be taken at the rate of 91 centimes per franc instead of 100—that is, at a discount of 9 per cent. The loss thus falls on the French people, who will only be rid of the Pontifical currency at the cost of 1,800,000 or 2,700,000 francs. The Court of Rome attempts to justify this sharp practice, first, by stoutly denying that the Roman coins are in any respect inferior in intrinsic value to those of the States of the league; and, secondly, by contending that the population of the Pontifical dominions is, or ought to be, not 600,000 or 700,000 souls, but 3,000,000 souls, as it was before Solferino and Castelfidardo had robbed the Papacy of its wealthiest provinces, and as it would be again, should the Pope ever come by his own. Even accepting this convenient theory, the issue of the Papal coin, by the terms of the convention, should not have exceeded 18,000,000 francs, and more than that sum, as we have seen, has found its way into France, besides what may still remain in Rome, and what may be circulating in Italy and the other States of the league."

Here are other coins found even now in circulation under the convention we are asked to join; all are either counterfeits or else official frauds.

The imputation against the Papal Government is either true or false; even if false, the fact remains, that national governments, though related to each other religiously as well as diplomatically, cannot maintain accord by monetary conventions. It is on all hands now admitted that only an international mint could be trusted to issue international coins; nevertheless, special objections to legalise currency here of international coins would remain, even though we were ourselves entrusted with the mintage of them. The French government, representing those most seriously mulcted by the inferiority of the Roman coinage, has itself heretofore not scrupled to make profit out of the tolerance on coinage. By that tolerance is signified the deficiency of two per thousand in quality, and two per thousand in weight, together four per mil, which the mint law of France permits, as might be supposed by way of compensation, in presence of the difficulty to ensure precision, and in reliance upon counteracting excess of weight and fineness in contemporaneous coins. It seems, however, that the French custom has been to set out by taking advantage of the tolerance, just as the vivandiere excused her habit of giving short measure by care to avoid spilling the cognac. I find in the *Journal des Débats*, 13th November, 1866, a complaint, signed "Secretary of the Redaction," of illegitimate profits made by taking advantage of tolerance—two per thousand weight and two per thousand quality.

Reports by German assayers of new 20-franc pieces of 1866, declare them $\frac{1}{4}$ per cent. below standard. Indeed, in French official returns such profits are avowedly carried to revenue:—In 1859, 295,820 frs.; in 1860, 278,119 frs.; in 1863, 164,380 frs. (on a smaller issue).

Mirabeau, 2nd April, 1779, reproaches the moneyers for making the coin too near the standard, so leaving too little profit.

I intend by these citations no imputation upon Gallic faith, for these clippings were openly avowed. Might it, indeed, have been retorted upon ourselves that, as Mr. Ansell, Mr. Seyd, and others assert, part of our own circulation has been defective *ab initio*, the compensatory issues having been garbled and resold to us at a profit? Without dwelling upon the force and scope of our own irregularities, let us be content to bear their burthen, but decline to incur such extra penalties as would fall to our share if foreign mintages were legal tenders here. I recall the fact that Australian sovereigns though at first (from containing silver and other causes) more valuable than the Imperial coinage, were not admitted as legal tender here until the Australian mint had been subordinated in all respects to home control.

There is still another point of view from which it might be maintained that, even if all nations except ourselves employed a common coinage, it would, nevertheless, be more safe and profitable to stand fast by our own, and to make as many bargains as possible by standards unchangeable at the fiat of others. So long as engagements are made in the British pound sterling, they must be kept in 113 grains of fine gold. If they be representable by an international coin, our debtors, despite us, could tamper therewith.

Only very recently, the London Council of Foreign Bondholders asked me, as its consulting accountant and actuary, to compute the loss imposed upon holders of certain Austrian bonds, by the pretence of that government to vary the monetary form in which the periodical interest is payable. It is estimated by that council that British investments in foreign loans and shares amount to hundreds of millions sterling. Can it be needful to demonstrate the risk which would be incurred by Englishmen, creditors *par eminence* of the whole world, if indebted countries could baffle us by instrumentality of any convention whatever, and vary the coin to be repaid by them to us?* International treaties have too often

* I have here a striking illustration of losses incurred upon currency variable at the will of an indebted State. A friend of mine, in the capacity of a trustee for a widow and orphans, receives, through Messrs. Baring Bros., half-yearly dividends upon the stock of one of the United States of America. If payable here in a gold equivalent, the product would be £510 per annum. In 1861, the net product here was £487, the difference ($4\frac{1}{2}$ per cent.) being a legitimate one for exchange, commission, &c. In 1864, the State began to pay in paper dollars, without compensation for the enormous loss upon their conversion into gold, and the second half-year's dividend for that year produced only £93 here instead of £255.

been international snares, bones of contention, rather than securities for agreement. Diplomacy may be regarded as in some sense international commerce, and the French language was long employed as its *quasi*-international currency. The statesmen of Great Britain, and even of the United States, prefer now-a-days to employ their own language for the record of their own meaning. And quite right too, remembering the disadvantage at which we can be placed by progressive changes in the significance of words not of our own mintage, and moreover subjected to abrasion by foreign currency. If our modern English can illustrate deviations of meaning, such as "prevent," signifying to assist, as well as to obstruct, progress; or "let," signifying liberation as well as hindrance, how much more embarrassing might be foreign symbols, whether of thought or value. Thorough-going advocates of free-trade deprecate commercial treaties of reciprocity. Is it not, by parity of reasoning, our best policy to keep free of monetary conventions, the more especially that the very parties who would have enticed us to surrender our monetary standards are, step by step, approximating them? It is inconceivable how English merchants can advocate the clipping of our coinage; yet nothing less is involved in the proposal to reduce the sovereign from 113 to 112 grains of gold. It is equally difficult to account for the confusion of ideas involved in appropriating the abstracted grain—equivalent to nearly $2\frac{1}{8}$ pence in every pound—as a legitimate charge for coinage.* Take the case of a foreign holder of Three per Cent. Consols—and such are numerous, indeed very likely to increase since our national stocks can now be held in certificates to bearer. How could we, in paying him a year's dividend of three pounds, put him off with 336 instead of 339 grains of gold.

With what pretence could the champions of our English holders of foreign bonds plead for honest fulfilment of the letter and spirit of those quasi-international engagements, if we ourselves clip the coinage wherewith we are pledged to fulfil our own engagements?

To save us from the scandal of such an attempt, it seems that a section, and a section only, of the international coinage party suggest a tariff of compensation. That would have to be about sixpence and $\frac{3}{8}$ths of another penny upon £3 consol interest, or, decimally expressed, £3·0265625, on a supposed abstraction of one grain of fine gold from every sovereign, at $2\frac{1}{8}$ pence per grain. Our wage-classes, if not paid for the abstracted grain, would be likely to strike for still more. Old contracts, based on small prices, would be excessively difficult of adjustment, yet without such adjustment the receiver would be pillaged, inasmuch as the costs of subsistence at home are, under free trade, regulated by the prices of all necessaries in the markets of the world at large (*vide* the reports of our diplomatic and consular agents, in recent blue-books). Fluctuations in international prices, within the limits of $\frac{7}{8}$ths per cent. (*i.e.*, the deficiency of 25 francs compared with £1) can so stimulate international commerce that foreigners would sweep from English food markets what the English workman could not buy with his clipped coin uncompensated, and still more inevitably withhold foreign food supplies, for which 25 francs only would be tendered, instead of 25 francs 22 centimes, as heretofore.

Tourists, who are the most clamorous for uniformity of coinage, scatter money so freely abroad that their season is one of efflux of bullion from the Bank of England. They should rest satisfied with such a facile rate of computation as 25·20 per £1, *i.e.*, £10 equal 21 dozen francs, 21 francs equal 20 tenpences, each tenpence being equivalent to a franc plus 5 per cent. A ready reckoner on that basis, for their special behoof, could be framed on the back of a visiting card. As to tourists' sources of monetary supply from stage to stage, it is easy to devise forms of letters of credit that would always be equitable and intelligible.

Let us, from that comparatively minor position, develop the more important object of this paper, namely, how we may devise international money of account, into which existing diversities of coinage may converge.

Suppose our traveller to be furnished with one or more documents of the following purport:—

"The transferee of this document will receive, on demand, bullion in merchantable condition, or coin, guaranteed to contain fine gold equivalent to * international units."

The holder who presents for payment an instrument such as this is much in the position of one who presents a banker's cheque, and is asked in familiar phrase, "How will you take it?" His claim is expressed in money of account; the current money which he seeks in exchange has various forms, and just as a £10 cheque may be exchanged for two fives, ten sovereigns, or for various other coins, so would a mint draft expressed in units entitle the holder to a choice of current money, but with this important privilege superadded that, if he mislike or mistrust the current money, he may demand the bullion which it ought to contain.

The international unit might be any convenient known weight, fixed with or without consent or convention. Our £10 note is essentially a voucher for deposited bullion, and its quantity would well serve for such a unit. Assume another of ten grammes fine gold, the appended table on that basis suffices for interchange, and to harmonise the so-called metrical system, with all the money-weights of Great Britain, the United States, India, &c. It may be observed that a normal *par* at £1·365 per unit is not so arbitrary a one as either 25f. or 25f. 20 cents. per £1, commonly termed *par*. It is, moreover, the rate at which we English could accept the unit without loss.

Old tables of mine in your *Journal* expose disparities of weight in specimens of the kilogramme, ascertained at various times and places. We need no international convention for issue of mint documents, or for assessment of their value for ourselves. If France pretend that the kilogramme is heavier than it proves to be in our scales, let its bankers get, if they can, so much per mille allowance as holders of such documents issued in England may be willing to pay. The difference cannot equal the smallest turn of the market on bills of exchange. The figures expressive of the sterling value of a ten gramme unit in excess of £1 are easily remembered, they singularly coincide with the number of days in a year. If, indeed, the kilogramme ever contains, as per the "Annuaire du Bureau des Longitude," 15,432½ of our grains, then units issued on that basis would involve a difference too small to be regarded, except in large bullion operations internationally, and those must always be matters of negotiation, even were weights absolutely and incontestably identical.

See how such documents—call them, if you please, mint notes—could, when issued here upon deposit of gold bullion, effect various economies. It might not be necessary to convert the deposited bullion into coin at all, for the voucher could better serve the object of remittance. The bank might at pleasure issue legal tender notes upon such documents, equivalent to bullion in its stores, just as it can now do upon its own bullion lying at the mint for coinage, therefore outside the issue department. The Bank of France does habitually take bullion or coin on deposit, and issue its bank-notes to the depositor at a small charge. That has been supposed to be one cause of gold accumulation in France, because here the owner must perforce sell or melt coin or bullion that he would prefer to have option to reclaim

* Time does not permit discussion of charge for coinage—an open question. Merchants have been encouraged to bring gold bullion to this country preferentially, and to rely upon their ability to discharge pre-existing contracts with 113 grains of gold per £. Hence to impose on importers a new obligation, *e.g.*, to bring 114 grains in order to obtain 113 in form of a legal tender would seem, *pro tanto*, a surcharge. On the other hand, to oblige creditors under old contracts to accept 112 grains in place of 113 must be, *pro tanto*, a spoliation.

* The weight of any bar or parcel of gold.

for export. The document undertakes to deliver bullion on demand. Our mint would be entitled to notice if coin were required instead. I learn from a friend at that establishment that it was formerly the practice to keep coin there in store, and to issue part only to the depositor of bullion, together with transferable vouchers for the remainder. It were our best policy to render this country, not merely, as it is, the *entrepôt* or place of consignment of gold *par eminence*, but also its main storehouse, and why not also its clearing-house, for mint-notes issued in various great commercial countries? That would, indeed, economise specie, minimise fraud and risk, and provide a heart for the life-blood of international circulation. The late Master of the Mint, to whom I propounded the idea many years ago, saw its advantages at a glance—saw the confidence felt in the comparative stability of our institutions, the means to secure safe custody of deposits at our mint, protected by the Tower of London, close to the packet-station of our noble stream, the highway of commerce to all the world.

Most of us remember when the Bank of France, the Bank of England, and the Russian Government lent each other bullion. Would it have been necessary to remove it, if international mint-notes had been then available? We need not draw on our imagination to illustrate how much safer it had been found for weak states to store their bullion reserves out of reach of sudden forays.

It is probable that other international banks, just as the Bank of France can do at pleasure, might, for a consideration, endorse English mint notes in a manner to render any so endorsed available abroad as well as at the place of issue.

It would be idle to speculate on what should be done by national banks where silver is the principal legal tender. All that was disposed of in my former paper (*Vide* tables displayed), and I deprecate discussion to-to-night upon issues even now raised at Paris, as between gold and silver bases. M. Chevalier, the great French economist, seems to agree with the French Rothschilds and other financial authorities, that the project of an international 25-franc piece is a snare and a delusion. French physicians would like a 25-franc piece to be circulated, because their fee would become of that value, instead of only a napoleon. Here is the 25-franc piece of Belgium; had it been wanted would it have been disused? It contains less gold than the louis of 24 francs, which it displaced.* It must have been overlooked by advocates of international coin that, from 1726 to 1784, the louis d'or of 24 livres, 11-12th fine, did virtually correspond with one pound sterling, both divided into 240 subsidiary coins. By the change France substituted 80 francs for 81 livres; and, afterwards, in 1810, refused to give more than 29 francs for 30 livres still outstanding. No longer ago than 1862, M. Chevalier, my fellow-witness before a Parliamentary committee, suggested that 10 grammes of 9-10th gold should pass for 32 francs instead of 31. It is always so. I exposed in the *Journal* of this Society how the last German monetary convention, in substituting the zollcentner for the Cologne-mark, had clipped the coinage to the extent of 4s. 6d. per £100.

And now to the subject of international accounts, to be kept in international units, enabling prices to be quoted, bargains effected, bills drawn, circular notes issued, statistics compiled, and commercial processes generally performed on a common system. My paper has already extended to such a length as to restrict me to brief reference to notorious precedents for reckoning and accounting in one money while paying in another. For a hundred years before 1817 we had no pound sterling coin, but only guineas, half-guineas, thirds, and quarters, for which no column of account was available. Our gratuities continue to be guineas, though public charities collect and keep accounts in £ *s. d.* British America formerly, for exchange purposes, kept accounts in so-called currency of £ *s. d.* while paying in dollars. We can remember when the Irish tenpenny piece and its multiples, as also the 5-guinea note, circulated, though accounts were kept in £ *s. d.* The still existing par of exchange with the United States is based on the hard dollar, arbitrarily assumed at four shillings and sixpence, and thereby over-estimated $9\frac{1}{2}$ per cent.—so-called par. By-the-way, the silver dollar, which the international coinage party once pressed for our adoption, has, like other specious ideas of universal coin, universal language, and universal creed, passed to the limbo of Chateaux en Espagne, whither, indeed, the universal franc, in the masquerade of tenpence, as combated here on the last occasion, has apparently followed. As I have already said our Sybil is ever lowering the price demanded, and the next tender will be our own terms.

Hamburg, notwithstanding that it has been absorbed into North Germany, transacts business and keeps accounts by the "marc banco," an ideal unit, a nominal subdivision of a weight equivalent to 3,608 grains of fine silver into $27\frac{3}{4}$ parts. The current money is the mark current, which contains no more than $\frac{1}{34}$ part of the same 3608 grains of fine silver. The ratio of one to the other is, in round numbers, as 52 to 37. Balances of trade in Hamburgh are adjusted by transfers of credit, based on deposited silver, just as the London Clearing-house effects the like operations by interchange of cheques, in manner not needlessly to remove bank deposits. Why should not our own mint, or some national establishment in relation to it, receive gold deposits, subject to transfer in the manner of banco money, leaving depositors, wherever resident, to carry on their domestic trade by any coinage agreeable to them? The ratios of French money to a common or quasi banco unit of 10 grammes of fine gold are now submitted for your consideration; they are obviously more tractable than the ratio of 52 to 37, and yet that has never been found a difficulty at Hamburg, by any other nation dealing with that important commercial centre.* In fact, money of account is a most ancient institution. The shekels paid by Abraham, for the Cave of Machpelah, are called "current with the merchant." Our departed friend, Mr. Gilbart, referred to the fact that in ancient Greece neither the mina nor the talent was a coin. So, again, the Romans had a money of account, called the sestertium, in fact, a weight of which each coin called a sestertius was the thousandth part. Witness even now the Chinese tael, a weight just one-twelfth of our pound avoirdupois, represented by a string of 1,000 cash.

Permit me briefly to summarise the foregoing propositions:—

1. Let us have international money of account—not international coins, or legal tenders beyond the limits within which there is security for their integrity, both *ab initio* and during currency.

2. Let the unit of international money be a con-

---

* A unit of 10, 25, or 100 francs has been proposed for international commerce. If gold and not silver be intended, then such a unit has less pretension to be decimal than our English one, for its weight must be expressed by an infinitely recurring fraction of no less than fifteen figures, *e.g.*:—

·322580645161290.

A £10 unit might be exceedingly convenient, considering how immense is the amount of international commerce carried on with familiar relations to the £ sterling, as the long-accepted regulator of the exchanges. But it is safer not to have any coin unit, and the gramme will do as well as any other weight for international purposes.

* Kelly defines moneys of account to be occasionally imaginary or ideal moneys, not represented by coins, but used in keeping accounts as units adopted for measures of value. Moneys of account, with respect to coins, perform the office of weights and measures with respect to goods, or as mathematical scales with respect to maps, &c. Thus they serve as standards of the value both of merchandise and of the precious metals themselves. Kelly gives a table showing, at date of publication of his "Universal Cambist," the existence of no less than 126 moneys of account, of which several were ideal moneys only.

veniently large and easily-verified weight of gold, expressed with decimal uniformity.

3. Let our Royal mint revive its former custom of issuing mint vouchers, transferable to bearer, for gold bullion fitted to be coined, and let its weight be expressed in equivalents of fine gold by units, as also by other recognised weights, domestic and foreign.

4. Let the bearers of mint vouchers have option to reclaim bullion, or to have it coined after sufficient notice given.

5. Let the economies and facilities of the clearing-house system, based on international money of account, in form of vouchers for deposited bullion, be concerted for international commerce, with securities analogous to those upon which Scotch banks cash each others' notes.

The following exemplifies the idea of such a mint note on a so called "par" basis of—

Grammes..	8·1	=	125 grains.
„	64·8	=	1000 „
„	31·104	=	1 oz. troy.
„	453·6	=	1 lb. avoir.
Kilos.	8	=	123,456$\frac{64}{81}$ grains.

"The bearer hereof is entitled to receive on demand gold bullion in merchantable condition, certified of fine contents, as follows:— UNITS, each equivalent to £ sterling; francs; U.S. dollars; Russian imperials; Indian tolahs, &c."

If the bearer desire that the bullion be coined, he must give notice, in conformity with published Mint regulations at the time in force.

TABLE I.

Basis of a £10 Unit.

10,000 grains fine gold, contained in £885, are equivalent to 648 grammes fine gold contained in 22,320 francs.

Grains.		Grammes.		Tolahs.		Grains.
1,130	=	73·224	=	$\frac{113}{18}$	=	1,130
£		**Francs.**		**Rupees.**		**Dollars.**
10	=	252·216	=	105	=	$\frac{56500}{1161}$
1	=	25·2216	=	10$\frac{1}{2}$	=	$\frac{5650}{1161}$

10$\frac{1}{2}$ rupees correspond to a price for sterling silver of about 61$\frac{1}{2}$ pence per ounce, and to a ratio of one gold to about 15$\frac{1}{3}$ silver, a rate convenient for a double standard intermediately, and for adjustment of 21 half-rupees per £. Thus 21 old shillings represented a guinea; and 21 francs now represent ten Dutch florins, under the systême metrique.

TABLE II.

Basis:—100 grammes fine gold = 13 guineas.
Unit = £1·365 = 3 × 5 × 7 × 13.

Units.	£	Shillings.	Pence.	Francs.
1	1·365	27·3	327·6	34·4
2	2·730	54·6	655·2	68·8
3	4·095	81·9	982·8	103·3
4	5·460	109·2	1,310·4	137·7
5	6·825	136·5	1,638·0	172·2
6	8·190	163·8	1,965·6	206·6
7	9·555	191·1	2,293·2	241·1
8	10·920	218·4	2,620·8	257·5
9	12·285	255·7	2,948·4	310·

310 francs are contained in 100 grammes of 9-10ths gold; so that, if M. Chevalier's project of a ten gramme coin be acted upon in France, ten such coins will correspond to nine international units.

	Units.		£.
e.g.:—	2,376—2,000	=	2,730
	300	=	409·5
	70	=	95·55
	6	=	8·190
			3,243·240

10 grammes = 1 unit.

£	Units.	Francs.
1	·7326	25·234
2	1·4652	50·468
3	2·1978	75·702
4	2·9304	100·936
5	3·6630	126·170
6	4·3956	151·404
7	5·1282	176·638
8	5·8608	201·872
9	6·5934	227·106

	£		Units.
e.g.:—	8,374·6—8,000	=	5,860·8
	300	=	219·78
	70	=	51·282
	4	=	2·9304
	·6	=	·43956
			6,135·23196

TABLE III.

Basis:—2,700 Francs = 107 £.

25 fr. : £1 :: 107 : 108.

$$\text{Francs} \times \cdot 04 \times \frac{107}{108} = \text{£s.}$$

$$\text{£s} \div \cdot 04 \times \frac{108}{107} = \text{Francs.}$$

Francs.	Pounds.	Shillings.	Pence.
1	3962	7925	95 1
2	7925	15851	190 2
3	11188	23777	285 3
4	15851	31703	380 4
5	19814	39629	475 5
6	23777	47555	570 6
7	27740	55481	665 7
8	31703	63407	760 8
9	35666	71333	856 0

TABLE IV.

Basis:—100 tenpences = 100 francs + 5 per cent.*

Francs.	Pence.	Shillings.	Pounds.
105	1,000	$\frac{250}{3}$	$\frac{50}{12}$
210	2,000	$\frac{500}{3}$	$\frac{100}{12}$
315	3,000	250	$\frac{150}{12}$
420	4,000	$\frac{1000}{3}$	$\frac{200}{12}$
525	5,000	$\frac{1250}{3}$	$\frac{250}{12}$
630	6,000	500	$\frac{300}{12}$
735	7,000	$\frac{1750}{3}$	$\frac{350}{12}$
840	8,000	$\frac{2000}{3}$	$\frac{400}{12}$
945	9,000	750	$\frac{450}{12}$
1,008	9,600	800	40
1,260	12,000	1,000	50
2,520	24,000	2,000	100
3,360	32,000	$\frac{8000}{3}$	[illegible]

* On this basis the franc is overvalued in the ratio of about 1,009 to 1,000.

TABLE V.

Approximate Relations of English and French Standards, easily to be remembered, and available for ready reckoning. (From the evidence given by Mr. J. A. Franklin before the Parliamentary Committee on Weights and Measures, 1862.)

COIN.

1,008 francs contain of fine silver 1 lb. avoirdupois.
144 „ „ „ 1,000 grains.
144 „ $\times 15\frac{1}{2} =$ (2,232) of fine gold, 1,000 grains.

WEIGHT.

8 kilos. = 1,2,3,4,5,6 grains,
or
$(3^4) =$ 8·1 grammes = 125 grains.
$(2^3 \times 3^4) =$ 64·8 „ = 1,000 „
$(2^3 \times 3^4 \times 7) =$ 453·6 „ = 1 lb. avoirdupois.
$(3^4 \times 7 \times 5) =$ 28·35 „ = 1 oz. „
$(2^7 \times 3^5) =$ 31·104 „ = 1 oz. troy.

MEASURE.

254 mètres contain 10,000 inches.
1,016 „ „ 40,000 „
9,144 „ „ 360,000 „

[See also Mr. Franklin's explanation at end of discussion.]

DISCUSSION.

Mr. F. Hendriks said he had had the advantage of hearing many papers on this subject, but he had never heard one which had more disappointed him, because it was a paper which seemed to condemn all the views of other gentlemen, without giving any reasons for that condemnation. It was not possible for them to travel over one-half or one-tenth of the ground Mr. Franklin had gone over, but he believed that every argument that had been used, and every assertion that had been made, was capable of being answered. He was disappointed that there was nothing more practical on the subject, for only at the close of the paper was there some unintelligibly expressed scheme for a system of international bullion notes. That scheme had not even got the merit of novelty, because, within the last nine months, it had been advocated both in Paris and America. He was certain that whatever might be done in Italy and other places, where there was a want of such a thing, the Bank of England would never endorse such notes as those, with the liability to pay them always in bullion. It seemed to him that it was a paper of such a character as might have been written at the commencement of this or the close of last century. It was a general condemnation of the decimal scheme. He did not think that, Sisyphus like, they were constantly to be rolling this stone up the hill. He certainly did not think that the advocates of the decimal plan came out badly on the last occasion that the subject was discussed in that room. The result of all that has taken place in the House of Commons was that the legislature is also in favour of that plan; but even if it were otherwise, he would only observe that something like 150,000,000 of the European family were not only in the daily habit of using the decimal system of account and of coin, but that nations in other parts of the world also were giving in their adhesion to it. When we know that the teeming population of China had always used it—when we remember that India in remote times used it—when we see that there is that universal opinion in favour of it, it really seemed to him that they were going back into the dark ages of benighted ignorance again, and that they were advocating the increase of the impediments and inconveniences which all other nations were desirous of removing. He thought Mr. Franklin was wrong in making so much of the fact, as against the international coinage plan, that the Papal Government, by some mischance or other, had issued some base silver coin, or rather coin not quite up to the mark. He would only ask whether we had not instances in this country also of the debasement of coin. This was no argument against the system at all. There is a large and compact gold circulation, of no less than £20,000,000 worth of napoleon coinage, strictly metrical coin, current amongst many nations. He would defy any gentleman to produce any scheme which is more absolutely metrical than that; and with certain weights given for the different coins, it was perfectly possible for any child when educated on the decimal plan to tell what the value of the coin of any country would be. Then, again, a great deal of value seemed to be attached to the decigramme of gold, although, strange to say, that with the exception of M. Chevalier and one or two others, no one is found to back it. Some petitions were certainly presented in favour of it, but only a few, and all he could say was, it is not a decigramme of pure gold, for there was one 1-10th of alloy, therefore there were only nine grammes of pure gold. He would also beg to refer to the fact that Mr. Franklin had said M. Chevalier was opposed to the 25-franc piece. He had had the honour of being examined on a government commission in Paris, at which M. Chevalier was present as one of its members, and his impression was that he entirely approved of the 25-franc piece. He did not say that that was any argument for it, because, of course, now-a-days it would be idle to advance such an opinion, for in these times, if a thing was not good in itself, no matter how eminent an opinion might be in favour of it, it would not be adopted. Well, then, Mr. Franklin had said that the effect would be to make all things that were sold at 20 francs be sold at 25 francs. Now, Mr. Franklin was not singular in that view, for Baron Rothschild, in Paris, had held the same and advanced it, and although they were amused, they were not convinced; and the example that Mr. Franklin adduced as regards the fees of medical and professional men was against him rather than otherwise, for though the sovereign has been in circulation since 1817, yet the honorarium remains the same. Then he spoke about our liability to suffer with regard to foreign loans. He thinks we should be mulct of something we now gain. He had had occasion to make inquiries into this matter, and he found that, as to some foreign government loans, negociated wholly or in part upon the London money market, and in which the interest (payable half-yearly) and the redemption (by periodical repayment or drawing) is discharged on the assumed equivalent values of £1 in London and 25 francs exactly in Paris, the original subscription to such loans having been made in London or in Paris at the fixed exchange of 25 francs per £1, and the bonds being saleable in London or in Paris. There was the Egyptian 7 per cent. loan of 1868, payable at the Imperial Ottoman Bank in London and in Paris. The French subscriber to that loan is only paid at the rate of 25 francs per £. He can come over here and receive the equivalent of £1 for 25 francs. That is a clear mulcting to the extent of 2d in the £. He might also state that the Turkish 6 per cent. of 1863-4, payable at Glyn's, London, and at Credit Mobilier, Paris; the large loans of 1865, payable in London and at Paris, and the 6 per cent. Mires loan, and the Russian 4 per cent. of 1867, was the same, and that, in addition to these, there were many millions sterling of railway bonds in which the exchange is assumed at 25 francs = £1. In the loans which have been contracted in the present year, he confessed, the exchange had been fixed at 25·20, as it ought to be where the place of subscription is either Paris or London. In the English money market there have been contracted loans to the extent of nearly a hundred million sterling, so that under this system there is a possible mulcting of the English public to the extent of one million sterling. He would not say that it all falls to us, but still it must be plain to anyone familiar with the figures of our finances generally, that the larger portion of the loss upon these loans would fall upon us.

Mr. S. Gerstenberg (chairman of the Council of Foreign Bondholders) said he had not heard the whole of the paper, but he understood the question to be whether it would be desirable to have an international money of account, and he believed that Mr. Franklin thought it would be desirable. It seemed to him that the first necessity would be to have the gold of the different countries of the same fineness. The British and the Russian gold were of the same fineness, while the French napoleon and the American eagle were as 900 of these parts. The second question is, would it be desirable to make the inferior like to the superior, or *vice versa?* He believed that the English and Russian gold was rather of too fine a quality. It was open to greater loss from wear, while the napoleon and the American eagle would, not being so fine, better stand wear, and therefore not so easily deteriorate. Consequently, it ought first to be explained what it ought to be. After due consideration, we ought to recommend that all the gold should be reduced, for the purposes of money, to the same standard of fineness, and therefore reduce the gold of the British sovereign and the Russian imperial to a fineness of the same standard as the French napoleon and American eagle. Then his first proposition could be carried out. The second proposition was to the effect that the unit of international money should be a conveniently large and easily verified weight of gold expressed with decimal uniformity. This was a very excellent proposal, but he missed the solution in it. What is the unit of international money to be? That is what we are all fighting about. Is it to be the sovereign or the 25-franc piece. While Mr. Franklin puts the question of a unit he does not tell us what the unit is. He asks what the Council of Foreign Bondholders would say if the Chancellor of the Exchequer were to propose to reduce the value of the sovereign, and to pay them 25 francs instead of 20 shillings? Why, he would cheat us of $2\frac{1}{8}$d.; but if he were to pay us 25 francs and $2\frac{1}{8}$d. he would not cheat us, but pay what was due in a more convenient form. And, consequently, when he says, in paying him a year's dividend of £3, we should put him off with 336 instead of 339 grains of gold, the foreigner would say, "You would cheat us of three grains." Consequently, he had simply to say that while Mr. Franklin had thrown out examples and suggestions, he had left it for them to solve; while he came with the expectation that a gentleman of the great experience of Mr. Franklin would also have the boldness to come forward and lay down a plan, right or wrong, of what he recommended. He had also told them that the only person who had suffered by the exchange between the different coins now current is the traveller; but considering he gives us a list of what they are worth, he does not lose much. Everyone remembered the story of the man who travelled with a sovereign, and who, when he returned, brought back 2d., the other being lost by the exchanges. The last gentleman made some very pertinent observations as to the foreign bonds now negotiable. As he said, they would consider themselves cheated if they received less weight; so would the British investor consider himself defrauded if the foreign government paid him back with coin of less value. In such instance, the British holder of foreign stocks would simply ask for his amount of gold in a different form. What was depreciated in quality would have to be refunded in quantity. This would very easily be provided for, if the House of Commons were to take the matter up, and to legislate upon it, so that the actual amount due would have to be paid, although in a different shape or form. The Council of Foreign Bondholders is an institution to protect the interests of the holders of foreign stock, and if any action contrary to their interests were to be taken, it would be the duty of the Council to agitate the matter, and to influence the press on the subject and affect public opinion, in order that the interests they have undertaken to watch over may not be sacrificed. For instance, the Austrian government recently, arbitrarily and compulsorily, compelled the holders of a certain stock to accept a reduced interest; but the subject was brought before the tribunal of public opinion, and the matter was altered. Thus it will be always easy to force people and governments to adhere strictly to their engagements, if they are brought before the tribunal of public opinion, and if the maintenance of their credit is worth having. The hon. chairman had taken a great interest in that matter, and he felt sure that he would give an equally strict attention to the subject before them. He hoped that whenever a change was proposed in Parliament with respect to the fineness of the standard of gold, or an international coinage, or the quantity contained in the sovereign, that the principle maintained will be that of good faith in adhering to our engagements.

Dr. Farr, F.R.S., had heard with very great pleasure the able paper which had been read before them, and would rather refer to those points he concurred with than to those from which he differed. Mr. Hendriks had criticised the paper with some ability, but he thought, nevertheless, that they all might agree to the first proposition laid down, that it is desirable to get an international money of account. He had got with him a tariff of the duties payable on goods imported here, and they would see it involved a great deal of calculation, and that these difficulties necessarily threw an obstruction in the way of a free intercourse of nations, and that if all nations could come to an agreement on this subject, it would be necessarily a great advantage to the commerce of the whole world; and if any country was interested in it he should say it was this. But the question arises, what is the unit of international money to be? Mr. Franklin endeavours to give it a go-by, and talks of international account and not coin. Now, you cannot make account a legal tender, consequently he corrects himself in the second proposition, and says, "Let the unit of international money be a conveniently large and easily verified weight of gold, expressed with decimal uniformity, and that is necessarily a unit of weight if you will, or it may be a coin." Mr. Franklin will very likely say it is a weight of gold, and he properly takes 10 grammes of gold. He thought that England, like other countries, must ultimately adopt the metrical weights. It must be made the basis of our coin. It was done formerly. As to adopting another system of weights, he thought they would be able to take, as the basis of their money, a metrical weight, and a metrical weight of gold. He had lately been at the Hague, where he had the honour of representing our government, and where the matter had been discussed, and the only two that were in competition were the franc and the £. You must adopt the one or the other. The English pound he preferred to the franc, as that was too small a coin. It would not be possible, he thought, to adopt so small a unit to express the large sums that are being dealt with now; and it would be in vain to ask the people of Europe to accept our pound. But at that congress, which was under the presidency of the Dutch minister, he made a proposition which was accepted by the representatives of all the States of Europe, and it was in this form—"That the authors of the papers referring to financial and commercial matters should express values in francs and in decigrammes of gold $\frac{9}{10}$ fine, the decigramme being worth nearly 25 shillings, or 10 half-crowns." Now, in that respect, they had agreed pretty nearly with what had been proposed, except that Mr. Franklin proposed 10 grammes of fine gold. Now, he had a paper in which the Hon. Mr. Kelly introduced a measure before the House of Representatives in the United States, in which he proposed that it should be as 1 in 10, or $\frac{9}{10}$ fine. That had attracted serious attention in America, for it was recommended by the American Association for the Advancement of Science and another society, and he believed that the proposition of M. Chevalier would get almost general support ultimately. You base your money on a

gramme of gold; that will admirably suit our system as it now stands. We could coin a 25-franc piece which would be 8 grammes, and we could coin a 25-shilling piece which would be a 10-gramme piece. It would not be exactly the same, it would be a difference of 5d. in that, and a difference of 2d. in the franc piece. He thought hard words had been unjustly applied to Mr. Lowe. Mr. Lowe says the sovereign will cost exactly what it does now. No one could get a mint sovereign made for less than he does now. In England it would have the same value with an account, and it would cost the same as it does now. Take an instance, your silver costs 7s. 6d. per ounce; the silver of which it is made costs 5s. 2d.; you pay for the work. Take all your works of art. Every work of art derives its value from the skill with which it is made. Take a sovereign; it required a great deal of skill to make it, and that skill is now done at the national expense, and what was not originally charged upon those who had the gold coin, is now to be charged upon the consumers. If gentlemen would be good enough to look at the sovereign, they would find that they do not weigh exactly what they should, that they are worn considerably, and it is found that the metal of the sovereign is about 1½d. less weight than it should be. And if you go to the Bank of England they will charge accordingly, and a considerable number will be proclaimed light. He might tell them that forty per cent. of the sovereigns in circulation get light in sixteen years. Indeed, Mr. Lowe proposed, he understood, to fine any of the bankers for using a light sovereign, but it created such an alarm among the bankers that it almost ended in a mutiny in the House of Commons. But the bankers sent the light sovereigns into the country, and the heavy sovereigns are exported, therefore he did not attach such importance to this. Get a common base of money, and then you will get an international system of coin.

Mr. E. Seyd asked Mr. Franklin to explain whether he recommended that bars should be cast of a certain value for an international money of account?

Mr. Franklin said he had no desire in the matter, whether it be in grains or bars, or any form acceptable to the receiver. It was not intended to be coin; it was not a thing current. It was like a dock-warrant or a deposit receipt.

Mr. Ernest Seyd said whatever it was, it must be in a deliverable form.

Professor Leone Levi thought that it was very desirable that every one should understand that there is a certain amount of agreement, even although there may be difference of opinion upon some points, in connection with this question. They were nearly all agreed that any system of international coinage must be founded on one standard only, and that must be gold. There is not any likelihoods that this country would consent to a double standard. It is well to carry away this notion. Then they were also agreed upon the degree of fineness that the new standard gold should be—nine-tenths fine and one-tenth alloy. There was a concurrence of opinion upon this point also; and he had reason to know that at the mint they would find no practical difficulty in introducing this change as a matter of practice for manipulation. Taking these two for granted, then, there was another point upon which there was a pretty general agreement, that the coinage must be decimal. Decimal subdivision was a desideratum upon which all were pretty generally agreed. If these three points were established and carried out by the legislature, it would be something gained. If we were not to go any further, but push these three points through, that would be an improvement, and would carry us a great deal further in the way of international coinage. Now, another point upon which they were agreed was that there should be a coin in circulation throughout the world equivalent to the sovereign. It had been suggested that 25 francs should be the unit. He would say nothing about that, or whether there should be a tariff or not, but it might be taken for granted that, inasmuch as this country used the sovereign, and a very large number of countries had the use of a coin pretty nearly equivalent to the sovereign, that the coin of 25 francs should be one of the series of international coinage. Now, the only question at issue was, whether we should stop there or go a little farther. For his part, he would go a little farther, and would suggest that that coin should be reduced to 25 francs value and should be divided, instead of as at present, into 25 shillings, each of the value of ten-pence, that two hundred and fifty of these new pence should make a sovereign. Having done that, he would leave it optional with the people generally to keep their accounts either by the sovereign as it is at present, reduced as he said into 25 francs, or by the 10-franc piece, or by the 100 pence, in which case we should have a precisely equivalent coinage, not only as regards the principal units, but also as regards all the intermediate and subordinate coins, with all the nations of the world. There was one important point we should remember, that we should require uniformity not only in the principal unit, but subordinate units also, because the prices of goods from one country to another are not quoted generally by the pound, or by the dollar, but by the shilling, the pence, or the cent. If you ask what cotton is quoted by in America, you find it is by the cent. France is also by the cent, but the French cent. would not be like the cent. of America. We must have the subordinate coin equal as well as the principal unit. Now, he believed all that was wanted was just to make a small alteration in the quality and fineness of the standard, whether with a tariff or not. If a tariff is deemed necessary, the trouble consequent on it would be of little moment, and therefore let it be undergone that the ultimate good may be gained. He thought that we should confine our observations to these points, for if we diverged our attention to minutiæ, we should gain nothing. It was important that the legislature should know that they were agreed upon certain leading points.

Mr. Brown wished to draw the attention of the meeting to this circumstance, that up to that moment no unit had been suggested. Mr. Franklin had merely suggested that there should be some unit. It was absolutely necessary that somo unit should be proposed so that they might discuss it definitely, and accept it or reject it. He felt certain we must go into the question, What is the most convenient unit of account. Now, this must be expressed in some coin which will be a medium of exchange. This was necessary for the convenience of trade. Hamburg has had an international coin, without an international system of currency in accordance with it, which has never worked well. He believed our own system would be better than that. When we look about amongst the different systems of Europe to see which is most likely to afford us the coin to convert into a currency easily, we must first begin with those nations using decimal coinage generally; for we must all admit that if the sovereign were made the coin, it would be necessary to decimalise it, and not carry it on as it is now divided. But when we look further, we find there is already decimal money in vogue amongst nearly 100 millions of people, and which is divided in the most convenient manner, supplemented by a decimal coinage—he alluded to the metrical system. Unfortunately for us, when we all admit that gold must be the universal standard, the original division of the silver money into the franc was by taking five grammes of the metric system as the unit of account; he did not know why they did not take 10 grammes, which would have been a much more convenient form. The next question was, in what way can the French unit of account be reduced into coinage. And supposing gold

to be the standard, then we have in the 10-franc piece a sufficient medium of gold, a coin which, being divided into ten parts, would represent in silver ten parts of one franc each; but taking the 10-franc piece as the unit of gold, we should then get in all accounts, in all statistical documents, in all lists of prices, and in every other mode in which commerce is carried on, precisely the same thing as the French do. But over and above all that, we should, in a remarkable way, facilitate the intercourse of nations by making the unit the 10-franc piece instead of 1-franc piece—call it what you please—a sovereign, a napoleon, or what you like, but let it be the unit of account in gold. It seems, therefore, that we should very easily assimilate our own coinage into the international usage by taking the present sovereign and reducing it in weight to 25 francs value, and so having an international coin. That would be two-and-a-half times the unit. He did not think the coin was debased because you charge for its coinage. The value of coinage is in its currency. So long as it represented in this country coin that would only pass here, as a sovereign, it has an equivalent value. If, therefore, you have to give for the value of a sovereign precisely the same weight of gold, it is evident the government, by charging the price of coining it, will give the same equivalent value to that coin which is newly to be used. And he contended that, on the very principle that you do not diminish the quantity of gold put into a sovereign, you require exactly the same amount of gold and issue that. He believed Mr. Mill was very strong in his expression that the value of the coin depends upon the price of making. If you coin it for nothing, the coin is worth no more. If you charge for the making you must give an additional value for it, according to the charge. If it were necessary, he would say let us have a tariff by all means. Rather than avoid going with other nations, and facilitating intercourse with them, he would put up with the difficulties and inconveniences of a tariff. He would only say that in all the discussions some multiplication of the franc has been advocated. Meetings had been held in Paris and in other places, not under the influence of the French Association, in Berlin, and in Florence and elsewhere, and at all these places some multiplication of the franc as a representative of the metrical system, either in gold or silver, has been universally advocated. He thought, therefore, it would be hopeless to enforce the British sovereign, with its present weight and complication, as a national coin for any country. If we insist upon having the British sovereign decimally divided, we must have a different unit.

Mr. William Pollard-Urquhart, M.P., said he was unwilling at first to introduce any observations, as his experience was not very great, but as he had taken some interest in the matter he hoped he would be allowed to speak a few words. There was one thing upon which they were all agreed, namely, that it would be very desirable to have some system of international coinage to facilitate the intercourse of nations. In short, just the same reasons that have made the different cantons of Switzerland have a general system of exchange, would make it also desirable for the different nations of Europe to adopt the same means of exchange. Now, of course, all Englishmen would think it much the most convenient form if they could have the sovereign, and perhaps that would be the less inconvenient for the whole of Europe than would be commonly expected; and he would say more international contracts are made in the pound sterling than are generally supposed. But if that object cannot be obtained, the next most desirable thing would be that it should be some unit that would be quite commensurable with our sovereign. He felt quite certain that the exact fraction between the English sovereign and the French napoleon could be met, and he did not believe that it would be difficult to find some international coin that would take in both the napoleon and sovereign, and he supposed that, if we could hit upon any international coin, it would certainly be the most convenient coin; but whatever was done, he sincerely hoped we should not make the object of getting an international coin of exchange as a sort of excuse for depreciating our own standard of value. For depend upon it, our position as a nation, commercially and politically, would always depend upon our acting with good faith, far more than many believe. Now, Mr. Lowe's proposition of charging for the coinage, and causing people to purchase, has been defended by plausible argument, but he thought it would be impossible to adopt it in practice without depreciating our coinage. This argument was used in the suspension of cash payments in 1797. It was said our notes might be made of the same value, but in practice that was found quite impossible. And he believed that the same would be found in respect to our sovereigns. It would be quite impossible that the sovereign would be of the same value with a less quantity of gold. And this would be especially true to any one going abroad. Would it be supposed that a man would get the same value in Paris when the sovereign contained less gold than it does now. It is all very well to talk about Acts of Parliament making it worth so much, but every one will recollect the Act passed in 1814, when Mr. Vansittart was the Chancellor of the Exchequer, when a one-pound note and one shilling was declared equal to a guinea, while it was well known that the guinea was worth a £1 note and seven or eight shillings besides. All he could say was that, if the government meant to do that, they had better go back to the old system of £1 notes. But whatever is done, above all things let us be careful of doing nothing that would injure our good faith.

The Chairman said he felt very much obliged to Mr. Franklin for the able paper he had read, although he must say it was somewhat vague in its conclusions, and rather difficult to follow, because it was so devious. Most of the gentlemen had not been in harmony with it, and perhaps there was this advantage in that, it enabled them better to arrive at truth, and created a little opposition. He did not know anyone who had condemned it more than Mr. Brown, who sat opposite to him. He held in his hand a coin. Sir Robert Peel had said this coin was the measure of value of this country, and represents quality and weight, and if it does not represent that it represents nothing; and if any debts are contracted in pounds sterling, he should expect to pay persons the money value. And, in the same way, if he had debts owing, he should expect to be paid the sterling value. Well, then, with regard to the quantity of light sovereigns in circulation, he believed Mr. Jeavon's calculations, which had been quoted, to be utterly mistaken. They were very much less than he said, and for this there is nobody to blame but the Mint. Because if this does not represent standard gold, it represents nothing. Because if the gold loses its weight, it is not fair to make the holder lose the sacrifice. And it is the same with regard to the loss by the wear and tear. It is due to them that they have been in circulation, because the bankers and others who have to calculate the loss they sustain by locking them up or selling them at 3d. or 4d. below the value, because its value is £3 17s. $10\frac{1}{2}$d., and because it is standard gold, and that gold, if he sold it in the market, he must sell it at £3 17s. 6d., whereby he lost more than 4d. Now, that is one of the reasons why there has been so much light gold in circulation, but now the Bank of England and the Chancellor of the Exchequer have made arrangements by which the light gold will be taken by the public at a price of very nearly its standard value, and he was quite sure, therefore, that all light sovereigns would soon disappear from circulation. Now, with regard to this international money of account, and establishing a clearing-house anywhere. The clearing-house in London is established on this principle:—The Bank of England being the bankers of all bankers, a system of accounts is kept, the various claims of one against the other are adjusted, a balance is struck, and cheques are drawn for the amount. No money

change takes place, but the money A owes to B is transferred in that way. But if a clearing-house were established at Paris, Amsterdam, and Berlin, and Berlin owed money to London, the quantity of mint notes must not represent the value in mint notes, but the coin itself. The money would be wanted and it must be got somewhere. Mr. Franklin has spoken of an operation with regard to France; but the money was wanted not in France, but in London. But if the clearing-house were at Paris, the bullion must have been transferred from Paris to London, much in the same way as before the clearing-house was established. The bank had to pay in £1,000 notes the claims upon them. It must be recollected that as regards this a bank-note goes from hand to hand, and when a mint-note was lost, it would in all probability be the same thing as a bank-note lost; they would not give you the money. Nor did he see that much would be gained if they had an international money of account. They wanted to simplify accounts, and, if it was possible, to do without figures at all. He thought it was possible for Mr. Franklin to make the matter more clear with the documents and tables which were set out, but he thought it was enough to make most persons almost giddy. However, to return to the paper, he thought that gentlemen who took the trouble to write and to read papers were doing a great public service, and that it was hardly fair to come down upon them with very heavy censures, because the simple answer is, "I meant well, and only desired to establish the truth." Mr. Franklin was deserving of their very best thanks for his able paper.

Mr. Franklin acknowledged the compliment which the Chairman had paid to him. He was unable to reply in detail at that late hour of the evening, but he would say that he had felt from the first that what he was propounding would be, perhaps, scarcely listened to and understood in its full bearing out of the City, and in many points he had been very much misunderstood. He had, however, had every statement tested, and at other places he had found more accord than here. He felt very strongly that the Society of Arts, philosophical and theoretical as it was, was not quite the place to discuss such questions. There were gentlemen now present who could further illustrate the matter, but who seemed too diffident to speak. Many had altogether misunderstood the scope and bearing of the paper. It seems to have been understood that he had proposed an international coin. He had never designed that there should be a coin. He did not think there ought to be an international coin; and he did not believe they were ever likely to get one. Those members of the International Decimal Association who had spoken had expressed very discordant views, and were not agreed among themselves. It was not a question of tens, but of sixes and sevens amongst them, and he felt that they at least should have propounded something, and when they did propound he would discuss it. The unit should be a weight and not a coin, and he should be prepared at the right time to go into matters of detail. It would be unfair to delay the meeting to-night with such abstract questions. He ventured to think that when the paper was read and considered it would be seen that he had been thoroughly misunderstood on some points. Meanwhile, if there was no agreement about it, they would remain where they were, and he was quite willing to let well alone; and he said deliberately that the only chance they had of keeping accounts with their correspondents elsewhere, was in a money of account, and not in an international coinage.

Mr. Franklin writes to supply an omission, and to render sufficiently obvious what are the monetary units suggested for international accounts. The particulars set forth below had been chalked up behind the Chairman's seat, but possibly not seen at a distance. They were not read out of the appendix to the paper, because a printed slip containing them had been circulated in the room.

INTERNATIONAL UNITS OF ACCOUNT.

(*Alternatives.*)

No. 1.

£10, containing 1,130 grains fine gold.

Grains.		Grammes.		Tolahs.		Grains.
1,130	=	73·224	=	$\frac{113}{18}$	=	1,130
£		Francs.		Rupees.		Dollars.
10	=	252·216	=	105	=	$\frac{56500}{1161}$

No. 2.

100 grammes fine gold = 13 guineas.

10 „ „ = £1·365 ($3 \times 5 \times 7 \times 13$).

Units.		£		Francs.
1	=	1·365	=	34·4
9	=	12·285	=	310 (100 grammes $\frac{9}{10}$ths gold).

No. 3.

2,700 francs = £107.

25 fr. : £1 : : 107 : 108.

No. 4.

8 grammes = 123·456 grains $\frac{11}{12}$ths fine.

£1 + $1\frac{5}{9}$ per thousand.

The £10 unit, as a first alternative, involves no departure from the pound sterling of account already accepted by other nations in international commerce, the exchanges, &c. Its embodiment, containing 113 grains of fine gold, is the coin of our home trade, not for exportation or currency abroad.

The 10 gramme unit, as a second alternative, could be coined by the French at their pleasure. 10 pieces, each containing 9 grammes of gold and 1 gramme of alloy, would correspond to 9 units of account at £1·365 each. We could not incur obligation to accept them otherwise than as containing bullion equivalent to 13 grammes per 10 units.

Another fifteen years will pass over before the International Decimal Association can agree amongst themselves upon the weight, value, name, or other essentials of international or universal coinage. Meanwhile, we can afford to remain as we are, and keep what we have got, decimalising it when convenient.

Mr. Hyde Clarke writes:—As on account of the close of the discussion I was unable to speak last night, I offer some observations now. From this, however, I might be deterred, as Mr. Hendriks lays it down that all enlightened men of all nations have determined to enforce the metric system, and reject all other. Enlightened men, and probably a majority, differ from him, and Mr. Hendriks himself avowed that no man, and no body of men, is to be accepted against truth. The denunciations of Mr. Hendriks have the less weight because, although he has said Mr. Franklin's propositions are impracticable, he has himself supplied a caution by his statement; they are not new, and, as Dr. Parr has shown, there are practical propositions of this character, as well as the impractical American plan, which differs altogether from that of Mr. Franklin. The American project proposes that all solvent states shall guarantee the notes of all insolvent states. Mr. Franklin's proposal is simply that we shall guarantee bullion notes when the bullion is in our possession. This distinction, the distinction, in fact, between the limits of international and national interest, is not sufficiently recognised. While the benefits of international arrangements are to be admitted as an element of

progress, so must the development of the individual nations be provided for, without abandoning every interest for international objects. In fact, it is only by the development of each nation, as a unit in competition with others, that the general standard can be raised. In our case, while by such exertion the prosperity of this country has been raised, so may it be ruined by the abandonment of its local advantages for a share in international benevolence. In this respect, Mr. Franklin's proposition, in its bearing on our interests in connection with our bullion market and our money market, is of great importance; it would accomplish the general objects, save us from the disadvantages, and materially strengthen our resources. So far as the international purposes are concerned, the bullion-note will accomplish them, as it will represent every measure of value. Mr. Franklin has, it is true, been subjected to some criticism, because he has not explained the details of the calculation of his bullion-note, but, as it appears to me, this criticism is really dependent on the misapprehension that the bullion-note is to be convertible into the coins of all nations. The bullion-note is, however, to be convertible solely into English sovereigns. So far as Russian gold is concerned, the English and Russian standards are the same, but the question may arise in other cases how far a unit of pure gold is to be affected by the varying alloy required for its conversion into the coins of the various countries. Although an English bullion-note may be made to represent so many francs or so many dollars, yet a bullion-note issued at Paris or Washington may differ in some respect as to the relative number of coins in relation to the local mintage. If there be any slight defects or trifling variations from a theoretical standard of uniformity, yet these defects are preferable to those consequent on the displacement of our own standard by the metric standard. The theoretical standard of absolute perfection claimed for the metric system has no more existence in fact than it has any support from natural phenomena, or the traditions of the human race. It is a delusion to seek absolute perfection instead of relative superiority; and the attempt to attain such absolute perfection is attended with corresponding inconveniences. The comments of an apparently hostile critic are those which appear to me to be the most effective in relation to change of standard. I regret greatly that Mr. Gerstenberg did not deal with the question of bullion notes, on which he is well qualified to give a valuable opinion. He expressed a preference for an international gold coin of 25 francs, which may, however, co-exist with bullion notes, and after all, the proposition of bullion notes is one that is independent, and may be carried out as a separate measure. Mr. Gerstenberg devoted his chief attention to a subject on which he speaks with great authority, that of our interest in foreign bonds. After demanding for the holders of consols a compensation and adjustment of their holdings and dividends, representing the three grains of gold in Mr. Lowe's proposition, and thus requiring a troublesome decimal for transactions relating to 800 millions of our debt, Mr. Gerstenberg demanded the same legislative expedient to be applied to the coupons and dividends on 500 millions of foreign bonds issued on the London Stock Exchange. Mr. Gerstenberg did not enter into all the details, or we should have learned from him that this affects a further amount of stocks and an additional amount of foreign railway and other shares without that ratification which Mr. Gerstenberg said the Council of Foreign Bondholders would demand. The foreign governments would be able to remit to this market for the payment of their debts 336 grains of gold instead of 339. Here I may observe that Mr. Gerstenberg has furnished the answer to an objection of Mr. Hendriks'. The latter thinks that an artificial or arbitrary alternative par of exchange of 25 fr. or 25 fr. 20 c. must inflict a loss on the English holder, but the cost of the operation has to be defrayed by the foreign government. As any loss in the respective exchanges must fall on the foreign governments, so would they profit by any gain, if an alteration in our standard without compensation enabled them to pay not only coupons but principal at 336 grains instead of 339. This would mulct the English holder, undoubtedly, but by mulcting the foreign holder of English sterling bonds it would injure the character and prestige of our market. Such compensations would therefore have to be given, and after compensations shall have been awarded to the holders of consols and Mr. Gerstenberg's *protegés*, it may be relied upon that the holders of all rent-charges, annuities, and rents, would demand the same readjustment. On the present occasion this is the point particularly to be observed, that an alteration in the standard, either on Mr. Lowe's plan, or the metric plan, will not only be injurious to our interests, but, as a matter of account and computation, will unsettle our transactions and operations. Benefit there may be and will be on the other side, but the benefit will not correspond to the disadvantages. The introduction of an international coinage into any country brings its disadvantages, but in this country they must be of a very serious character. Looking at the matter in a practical banking aspect, an international coinage would expose us to consequences even more serious than those stated by Mr. Franklin. Those affecting the deterioration of the coinage I regard more seriously perhaps than he does, because the parties to the metric international conventions will include the small South American States, Greece, and other communities which have not yet reached the highest standards of political organisation. These evils are only contingent and partial, but with an international coinage we should have the country flooded with bullion or denuded of it for the purposes of speculators, by the vicissitudes of war elsewhere, or the contingencies of some distant famine. These would be aggravated by our present Bank Act; and, in fact, as coin now in most countries is only one element of the currency, particularly only so in relation to paper, we should have disturbances as yet unparalleled in financial history. Of course, we have no experience of these, and few in this country can estimate their effect, but there are many of us who have seen the bullion operations in smaller markets abroad in connection with the case of a foreign coinage. In this respect our means of preservation and defence consist in the use of a local currency, and, for international purposes, the adoption of a bullion-note, that proposed by Mr. Franklin, or something corresponding to it. If that of Mr. Franklin be adopted, it will contribute, as he says, to the great advantage of this country, and may be the means of restoring the supremacy of our bullion market, now so seriously affected by that of Paris since the establishment of the French line of steamers to South America, bringing bullion direct to France, instead of to England in transit. This market as a place of deposit has the advantage, and it would become the depository of the world, and the seat of a profitable transit trade. It is dangerous to differ from those present having a right to speak from experience, but the basis of Mr. Franklin's plan rests on long experience, that of centuries, in the Bank of Hamburg; and the more the whole subject comes to be considered and discussed by those having practical knowledge, the more will the danger be appreciated of displacing our standards for a metric system, which is not, as its advocates put forward, the sole representative equivalent of a decimal system.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

Her Majesty the Queen has expressed her intention

to give a prize of 1,000 francs (£40) for the best fan, painted or sculptured by a female artist, under 25 years of age, and exhibited next year. The competition will be international.

The Commissioners have requested Lord Bury, Lord Elcho, and Sir Coutts Lindsay, in concert with Mr. Boxall, R.A., and Mr. Redgrave, R.A., for painting, and with Sir William Tite and Mr. Beresford Hope for architecture, and with Mr. Westmacott, R.A., and Mr. John Bell for sculpture, to advise what steps the Commissioners should take for appointing judges to admit works of art in the next year's exhibition. All the several committees have met, and have made their reports.

A conference of representatives of the various trades connected with the manufacture of woollen and worsted fabrics was held in the Great Room of the Society of Arts, on Tuesday, May 17th. The chair was taken at 12 o'clock, by the **Viscount Halifax.**

The following gentlemen were present:—James Allan, John Atkinson, W. J. Barron, Wm. Botly, J. P. Burr, J. H. Cambridge, V. Cardon, Edwin Chadwick, C.B., Henry Cobbett, T. Cuffs, James Curtis, C. S. Edwards, Francis Farr, James Ferrabee, B. Gadsden, Samuel Gibbins, Peter Graham, William Hall, James Harding, S. Hawksworth, G. R. Heaver, Isaac Heywood, E. Hoff, Chandos Wren Hoskyns, M.P., George Hyatt, Charles Joye, D. Law, J. F. Lawton, Henry Lee, David Lloyd, Thomas McGregor, Joseph Naylor, R. W. Paget, G. R. Peerless, William B. Pullar, B. Robinson, W. J. Rogers, W. F. Rolfe, Ralph Simons, R. S. Sly, J. H. Smalpage, Turberville Smith, J. Sparrow, Edward Tattersall, P. Toohey, Charles B. Vignoles, Robert Venables, H. Wheeler, J. Whitwell, M.P., W. L. Williams, H. T. Woodward.

The following firms were also represented:—Ashwell and Ormond, Brangwyne and Co., Bruton and Lewis, Burr and Son, Thos. Cook, Son, and Wormald, M. Davies and Co., Dawn and Co., Domlier and Co., Doubleday, Son, and Co., Edward Early and Son, Gleeson, Smith, and Co., J. T. Gledhill and Co., Gower, Woodward, and Co., Daniel Biddle Haywards, Charles Hooper and Co., Hindley and Co., Inglis and Tinckler, Jas. Pearsall and Co., Pim Brothers and Co., Jas. Platt and Co., David Speers and Co., Spreckley, White, and Lewis, Jas. Templeton and Co., Thomson and Son, Unwin Brothers, Thos. Wain and Co., T. Watkinson and Sons.

Viscount Halifax, in opening the proceedings, said that although no doubt all present were aware of the general purpose of the meeting, he might state shortly the reasons and objects with which they had been called together. Great exhibitions, commencing with the one of 1851, were sufficiently familiar to all, and they had assisted materially, he might fairly say, in developing and improving the industries of all great producing countries. If there were any fault attached to them, it was perhaps the great size of the building, and the multiplicity of objects, by which at any rate the unintiated were sometimes bewildered and confused; and it had been thought, therefore, that it would, upon the whole, more promote the progress of industry and the improvement of manufactures if exhibitions were instituted, not at intervals of years, but annually, on a smaller scale, not combining so many objects, but a smaller number carefully selected. It had been determined, therefore, to have annual international exhibitions, under the direction of her Majesty's Commissioners of the Exhibition of 1851, the first being intended to be held in the spring of next year. The first division would consist of objects of fine arts, whether applied or not applied to objects of utility, which would be continued every year; but with regard to objects of industrial art, they were in this first exhibition to be confined to a specified number of branches of industry in each year, taking them in their turn, until every branch had had an opportunity of displaying the products peculiar to itself. The branches of manufacture and machinery which had been selected for the exhibition of next year, were pottery, and all kinds of woollen and worsted fabrics, together with all kinds of educational works and appliances. Of course, the branch with which his hearers were most acquainted was the woollen and worsted fabrics. He felt it to be an honour to preside over the present meeting, and he hoped the interest which he took in all matters connected with the West Riding, would be a sufficient guarantee that his best endeavours would be used to further an object so intimately connected with the district with which he had been connected all his life, and in which he could never fail to feel the greatest interest. One feature of the forthcoming exhibition would be, that not all goods would be admitted, but only the best specimens of every kind—selected specimens which were superior to others for some reason or other—they might be better, they might be cheaper, they might be more beautiful or more durable, whatever their peculiar quality was, it was to be taken into consideration, but the best of all articles of each description would be selected and shown. This might be illustrated by the way in which the pictures were selected at the Royal Academy—a great number were sent in, but the best only were selected by some persons most qualified to judge. No prizes would be given, because the admission in itself would be in the nature of a prize, it being a proof that, in the opinion of competent persons, the article exhibited was superior to its neighbours. Another distinction proposed was that, instead of sending in articles in a lump from Bradford, Westbury, or any other place, each description of product would be so classed as to bring into juxtaposition all articles of the same description, whether coming from the north or south of England, or from abroad, so that persons visiting the division might have an opportunity of comparing articles of the same kind, making up their own minds which was the best, learning from comparison which they thought most desirable, or in what way those not quite so good might be improved by being assimilated to those which the spectator would have the best possible opportunity of comparing with them on the spot. The commissioners would provide glass cases, stands, and everything of that kind, and would be responsible for the general arrangement. A report would be published as soon as possible after the opening, which would be of great advantage to persons visiting it at a later period. These rules would be common to all articles to be exhibited, but a list had been published separately for woollen and worsted fabrics produced in the United Kingdom or abroad; and the great object of calling the present meeting was, first, to invite co-operation in order to produce the best exhibition possible in this country, and next, to invite any suggestions as to the proposed rules, which had been drawn up to the best ability of the commissioners, and, lastly, to ask how they thought competent and impartial judges of the articles to be exhibited could be best obtained. One notion was that the chambers of commerce in different towns might be invited to select or recommend a certain number of persons. It might be done in other ways, but those are points on which the Commissioners would be glad to have any suggestions made by gentlemen present, who were supposed to represent in various ways the different interests concerned in the exhibition. If there were any points on which the meeting required explanation of the rules, Lieut.-Col Scott or Mr. Cole would be able to give it more fully than he could do; but, he might add, that any suggested alterations would receive the fullest consideration, as had already been done in the case of the fine arts, for several modifications to a small extent, not inconsistent with the general principle of the exhibition, had been made in accordance with suggestions offered at a recent meeting.

Mr. Chandos Wren Hoskyns, M.P., said he was not in a position to offer any suggestions, or even to ask any questions, with reference to the rules; but in order that the discussion might be opened, which he had no doubt would lead to very material and useful additions to the rules, he would venture to say a word upon the subject of this great exhibition. He happened to be a very old member of a Society which held annual exhibitions in the country, and which had looked upon this mode of encouraging trade as being one of the most valuable which could be devised. He was old enough to remember when the construction of agricultural implements was almost confined to the village blacksmith and carpenter, and he was now able to see how, by the simple operation of annual exhibitions, a system of manufacture had grown up which almost obliged the manufacturers to put upon every one of their implements, not only the town where they lived, but also England at the end of the address, because over the whole world were scattered the customers for whom they now provided these implements. The society to which he referred began by a system of prizes consisting of money payments, medals, and so on, but from the effect of this plan upon the minds of the exhibitors themselves, they had gradually become disenchanted of that mode of attracting emulation, and had found more and more that the honour itself was the best of all rewards for the successful manufacturers. Therefore, he heartily approved of the system, which had been so well explained by his lordship, of the modes by which wholesome and honorable emulation would be promoted by the operation of these exhibitions. He happened to belong to a county which once was most celebrated for wool, the county of Hereford, where the old Ryland flocks used to provide a fleece so exquisite, the lustre of which was so great, as to give it the name of Leominster ore, meaning that it was as bright as gold, and although modern improvements in manufacture had made these short, bright fleeces less valuable than they were, because by the admirable manipulation of machinery a long staple could be equally well wrought into cloth as fine as that which required formerly the staple only to be found on the backs of Merino sheep, in Spain, and of the Ryland sheep in England, that natural superiority had gradually ceased, and the skill of human invention had triumphed, as it alway would, and enabled the more common fleeces—which were more productive, and therefore more suited to clothe the million—to take the place of those which formerly possessed these natural advantages. He must say that he hailed with gratitude these triumphs of art, which made the productions of nature applicable to the comfort of large numbers, instead of being merely confined to the wealthy. The ancient mode in which the woollen manufacture was encouraged in England was by insisting upon the dead being all clothed in it when they were buried, but we had now improved upon that system, and, instead of embalming those who were gone, we now embalmed the living inventor and the living improver, and no one could doubt that this was a far more effective system, and one much more in accordance with the true principles of political economy.

Mr. John Whitwell, M.P., said there was a reference to new machinery for woollen and worsted fabrics, and he should like to know therefore whether it was intended that this machinery should be shown in motion. After carefully looking over the programme, he could suggest no improvements whatever in it, for everything which was not specially included seemed to be comprehended in the non-classified department. He could, therefore, only express his great satisfaction in the proposal which was now made to the meeting. They all knew that past exhibitions had incurred an enormous amount of wasted labour and attention on the part of visitors, and the selection that was now going to be made of the best of every description of articles, was the best thing which could possibly be done, in order that England might have, which he hoped it would continue to do, the best fabrics open to the public for instruction as well as for admiration. If it were open to him to do so, he would like to move "That the plan and rules proposed be adopted by the meeting."

Mr. Edward Hoff, as a member of the carpet trade, said he should like to ask whether, in the selection of carpets, a choice would be made according to the rules of the Society of Arts, viz., that a carpet should be, according to the strict rules of propriety, merely a groundwork, or whether such carpets should be admitted as manufacturers were obliged to make in order to sell. Mr. Whitwell would bear him out that manufacturers were not able to confine themselves to what they knew and believed to be the proper form and colour as a groundwork for a room. They all held that a carpet should be used simply to set off everything else in the room, and not be seen of itself, and, therefore, he would ask whether this rule would be adhered to in the selection of carpets for exhibition, and also whether those to be exhibited would be hung upon a flat surface, as had been the case in previous exhibitions? A carpet that would be seen very well on the ground would not be seen at all hanging on a wall, not being made for that purpose. If carpets could be shown so as to be looked down upon from a higher room, then they might show those which were fit for a floor, and those only which were constructed on proper and right principles for such a purpose might be selected. He begged leave to second the resolution.

Mr. Henry Cole, C.B., in reply to Mr. Whitwell's question, said that it was intended that machinery for the woollen manufacture and also for pottery, which were the two manufactures to be exhibited, if need be, should be in motion. Whether it would be in motion or not would depend in the first instance on the manufacturer. If he desired it, and if the judges admitted the object as presenting some novelty and some interest, it would be kept in motion. With respect to the question as to carpets, two broad principles should be adhered to. The one was that, if a carpet were exhibited as an object of art, and of course they knew perfectly well that carpets made at Aubusson, and also some of those made by Sir Francis Crossley, whether right in principle or not he would not say, were produced as objects of art—if one of this class were submitted, something which looked like a piece of tapestry, the judges, who were appointed as artists and connoisseurs, would say whether it was such a carpet as was proper to be admitted. If a Turk or an Indian sent a carpet, saying that he submitted that as a work of art for beauty and arrangement of colour, he had no doubt the judges would deal with it as they ought to do. Whether they would lay down any rules about flat surfaces or anything of that kind, he was not in a position to say. They were not yet appointed, and they must consequently wait till they were, to see what rules they would lay down. With respect to the question of exhibiting carpets, no doubt common sense pointed out that they ought to be exhibited on the floor, but it was extremely difficult to find floor enough to exhibit every possible carpet. Whether the committee whose function it would be to arrange such matters could devise any plan by which, in rotation, carpets could be criticised on the floor, was a problem he must leave them to determine. He entirely agreed that a carpet should be put on the floor, but as acres of carpets would be exhibited, and as the acreage of floor was very limited, he must leave that question to be settled by the judges whose business it would be. He could conceive that, as in an exhibition of horses it is customary to trot them round, so they might in some way trot round the carpets in a given space, in order that the public might be able to see them in their natural position.

Mr. Peter Graham said, after reading the regula-

tions framed for the purpose of the ensuing exhibition, he was bound to say that they appeared exceedingly well considered, and he could not suggest any improvement. He would, however, throw out, for the consideration of the authorities, whether it would not be desirable, where an exhibitor did not happen to be the manufacturer of the article which he exhibited, to attach the name of the manufacturer to it; and in cases of artistic manufacture, to fix the names of the respective workmen, or the name of the artisan himself? That was the course which had been taken by his own firm on former occasions, and it had been found of great advantage in exciting emulation amongst artisans in the production of these things. With reference to the doctrine laid down about the art-principles of carpet-manufactures he must say he dissented from it a little. He thought a carpet should be seen, that it should be itself an article of beauty (though by that he did not mean that it should have large gaudy flowers, and deep shadows). It was perfectly clear that the treatment of it should be flat, and as far as possible or entirely without shadow. That might be laid down as an incontestible principle, but that flowers were to be excluded altogether, he could not at all admit, and he believed very few would hold that extreme doctrine.

Mr. Cole said the list of trades mentioned in the programme had been taken from the "London Directory," and then sent round to the various chambers of commerce, with a request that they would make any additions which they thought necessary. He supposed, taking the "London Directory" as gospel, that there were people in England called cloth-pressers, cloth-drawers, and cloth-frizzers, although he did not know what it meant, and also cloth-fullers, millers, printers, waterproofers, workers, and cold-pressers. Each of these, he supposed, had a process of its own, which constituted in some way a distinct branch of trade. He did not at all know what was meant by cloth-frizzers, but he supposed in some way it constituted a speciality, and it was the desire of the commissioners that a cloth-frizzer should appear with his speciality, and if he had a process which was comparatively unknown, which was undergoing improvement, which could be done better this year than the year before, that he should call the attention of the merchants and manufacturers to it. He might send perhaps a portion of the instrument by which he frizzed, or he might have some new process of doing it, and, therefore, the object of this great subdivision was to enable everybody who lived by his trade in any minute and microscopic way to come and exhibit the speciality, if he thought fit to do so. There was the shoddy manufacturer, and he thought, according to the reasons given by Mr. Hoskyns, he must even approve of shoddy. He had said that his county did not now compete in the beauty of its fleeces, because science and art had stepped in and made other common fleeces as useful as those more beautiful ones, and so in the same way any exhibitor who made use of this despised material, and turned it to account enabled some one to get a coat who possibly would not have one otherwise. He ventured to hope that they would have shoddy manufacturers appearing in the exhibition, and if, indeed, they could take something lower than shoddy and turn into good account, he would be doing good service by making his process known. He would not go further into details, but it was desirable that each trade should stand on its own merits, and put in an appearance if possible. He might, however, draw attention to the distinction between woollen and worsted, for, although the State managers of commerce, so far as collecting customs and making statistics in Board of Trade returns were concerned, had not yet recognised any distinction between woollen and worsted, he was told that there was as much distinction between the two as there was between Bradford and Leeds. The worsted trade, therefore, had been separated from the woollen, and in it a great number of minute subdivisions had been made, many of which he did not understand, but no doubt they represented matters of commerce which he hoped would appear in the exhibition. Then next came the question of the quantity to be exhibited. In former exhibitions, the exhibitor had endeavoured to show all that he produced, but in future, on the contrary, every object was to come with a reason given for its appearance. They did not want cloths that you might go and buy in any shop, for in all these matters commerce could take care of itself, but if there were any specimens of cloth made from a new material, or any mode of improving by which increased economy or increased beauty were obtained, that would be eagerly welcomed. That is the one thing wanted, and he did hope, as trade went on—and he was happy to think it was reviving—there would be a great many new points in the woollen trade of snfficient importance to be brought before the knowledge of the world, and to be exhibited next year.

The resolution was then put and carried unanimously.

The Chairman said the next question was as to the mode of selecting judges, or those who were to determine as to each article, whether or not it was worthy of admission. The space being limited, there could only be room for a certain number of each article. There was a notion that chambers of commerce might be requested to appoint or select persons to judge of the produce of the respective towns, the Leeds Chamber of Commerce appointing judges to determine as to the cloth produced there, and the same with other places. But in some places he feared there might not be chambers of commerce, and he should be very glad if gentlemen present could give any information which would assist the Commissioners in this important part of their duty.

Mr. Cole said it might be easy to ask chambers of commerce, where they existed, to appoint judges; but as he had no doubt that more than half the trades which could exhibit, if they thought fit, were located in London, it was not so very easy to see how they could get, except from a despotic nomination, a jury for this purpose, and therefore any suggestions would be very acceptable. For instance, would it be a good plan to go to the old City companies? He was not at all certain about that; for he had heard it said that there were companies in which, although they bore the names of trades, there was not a single representative of those trades. There was no chamber of commerce in London, and it was therefore quite a puzzle to know how to proceed, and he should be very glad of any assistance.

Mr. Chandos Wren Hoskyns said the Royal Agricultural Society were obliged to have judges of every description of stock, and of agricultural and other implements, and the mode in which that was accomplished was by appointing a committee of selection, which sat in London, and invited the names of judges to be sent to it from the different parties who were most competent to nominate them. For instance, they would ask Herefordshire to appoint a judge of Hereford stock, and the Channel Islands in the same way, and if there were two or three judges mentioned, the committee, was generally able, with some little assistance from the locality, to select those which might be best able to carry out the object in view. He should think, bearing that analogy in mind, the same end might be accomplished here, if a committee of selection were appointed, and he had no doubt many gentlemen present would be fully competent to form a body of that kind, and would be able, by inviting assistance from Leeds, Bradford, Halifax, and different localities, to recommend, as judges of each particular material, gentlemen who would command general confidence. If more names than necessary were sent in, it was a much easier task than might first appear to winnow out those who were not the most competent, and to select those who were best qualified

Mr. Peter Graham thought Mr. Hoskyns' suggestion was a very good and practical one. It was a very good principle that Chambers of Commerce should be requested

to nominate such men as they considered competent in their respective trades, and this was very much like what had been done in connection with former exhibitions, and, for his part, he saw no better way of proceeding.

Mr. John Whitwell thought it would be quite impossible to take the nomination ultimately out of the hands of the commissioners, for no chamber of commerce could prescribe who should be judges of any special article, unless it were a very limited one indeed. He belonged to the Associated Chambers of Commerce, which comprised forty-two chambers, and therefore, if all these were asked to send names, the selection must finally be left in the hands of the Royal Commissioners.

The Chairman did not see how it was possible to avoid the final selection being left in the hands of the Commissioners, but they were very anxious to receive every assistance they could from interested parties, so that the selection might be as good and complete as possible, and comprise the most competent and impartial persons who could be found in the country. However, he believed, judging from past exhibitions, that the mode in which these matters had been conducted had given pretty general satisfaction, and would entitle the Commissioners on this occasion to the confidence of all parties interested.

Mr. Bull (of the firm of Messrs. Bull and Wilson) said he thought it would be desirable if some other gentlemen connected with various branches of the trade would do as he was about to do, go through the list and see what could be left out, for thus the labours of the commissioners might be much lightened. In the first place he saw "Blackwell-hall factors;" now it was impossible they could exhibit anything unless they exhibited themselves. They were a class of persons now employed by manufacturers to dispose of their goods in town; some hundred years ago they formed an influential body, by whom all cloths were measured, and if any dispute arose between the seller and the purchaser, it was referred to them to settle; but the race was now fast dying out. Although, however, they could not exhibit, they might be useful as judges. Cloth factors and merchants were in much the same case; they received goods from the manufacturer in Leeds, Huddersfield, and so on, and disposed of them in London. Cloth-finishers would have to exhibit cloth made by other people, and he did not know to which the honour would be due, the manufacturer or the finisher—probably the latter. Some manufacturers finished their own goods, but there were such constant improvements taking place in machinery, that, as a general rule, it was much cheaper and better for the manufacturer to employ a finisher who could adapt himself to these improvements, than to finish his own goods; he referred, of course, to the best materials, not to shoddy or things of that kind. In Leeds there were a great number of these finishers who put a face upon the foundation which others had made, and these men, or some of them, would probably exhibit very fine cloth with their "patent finish" upon it, or something of that kind. "Frizzers," he supposed, meant those who friezed or put a nap on cloth; this was a process which was undergoing constant changes, but excellency was required, and no doubt it should be included. If a man were to frieze a cloth as the Irish friezed it, it would not be the same article. It would not be an Irish frieze, but it might be good in its way. Beavers were napped or friezed, and there were several eminent manufacturers, particularly in Germany, who produced a very beautiful finish upon these cloths, with a very small and close nap. Cloth-fullers were not likely to exhibit, inasmuch as this was a very dirty process, which could only be carried on at the manufactory, unless any one exhibited a machine by the aid of which he could full better than anybody else. He did not know how cloth-workers would appear, but they were, in some respects, the enemies of cloth manufacturers. The latter put a beautiful finish on his cloth, which was, however, sometimes liable to be spoilt by rain, which was of course objectionable. The purchaser, therefore, sent it to a cloth-worker, and he put it into a wet sheet, which, in his (Mr. Bull's) opinion, spoiled it; but still it was the custom to have it done. He did not think merchants would be exhibitors, but from amongst them he had no doubt that some good judges of the various classes of goods might be selected.

A Gentleman in the room suggested that the wholesale City houses might render assistance in the selection of judges. There were hardly any things mentioned in the printed list which were not sold by large houses in London, Manchester, Glasgow, and other large centres of commerce. Each of these large houses was divided into departments, and each department was under the superintendence of a buyer, who had the selection of the whole stock in his own department, and he, of course, must be a good judge of those things which constantly passed through his hands. In the case of Irish frieze, the buyer must look to the finish of it when it came in, and if he saw that, though of good quality, it would shrink with rain, he must send it to be shrunk. He must, therefore, not only be a good judge of the stuff itself, but also of the stuff as regarded its wear and its suitability for the purpose to which it was intended, and as to whether the cloth shrinker and finisher had done their work properly. He suggested, therefore, that wholesale houses should be asked to mention the names of gentlemen in whom they had confidence as good judges of any particular department, and who would be willing to lend assistance in the forthcoming exhibition.

Another Gentleman fully concurred in the suggestion just made, that buyers from the City and West-end houses should be asked to assist as judges, for they were in the habit of visiting all the principal manufactories, and often gave them ideas which they carried out. He also thought it would simplify matters if all the classifications, from cloth-drawers downwards, were included under one heading.

Mr. Cole said Mr. Bull had seemed to imply that a merchant could not be an exhibitor, but in this he could not agree with him, and he was confirmed in this view by an opinion he had heard from Bradford. Sir Titus Salt, to whom he put the question whether he would be an exhibitor, said no, he should not, because he only did a certain part of the work, that his alpacas and other articles of that kind were bought by the merchants, who finished the process, and they were the persons who ought to exhibit. And his opinion seemed to be, not that the producer should exhibit, but that the completer of the process, whoever he might be, should be the exhibitor; and then they even carried the principle farther, and proposed that the ultimate exhibitors should be the chambers of commerce, constituted of the merchants in each particular district. Of course, everyone must judge for himself, but he considered it quite possible that some gentlemen in wholesale houses might have some notions of their own, or might be in possession of something which they might choose to exhibit, giving full credit to the manufacturer, finisher, and everyone concerned in the operation, so that, if Sir Titus Salt's view prevailed, the merchant would exhibit, giving to Sir Titus credit as the weaver, and somebody else as the finisher. He could not conceive of any gentleman present engaged in the commerce of worsteds and woollens, but that, if he looked around, he might find something novel and interesting, of which he might say, "That shall be my exhibit; it is quite true it comes into my warehouse from Glasgow, Bradford, or elsewhere; the fleece has been grown by one man, woven by another, and made into carpets by somebody else, but it has come into my premises, and I will take the trouble of being the exhibitor."

A Gentleman said he might throw some little

light on the word "merchant," and thus reconcile two opposite views. Sir Titus Salt's "merchant" was really a warehouseman, though it was customary to call them merchants; but a London merchant, in the proper sense of the term, who exported and imported goods, could not, in the ordinary nature of things, be an exhibitor. With reference to a remark that had been made, he agreed that a great many of these designations might be usefully left out, but a cloth-dresser and a cloth-finisher could not be considered as one, their functions being perfectly distinct. On the other hand, he could not understand that there was any difference in a flushing manufacturer and a woollen flushing manufacturer.

Mr. E. S. Minton (Hanbury and Co., Aldermanbury) begged leave to suggest, in addition to what had been proposed by a previous speaker, that the jurors should, to some extent, be selected from the buyers of wholesale houses in London, Manchester, and elsewhere; that the selection should be also extended so as to include the buyers in large retail houses. And this was not merely a gratuitous extension of the principle already suggested, for he had a reason for making it. His firm were producers of special goods, which had to be placed almost directly before the large retail houses, because, in many instances, their cost was so great that wholesale houses could not touch them. The producers were, therefore, compelled to go to the leading houses at the West-end and in the provinces, and he would, therefore, suggest that, in order to give that class of goods a fair chance, a juror from this class should be included. The main portion of the value of these goods consisted in the taste exercised in their production and in their saleability, the raw material being a comparatively trifling element in the cost. It was therefore those who come into communication with the consumers of these articles, and who had to study the tastes and wants of the community, who were best able to judge of their value.

A Visitor thought this a very good suggestion. In the carpet trade there were none more competent to give an opinion, both as regards quality and taste, than the highest class of decorators, the men who dispensed the goods to the public. They to some extent guided the public taste; manufacturers had to consult their views in bringing out designs. He would, therefore, suggest that some of this class of men be requested to act as judges.

Mr. Cole said he supposed there would be no objection to the man who paid—the purchaser—having some voice in the matter. He mentioned this, because at a recent meeting to consider the selection of judges of works of art, there was an almost unanimous feeling in favour of a mixed jury of artists and purchasers.

The Chairman suggested that it would be a good plan if any gentleman present would put down on a piece of paper, and hand it in to him, the names of any persons whom they thought competent to act as judges on any particular subject. He would then hand those names to Mr. Cole, and the list might be some guide to the Commissioners, for it was clear that the ultimate selection must rest with them.

Mr. Cole said he should be very glad if the suggestion were carried out. It would be bringing the business of the meeting to some kind of practical conclusion, which would be very useful. A good deal of trouble had been taken to invite gentlemen particularly connected with the woollen and worsted trades, and he did not think there would be such a good opportunity again.

Mr. Graham asked if any gentlemen who might be appointed judges would be thereby disqualified from exhibiting.

Mr. Cole said this was a new point which had not yet been considered; but, taking the analogy of the Royal Academy, he saw no reason why judges should not be exhibitors.

Mr. Ferrabee wished to ask in what way the machinery was proposed to be selected. If any man produced a new invention, who was to decide whether or not he should be admitted to the exhibition?

Mr. Cole said it would be judged on its merits, in the same way as other things. No doubt there were more difficulties in the shape of machinery than with regard to other articles, on account of the space it would occupy, and therefore it was desirable that those who wished to exhibit should state beforehand, more or less precisely, the space they wanted, the kind of machinery they wished to exhibit, and the excellence or novelty which they claimed for it. Of course, it was possible to conceive a case in which something might be excluded which ought to be admitted, but he thought it would be found practicable to devise a mode by which, on the one hand, the machinist should not be put to any unnecessary trouble, in submitting that which the judges thought to be inadmissible, and on the other hand, not to discourage machinists in sending up that which ought to find a place.

Mr. Ferrabee said he spoke as an old exhibitor of machinery who had introduced several novelties, and he sometimes found the judges were not quite prepared for such things. He had had experience of this in the last French Exhibition; and it was a serious matter for a machinist to incur an expense of £400 or £500 in fitting up a machine, and then possibly have it rejected.

Mr. Cole said he thought there would be no difficulty in sending up a demand in such a way as to enable the judges to say whether or not it promised to be worthy of admission. If it were not so, of course he need not go to any further expense about it. This difficulty had occurred in the same way with agricultural machinery; and it had been there met by making exhibitors pay for their own space, and then leaving them to judge whether or not their machines were worth exhibiting. This was not proposed in the forthcoming exhibition; but still he thought a machinist might say that, if his production were not admitted, he would himself offer to pay for the space requisite for its exhibition. No doubt there would be difficulties, but he thought they might be easily got over.

Mr. Ferrabee said he had been asked to bring this subject forward by other machinists in Leeds and Rochdale, and it was most important to them to have it decided.

Mr. Cole said Major-General Eardley-Wilmot, who had had great experience in machinery of some kinds, suggested that one of the judges should, before a manufacturer sent up his machine, visit his factory, and confer with him as to the advisability of sending it. In this way it was thought all difficulty would be removed. He hoped the arrangements would be such that no manufacturer who sent up any machine would be in any uncertainty as to its being admitted. In fact, it would not be possible to send a machine to be judged of at the door.

Mr. Ferrabee said the last suggestion was most excellent, and he thought it would meet all difficulties.

The Chairman said he did not think there was any more business to be transacted, but he could not conclude the proceedings without expressing the grateful thanks of the Commissioners to the gentlemen present for their attendance and the suggestions which they had offered. He should be glad if anyone would adopt the hint which he had previously thrown out, and submit to Mr. Cole the names of any parties whom they thought suitable to act as competent and impartial judges. It was obviously a task of some delicacy to select jurors, and any assistance given to the Commissioners in performing that duty would be well worthy their consideration, and

would receive it. It would also contribute, more than anything else, to a general feeling of confidence that an impartial selection had been made.

Mr. Whitwell said they could not part without proposing a most cordial vote of thanks to the nobleman in the chair. He knew of no one who could have been selected more suitable to preside over the business of the meeting, not only on account of the eminent services he had rendered to this country generally, but especially on account of his connection with that county which was principally concerned in the woollen and worsted trades.

Mr. Wren Hoskyns seconded the motion, which was carried unanimously.

The Chairman said he must return his most cordial thanks for the kind manner in which the meeting had received his endeavours to promote the cause which he had so deeply at heart. He had been connected all his life, in one way or another, with the woollen and more especially with the worsted manufacture. Although the distinction might not be very obvious to the whole world, all those who were connected with the West Riding were perfectly well aware there was a very broad distinction between the two. He had taken a part, in earlier life, in endeavouring to promote the interests of all matters connected with the produce of wool, and had advocated many years ago the repeal of the duty on wool. He had never ceased to take a lively interest in this branch of industry, and now that he had ceased to be very actively employed in any way, he did not know that he could employ any time or talents at his disposal more profitably than in promoting the interests of the trade which was so adequately and ably represented at the present meeting.

EDUCATIONAL NOTES.

A deputation from the National Society stated the views of that body to Mr. Gladstone and Mr. Forster, on the 11th inst. The Bishop of Gloucester and Bristol presented the memorial, and stated that the society were desirous of co-operating with the government, but they strongly objected to the separation of religion from education, and were willing that State aid should be given equally to other denominations. Mr. Beresford Hope, Mr. Hubbard, Lord Redesdale, and Archdeacon Randall stated their views, and Sir C. Adderley specially approved of the conscience clause, which he hoped would be retained. He approved of its being to some extent vague and indefinite, as not likely to be made much use of, and thought that if a fixed hour were assigned for religious teaching, many parents would avail themselves of the right of withdrawing their children. Mr. Gladstone said they could hardly urge that a conscience clause should be made indefinite on the ground that if it were not so it would be mischievous. He gathered that the deputation generally did not object to a time-table if settled by local managers. This view was assented to.

The Society of Friends have expressed their views on the Government Bill, by means of a deputation to Mr. Gladstone and Mr. Forster, introduced by Mr. Pease, M.P. Their main principles are:—1. That the Bible and scriptural instruction ought not to be excluded by Parliamentary enactment from public elementary schools. 2. That in all schools, established or conducted by local boards under the Act, the teaching of any denominational catechism, or of the peculiar religious doctrines of any church or sect, should be absolutely prohibited, it being their conviction that the public support of such teaching involves a direct infringement of religious liberty. 3. That the Act should require that, in all districts in which there are no board schools, adequate provision should otherwise be made for public elementary education of an undenominational character. The Society foresees great, and it fears insurmountable, difficulty in the application of local rates to existing undenominational schools; but if the proposal to that effect continues to form part of the Bill, it considers it absolutely necessary that, at the least, effectual provision be made to secure that such funds should not be applied in support of sectarian teaching.

At a recent influential meeting of Yorkshire Roman Catholics, held at Leeds, under the presidency of the Duke of Norfolk, Lord Howard (of Glossop), Sir Charles Clifford, Mr. Charles Langdale, and others taking part in the discussion, a petition to the House of Commons was adopted, expressing regret that the Education Bill does not promote the extension of the existing system of denominational education, and praying the House to retain in any law which may be enacted that religious freedom under which the children of the poor are now educated, and not to pass "any measure which would compel the poor of the Catholic community to send their children to schools in which the discipline and course of instruction would be a violation of conscience and a spiritual injury to them as Catholics."

Mr. Edward Baines has published a letter, in which he draws attention "to the greatly improved feeling that is manifesting itself towards the government Education Bill," and maintains that "the call for secular education appears almost to have ceased." He goes on to say:—"The fears which prevailed so extensively among the Nonconformists as to the probable working of the Bill are changed for a grateful recognition of the intentions of its authors, and a hopeful view of the removal of every serious objection by reasonable modifications. The utter impracticability of banishing the Bible or scriptural instruction from the rate-aided schools is generally felt and expressed. All over the land the teachers of existing schools declare that the religious difficulty has had scarcely any existence in their experience. While Convocation approves a conscience clause, even for the existing schools, the Nonconformists no longer contend that a conscience clause must be inoperative." Mr. Baines points out that the great majority of petitions presented to the House of Commons pray for the continuance of religious instruction; 3,540 petitions, with 381,214 signatures, support this object, while only 318 petitions, with 23,642 signatures, object to the clauses affecting religion as dangerous to liberty or to conscience. "The tone of the annual meeting of the British and Foreign School Society was," he says, "strongly and unanimously favourable to undenominational Bible instruction. The Wesleyan body, after much deliberation, has decided that the teaching in rate-supported or State-aided schools ought to be religious. The Congregational Union, at its annual meeting, has passed a resolution expressive of general confidence in the attachment of the government to religious equality; and while it indicates important points in the Education Bill requiring amendment, it cheerfully anticipates that the needed amendments will be made. An influential deputation of the Society of Friends has supported scriptural teaching in the schools. The great body of Calvinistic Methodists of North Wales have resolved in favour of undenominational Bible teaching. Many clergymen of the Establishment, and many ministers of other denominations, in various parts of the kingdom, have found out how numerous and grand are the points of Christian faith and duty which they can all agree to teach, and how possible it is to exclude the distinguishing points on which the denominations differ."

Mr. Baines concludes his letter by stating that he has seen "not a few forms of petition expressive of this happy concord," one of which he quotes. It bears the signatures of the Rector of Cheltenham and nearly every clergyman in that place, as well as of the ministers of the Congregational, Wesleyan, Baptist, English Presbyterian, Primitive Methodist, Methodist Free Church, and Countess of Huntingdon's Connexions.

The harmony thus so agreeably described by Mr. Baines is somewhat marred by Mr. Winterbotham, who, in a letter in reply, says, "Mr. Baines's letter will, I fear, hinder rather than help what we all desire, the passing of this measure. Its non-success hitherto has arisen not so much from the so-called religious difficulty itself —though this is not slight—as from the failure of the government to recognise its reality and importance. Even Mr. Forster had persuaded himself, before the session commenced, that the difficulty was not serious—he could ride over it at a canter. But those who desired a really national system of education, and not a patching up of the present denominational system, which should intensify and perpetuate its injustice and its consequent evils, felt the reality of the difficulty." Mr. Winterbotham adds:—"What I said on the second reading of the Bill has, I have good reason to know, and I think Mr. Baines will admit, been endorsed by those on whose behalf I ventured to speak, and, indeed, by almost all the opponents of denominational education in the country. The government promised amendments which are to remove our objections. These amendments we have not yet seen, nor have I any idea what they will be. But we put faith in the promises of government, and are bound to wait until in due time they are redeemed. If the amendments, when produced, do not remove our objections, it will be our duty to oppose them, as we did the original propositions of the government, and, if necessary, by meetings or otherwise, to elicit the opinion of the country on them. It would be most ungracious and unfair to the government, and especially to Mr. Forster, to agitate now against propositions which they have promised to withdraw, or others which we have never seen. But to interpret our silence into change of opinion, and contrast it with the natural agitation of those who wish the Bill to stand as it is, is neither reasonable nor generous. It will be a fatal mistake if Mr. Forster and the government suffer themselves again to be misled as to the character and intensity of our opinions on the matter, or to anticipate any change in them. They were not lightly taken up, nor will they readily be abandoned."

Lord Shaftesbury comments on Mr. Baines's letter, as going far to disprove the existence of the "Religious Difficulty." His lordship says:—"It has, of late, been my duty to hear, read, and see a great deal on the subject among the working classes, and all the shades and forms of dissent. The admission of the Bible into the schools, with due religious teaching, is (especially among the women) all but unanimous; and I believe that I am speaking the sentiments of many of the clergy and laity of the Church of England, when I say that, were this principle conceded, they would assent on their part to the exclusion of catechisms and formularies from the rate-provided schools."

On the other hand, Mr. Guinness Rogers, the mover of the resolution at the meeting of the Congregational Union, referred to by Mr. Baines, thinks that gentleman has attached to it a meaning it was not intended to convey, and that the sentiments he expresses are "very different from those in most Nonconformist circles."

The views of so large and influential a body as the Wesleyans, deliberately expressed at their recent conference on education, are alluded to by Mr. Baines, and are worth every consideration. Among their more important recommendations are—That a school board, elected by the ratepayers, should be formed for every district immediately on the Act coming into force. That in schools created under a school board, no denominational formularies, such as creed or catechisms, ought to be permitted to be used, but that no bye-law of the school board should prohibit reading the Scriptures, or instruction out of them by the teachers. That in school-board schools no person except the school teacher shall give instruction in religion. That in any inquiry as to educational deficiency, to be made under the Bill, no school shall be considered to give efficient instruction which does not offer education on conditions fair and equal to all, and accept the conscience clause. That the existing denominational schools should not be interfered with, except so far as requiring the adoption of a satisfactory conscience clause. That no clergyman, priest, member of any religious order, or minister of any religious denomination should be appointed school teacher in any public elementary school within the meaning of the Act. That under no circumstances should her Majesty's Inspectors examine the scholars in any public school in religious knowledge. That the Bill is defective in regard to the general provisions for enforcing education throughout the country, especially with regard to pauper and neglected children. That no bye-law of any school board affecting religious instruction shall have force unless it receive the sanction of the Education Department.

THE ENDOWED SCHOOLS COMMISSION.

It will be remembered that the outline of an important paper, submitted by this commission to the Bristol Charity Trustees, and expressing the general principles on which the commissioners propose to act, was given in last week's *Journal*. This paper does not appear to have been favourably received by the trustees, who were in it invited to communicate their views as to the mode in which, in their opinion, the Act should be applied to their endowments, and, moreover, the Act had reserved to the four principal foundations in Bristol the privilege of taking the initiative in framing schemes, which they have not thought fit to avail themselves of.

One of the assistant-commissioners, Mr. J. G. Fitch, had an interview with the chairman of the trustees, and explained the paper above referred to, and in a letter which he subsequently addressed to that gentleman, he expresses regret at the attitude assumed by the trustees. "Had they," he says, "desired time to consider the general outline of policy which I sketched out to you, and to mature their own views among themselves, the commissioners would probably have been willing to suspend operations for this purpose. But it has happened that, on the first overture, a plan hardly even in embryo has been treated as though it were complete; hasty apprehensions formed of it have been published to the world, and the public of Bristol has been invoked to take part in the agitation of the question. Now, the commissioners have no reason to fear publicity; on the contrary, they will look to the public to support an enactment which brings them great benefits, and publicity will be of the very essence of their proceedings. In this case, as in every other, they propose to invite public inquiry before framing the draft schemes, which, when framed, will be deposited for three months to receive objections from all quarters. But it is obvious that, when public discussion has begun, the special consideration due to the trustees, as a privileged body, endowed with official knowledge of the subject, cannot long be preserved unimpaired." He reminds the trustees that, in the report of the Schools Inquiry Commission, two of the Bristol charities are referred to by name among others of the same type, and the report condemns the hospital schools as a class, and describes them as doing some harm and little good. It also makes suggestions for their improvement, with a strong hint that, even after those improvements, the funds would not be so well applied as they might be in maintaining such institutions. The "Endowed Schools Act" adopts the hint given in the report, and deals with these institutions in a very decided manner. It declares that all endowments attached to any school for maintenance, clothing, &c., shall be deemed to be educational endowments, and the commissioners are instructed to frame schemes so as to render any educational endowment most conducive to the advancement of the education of boys and girls. Mr. Fitch goes on to say:— "Without prejudging the special case of Bristol, the

commissioners are prepared to express their entire agreement in the principle foreshadowed in the report, and embodied in the Act. The patronage of the trustees, though naturally valued by them, is not, in the commissioners' judgment, for the public benefit, and I feel sure that, if this were proved, those gentlemen would willingly sacrifice any personal privilege for the sake of the general welfare of their fellow-citizens. As for the class of poor affected by such endowments, even granting the very doubtful proposition that it is good for the actual recipients to have their children wholly maintained without effort or merit either on the part of parents or children, still, under the existing system, the actual recipients are few, whereas, under an altered system, the actual recipients can be largely multiplied in number, and the whole of their class can be enlightened and elevated. I may remind you of the one cardinal point on which I sought to insist so strongly at our meeting, that a rich endowment can be far more advantageously used in the interest of a community if, instead of giving a gratuitous education to a few, and those not necessarily the poorest or the most deserving, it is made the means of cheapening and ennobling the education of ten times that number."

He then goes on to apply these views to the three great hospital schools of Bristol, which have, it appears, between them a gross income exceeding £14,000 per annum, out of which they educate no more than 436 children, in a population of 160,000.

"Now suppose," he says, "the plan which I sketched out to you, at the desire of the commissioners, to take effect, there would be, in the first place, large day schools and boarding schools of the third grade for boys and girls on the best models, the capacity of which cannot yet be foretold, but which might possibly suffice for the whole of Bristol, and certainly would benefit, in far greater numbers than at present, the very same classes who now receive benefit from the hospital schools. For all there would be an excellent education on very cheap terms, and there would be, as in other places, a plan of total and partial exemptions from payment, and of exhibitions calculated to cover the whole or part of the expense of boarding, embracing altogether a large percentage of scholars, and all conferred in such a way as to stimulate industry and good conduct. Nor is this all. There would be schools of a higher grade in immediate connection with those of a lower, and to them the most meritorious boys would pass, and if they could gain exhibitions, they might be educated gratuitously, at a small cost, up to the age of 16 or 17, while lads of more than ordinary industry or talent may even pass to the University and into professions, by means of the emoluments which they could win from time to time. As a mere matter of money, it would be found that the poor of Bristol would, owing to greater economy of method, gain much by the proposed plan. What they would gain in mental and moral stimulus cannot be calculated."

Mr. Fitch points out that these endowments ought not to be retained for the poorest classes, who "have for some years past been better supplied with the means of education than the classes above them, and now, it may be hoped, fuller provision will be made for their wants;" and in conclusion he says:—"On general grounds, it will be the duty of the commissioners to apply the principles I have thus indicated to the educational endowments of Bristol, unless there should appear any good reason why those endowments should form an exception to the rule. But I shall be very willing to convey to them any information, or to submit for their consideration any argument, which from your local knowledge and interest in the welfare of the city should appear to you to justify such an exception."

The views of the commissioners, as expressed in their own paper and in Mr. Fitch's letter, should be carefully weighed by educational trustees all over the country. Such bodies may, by wise and prompt action, in many cases anticipate the reforms which would otherwise be forced upon them, and will certainly be regarded by the public with more respect if, instead of clinging to old abuses, whose only merit is their antiquity, they take the lead in the preparation of broad and liberal schemes for the application of the endowments intrusted to their care.

GENERAL NOTES.

Bromide of Potassium.—Dr. Namias, of Venice, has discovered that, after the administration of bromide of potassium as a medicine, it can be detected in the brain, the lungs, and the liver, as well as in the blood.

Railways in Europe. — Europe is said to contain 70,718 miles of railway, composed of 150,000,000 cwt. of iron rails, on which 400,000 passengers' carriages and 600,000 baggage cars are dragged by 18,000 locomotives, over 52,000 bridges and through 34 miles of tunnels, at the rate of 60,000,000 dols. per annum, with a consumption of 4,000,000 tons of coals.

English Channel Passage.—In the House of Commons on Tuesday night, the 17th inst., Sir W. Gallway moved:—"That in the opinion of this House, her Majesty's Government should invite the co-operation of the French government for the purpose of improving the Channel passage between the two countries." After some discussion, which it is proposed to give in the *Journal* next week, the motion was withdrawn.

Fluids or Crystals. — Spectrum analysis has been applied to the difficult question of determining the chemical nature of the fluid found inclosed, in minute quantity, in the cavities of certain quartz-crystals. Fragments of quartz were placed in a small retort, which was connected with an air-pump and exhausted; then, by the application of heat, the quartz decepitated, and the evolved vapour was examined in a Geissler-tube. The presence of carbonic acid was thus abundantly proved, and this was confirmed by the turbidity which it produced in lime-water.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. United Service Inst., 8½. Capt. Alexander B. Tulloch, "The Protection of London against an Invading Force landing on the East Coast."
Inst. of Surveyors, 8. Mr. R. Hall, "Notes on the Inclosure Acts, and their Results."
Social Science Assoc., 8. Mr. G. W. Jones, "How to Develop the Passenger Traffic on Railways, exemplified by special reference to the Midland Railway." Chair to be taken by Mr. Seymour Teulon.
R. Geographical, 1. Annual Meeting.
Victoria Inst., 4. Annual Meeting.
London Inst., 4.

Tues ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on "Hot-blast Stoves." 2. Mr. Geo. Fowler, "On the Relative Safety of different Methods of Working Coal." 3. Mr. Emerson Bainbridge Street, "On Coal Mining in Deep Workings."
Ethnological, 4. Annual Meeting.
Royal Inst., 3. Prof. Seeley, "History."
Linnæan, 3. Annual Meeting.

Wed ...SOCIETY OF ARTS, 8. Henry Youle Hind, M.A., "On Gold Mining and its Prospects in Nova Scotia, embodying the results of Geological Surveys of the Districts of Waverloy and Sherbrooke for the Provincial Government."
Geological, 8.
R. Society of Literature, 8½.
Archæological Assoc., 8.

Thur ...Antiquaries, 8½.
Zoological, 8½.
Philosophical Club, 6.
Royal Inst., 3. Prof. Tyndall, "Electricity."

Fri ......R. United Service Inst., 3. Dr. F. de Chaumont, "Military Hygiene."
Royal Inst., 8. Principal Dawson, "Primitive Vegetation."
Quekett Club, 8.

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, MAY 27, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

ORDINARY MEETINGS.

The date of the adjourned discussion on Mr. W P. Andrew's Paper on "Railways in India," will be announced in a future number of the *Journal*.

DRILL REVIEW.

The Review of Schools will take place on June the 21st, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and Her Royal Highness the Princess Mary of Teck.

The Council have requested the following to act as a Committee, to organise the details of this Review:—

R. K. Bowley; Field-Marshal Sir John F. Burgoyne, Bart, G.C.B., F.R.S.; Viscount Bury, M.P.; Edwin Chadwick, C.B.; Henry Cole, C.B.; Major-General F. Eardley-Wilmot, R.A., F.R.S.; Lord Elcho, M.P.; Lieut.-Col. Ewart, R.E.; Major-General Napier; Rear-Admiral Erasmus Ommanney, C.B.; Sir Charles Russell, Bart., V.C.; Rear-Admiral A. P. Ryder; E. Carlcton Tufnell; General Sir Fenwick Williams, Bart., K.C.B.; and Captain Donnelly, R.E., Secretary to the Committee.

The Committee met on Monday last, Sir C. Russell, Bart, V.C., in the chair. The Secretary reported that the following schools had already signified their intention to be present:—

Royal Caledonian Asylum, Holloway, N.	40
Lambeth Industrial Schools, Norwood	133
Central London District School, Hanwell, W.	263
St. Mary, Islington, Hornsey-road, N.	60
St. Marylebone School, Southall, W.	100
Children's Establishment, Limehouse, E.	125
Welsh Charity School, Ashford, Staines	50
Royal Naval School, Greenwich	800
S. Metropolitan District School, Sutton, Surrey	300
Royal Military Asylum, Chelsea, S.W.	294
British Schools, Brentford	100
Shoreditch Industrial Schools, Brentwood	85
Mile-end Industrial Schools, Bancroft-road	50
St. Olave's School, Tooley-street, S.E.	230
Strand Union School, Millfield House, Edmonton	100
Chichester Training Ship	200

The Committee discussed the proceedings to take place. It is the intention not only to have a display of military and naval drill, but also of swimming and gymnastics.

After the review, the members of the Society and their friends will partake of a cold collation, during which the schools will sing and their bands play. The price of tickets for the collation will be announced in a future number of the *Journal*.

INDIA COMMITTEE.

The Council, last July, offered the silver medal of the Society for the best treatise on the profitable production of tea. Competing treatises must be sent in to the Secretary of the Society of Arts, on or before June 1st, 1870. Each treatise must bear a distinguishing motto, and be accompanied by a sealed envelope, containing the name and address of the writer, with a corresponding motto on the outside.

The report of the Conferences on "A Gold Currency for India" has been reprinted, and may be had of the Society's publishers, Messrs. Bell and Daldy, price one shilling.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 25th, 1870; Warington W. Smyth, Esq., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Alforth, Charles Edward, 17, Gracechurch-street, E.C., and 4, Elgin-road, W.
Croggan, Major-General, R.A., 35, Tregunter-road, S.W.
Diamond, James, 11, Park-lane, W., and the Beeches, near Axminster.
Evill, Henry, Ladbroke-house, Ladbroke-road, Notting-hill, W.
Jones, Alfred, 64, Grosvenor-street, W.
Kendall, Richard, 65, Conduit-street, W.
Knight, Walter, 104, Great Russell-street, Bloomsbury, W.C.
Sutcliffe, James S., J.P., Beech-house, Bacup, Lancashire.
Williamson, John William, 4, Stone-buildings, Lincoln's-inn, W.C.

AND AS HONORARY CORRESPONDING MEMBER.

Malarce, Auguste de, Membre du Conseil Général des Crèches, 102, Rue du Bac, Paris.

The following candidates were balloted for, and duly elected members of the Society:—

Bailey, Henry J., 134, Kennington-park-road, S.E.
Baruchson, Arnold, Liverpool.
Bewicke, David, Hackney-wick, E.
Bowler, Henry A., 21, Pembroke-square, Kensington, W.
Burn, Robert, jun., 30, Botolph-lane, E.C., and the Terrace, Epsom.
Carr, Jonathan T., the Firs, Lavender-hill, S.W.
Dows, Gustavus Davis, 1, Chandos-street, W.C.
Ell, George, 38, Fitzroy-square, W.
Ellis, Alexander J., F.R.S., 25, Argyll-road, Kensington, W.
Findlater, Joseph, 33, Wellington-street, Strand, W.C.
Fisher, Morton C., 58, Threadneedle-street, E.C.
Fontana, Giovanni, 217, King's-road, Chelsea, S.W.
Fort, Michael, 138, South Lambeth-road, S.W.
Foxon, Foxon, 231, Brompton-road, S.W.
Godden, Henry James, 168, Fenchurch-street, E.C.
Goodchild, John Eastty, 114, Englefield-road, N.
Goldsmid, Augustus, 19, Ryder-street, St. James's, S.W.
Gough, Alexander D., 10, Lancaster-place, W.C.

Gullick, Thomas J., New British Institution, 39, Old Bond-street, W.
Higgins, Thomas, 5, Warrington-gardens, Maida-hill, W.
Hill, Finch, 2, Barnsbury-park, N.
Hill, Robert Gardiner, M.D., Earl's-court-house, Old Brompton, S.W.
Hill, Thomas Daniel, 30, Grosvenor-place, S.W.
Hobhouse, Arthur, Q.C., Endowed Schools Commission, 2, Victoria-street, S.W.
Hodge, Paul Rapsey, C.E., 10, Adam-street, Adelphi, W.C.
Holland, W. H., C.E., 102, St. George's-square, S.W.
Holt, Geo. A. H., 36, Cambridge-terrace, Hyde-park, W.
Holt, Henry F., 6, King's-road, Clapham-park, S.W.
Houghton, Henry George, M.D., 6, Mount-street, W.
Houle, Josiah, 9, Guildford-street, Russell-square, W.C.
Howell, Henry, 151, Old-street, City-road, E.C., and 2, Birnam-villas, Tollington-park, N.
Hutton, T. O., 32, Budge-row, Cannon-street, E.C.
Johnson, Thomas Marr, 22, Great George-street, S.W.
Jones, Rev. William Taylor, jun., Woodside-college, Howard-road, South Norwood, S.E.
Joseph, Felix, 39, Wimpole-street, Cavendish-square, W.
Lockington, William Neale, 34, Coleman-street, E.C.
Locock, Frederick, 9, St. James's-place, St. James's, S.W.
Mackey, John B., 2, Bouverie-street, E.C.
Magnus, Walter Allingham, Cambridge-pk., Twickenham.
Meyrick, William, 5, Talbot-square, Hyde-park, W.
Miller, Captain James Cornwall, Club-chambers, 15, Regent-street, S.W.
Moore, Ira L., M.D., 36, Bedford-place, Bloomsbury-square, W.C.
Murray, Andrew, 5, Merton-villas, Richmond, S.W.
Nightingale, Samuel, Great Yarmouth.
Nisbet, Captain Edward Parry, Hollywood-road, West Brompton, S.W., and Trinity-house, E.C.
Petrie, Captain Francis W. H., 11, Gloucester-terrace, Campden hill, W.
Phillips, John, 197, Adelaide-road, N.W.
Piper, Thomas, 61, Threadneedle-street, E.C.
Risdon, Robert, 8, Buckingham-gate, S.W.
Roper, Edward, Graphotype Company, 7, Garrick-street, W.C.
Royston-Pigott, George W., M.D., 2, Lansdowne-crescent, W.
Schofield, James, 5, Keppel-street, Russell-square, W.C.
Sirr, Henry Charles, 22, Park-village East, N.W.
Shaw, John, 20, Great Knightrider-street, E.C.
Shea, Charles Edward, 84, Blackfriars-road, S.E.
Stryan, Captain Arthur, 28, Norfolk-crescent, Hyde-park, W.
Thomas, E., M.D., 9, Great Castle-street, Regent-street, W.
Thomas, W. Cave, 49, Torrington-square, W.C.
Thornton, Edward Owen, 12, Wellington-chambers, London-bridge, S.E.
Tilley, Samuel, 70, Union-road, Rotherhithe, S.E.
Verdon, George Frederick, C.B., 8, Victoria-chambers, S.W
Vickers, Austin, 5, Hyde-park-terrace, W.
Welton, Thomas A., 91, Mortimer-road, De Beauvoir-square, N.W.
Westell, Edward, M.D., 28, Holland-villas, Kensington, W.
Whiffin, William Harding, 12, Sandringham-gardens, Ealing, W.
White, John Aubrey, 34, Millman-street, Bedford-row, W.C.
Willis, Henry, 9, Rochester-terrace, Camden-town, N.W.
Willis, Rev. Robert, M.A., F.R.S., 5, Park-terrace, Parker's-piece, Cambridge.
Wilson, Alexander, Enmore-lodge, Jeffries-road, Clapham-rise, S.W.
Withers, Robert J., 51, Doughty-street, W.C.

AND AS HONORARY CORRESPONDING MEMBERS.

Garrubba, Professor Santo, Royal Tullian College, Arpino, Italy.
Mariani, Professor Lewis, Royal Tullian College, Arpino, Italy.
Pallottino, Professor Anthony, Royal Tullian College, Arpino, Italy.

The Paper read was—

ON GOLD MINING, AND ITS PROSPECTS IN NOVA-SCOTIA, EMBODYING THE RESULTS OF GEOLOGICAL SURVEYS OF THE DISTRICTS OF WAVERLEY AND SHERBROOKE, FOR THE PROVINCIAL GOVERNMENT.

By Henry Youle Hind, M.A.

I.—General Description of the Relations of the Gold-bearing Rocks.

The area occupied by the lower Silurian gold-bearing rocks of Nova Scotia has been variously estimated at from 6,000 to 7,000 square miles.* Since these estimates were made, there has been described a series of gneissic rocks, supposed to be the equivalents of the Cambrian and Laurentian,† which occupy at least one-half of the area hitherto assigned to the lower Silurian. These rocks are not yet known to be auriferous, although from the discovery of an auriferous band in the lower Laurentian, in Ontario, beneath the great iron deposits,‡ there is good reason for the expectation that an auriferous zone will be found in the Nova Scotian gneisses underlying the present gold-bearing series.

I do not suppose that the lower Silurian gold-bearing rocks of Nova Scotia cover a larger area than 3,000 square miles. Gold has been found also in the upper Silurian, which may be exposed over an area of from 500 to 800 square miles, so that the total known area of the gold-bearing rocks of Silurian age probably does not exceed 4,000 square miles.

There is, however, another remarkable source of gold in the conglomerates at the base of the lower carboniferous rocks. It is not surprising that gold should have been discovered resting in the form of worn particles on the Silurian slates which support the oldest of the lower carboniferous conglomerates, or in the lower beds of the oldest conglomerate itself; but it is remarkable that gold should be found near the summit of a bed of conglomerate whose thickness is about 600 ft., and which is separated from the oldest conglomerate of the lower carboniferous series in Nova Scotia by an immense mass of bituminous shales and sandstones. In Cape Breton, gold has been discovered at the summit of a conglomerate occupying this horizon on the peninsula opposite Baddeck.

The occurrence of gold in the carboniferous conglomerates of Nova Scotia, especially at the base of the series, and in the fissures and crevices of the Silurian slates on which they rest, is highly important and suggestive, but too little is known respecting its distribution to make it a subject for description or discussion in this paper. During the ensuing summer its relations will probably be studied with some detail.

The lower Silurian rocks appear to be distributed chiefly on the south-eastern flank of a great gneissoid axis, which extends with some interruptions, hereafter noticed, from Cape Sable to the Gut of Causo, or, throughout the entire length of Nova Scotia. The most important break in the continuity of the gneissoid axis is a profound Silurian valley, averaging twelve miles in breadth, and extending from the Atlantic, at Halifax, to within ten miles of Windsor, near the Basin of Mines (Bay of Fundy). West of this Silurian valley, the gneissoid rocks occur in detached area, of greater or less

* The total area of the gold region may be estimated at about 7,000 square miles, and the proclaimed districts do not yet reach a twentieth part of this area.—Dawson, "Acadian Geology," second edition, p. 632.

† "Preliminary Report on a Gneissoid Series, underlying the Gold-bearing Rocks of Nova Scotia." By the author.

‡ Summary Report of Progress in Geological Investigations. "Geological Survey of Canada, 1869."

extent, to the Gut of Causo. The most important at present of these gneissie areas is situated in the county of Guysborough.

In the Silurian valley between Halifax and Windsor, the gold districts of Lawrencetown, Montague, Waverley, and Renfrew, are situated on the east side of the valley; Mount Uniacke and Hammond Plains on the west side. Around the gneissic nucleus in the county of Guysborough, the districts of Sherbrooke, Wine Harbour, Isaac's Harbour, Country Harbour, and Cochrane's-hill, are symmetrically arranged. The other districts, such as Tangier, Musquodoboit, Oldham, and Fifteen-Mile Stream, bear also a certain relation to gneissic areas, but enough is not known of this relation to admit of description.

The Cambrian gneiss occurs about two and a-half miles to the east of the worked lodes at Waverly, and about the same distance east from Goldenville at Sherbrooke. At Mount Uniacke it is about the same distance to the west. Most of the known gold districts occur in close proximity to gneissic areas, but this arises from the circumstance that denudation has been most active on the more elevated intersections of the anticlinals, and has removed the Silurian strata, thus exposing the underlying gneiss. When comparatively low anticlinals intersect, there is no gneissic exposure. Two sets of main anticlinals intersect one another in Nova Scotia, one set having an easterly and westerly direction, the other at nearly right angles, or a northerly and southerly course. At the intersections of these anticlinals the gold districts are situated, and here, also, where denudation has removed the Silurian strata, the underlying gneisses are exposed, or have been brought to the surface by the great dislocations which accompanied the last, or north and south folding.*

The districts of Waverley and Sherbrooke have been carefully surveyed, and their geological structure worked out with considerable detail. I was engaged in this duty during part of the autumn of 1868 and the summer of 1869, for the Department of Mines, and the maps which illustrate this paper are those which I prepared for the Department, and which, by permission of the Chief Commissioner, I have brought with me.

Waverley and Sherbrooke are types of all the known gold districts in Nova Scotia. One (Waverley) occurs with several others in a Silurian valley between two great exposures of gneissic rocks, the other (Sherbrooke) is one of many arranged round a island of gneiss.

II.—ORIGIN OF THE GOLD.

The results of my surveys do not show any direct relation between the origin of the gold and the gneissic areas. I consider that all the evidence hitherto accumulated in Nova Scotia tends to show that the gold was originally deposited from oceanic waters, and diffused throughout their sediments, especially in beds of quartz. Much of it was, no doubt, subsequently concentrated in intercalated beds of quartz, and in some instances in fissure veins.

There is no evidence to show that intrusive rocks, or veins, or dykes had any share in the introduction of the gold; indeed, I have not yet seen any rocks in Nova Scotia near the gold districts which, upon close examination and study, can be regarded as intrusive rocks. Gold is found and worked in beds of quartz of contemporaneous age with the interstratified slates and quartzites, and in their beds of slate adjacent to beds of quartz, throughout a vertical thickness of 6,000 ft. These beds are worked in one district or another throughout that thickness of strata on anticlinal or synclinal folds.

Waverley and Sherbrooke districts are eighty miles apart in an air line, and yet so uniform is the mineral composition of the series, that certain beds of grit can be identified at these distances, not only by the occurrence of peculiar forms, supposed to be an *Eospongia*, but by their mineral characters.

*For a description of the structure of the gold districts, see reports on Waverley and Sherbrooke.

It must not be supposed, however, that all the worked auriferous lodes of Nova Scotia are contemporaneous beds. I conceive that a large number are intercalated, as subsequently described, and of the contemporaneous auriferous beds many have suffered much modification since first deposited.

III.—STRUCTURE OF WAVERLEY GOLD DISTRICT.*

The strata at Waverley† are arranged in the form of a long elliptical dome, tilted over to the north. This form was occasioned by the intersection of two great anticlinal folds, one having a course from east to west, the other from north to south. The east and west fold has a slight overturn to the north. At Mount Uniacke the east and west fold has an overturn to the south, which is also the case at Sherbrooke.

The thin contemporaneous beds of auriferous quartz, or lodes, necessarily partook of all the movements to which the strata with which they are associated were subjected; hence, we find the outcrops of the lodes curving round the axis of the tilted east and west anticlinal in the form of long semi-ellipsis, where denudation has exposed the edges of this bed. This distribution of the outcrop of the lodes is of the first importance, and it may be easily illustrated by bending a number of sheets of paper in the form of an arch, to represent the east and west anticlinal, tilting up one extremity to represent one side of the north and south anticlinal, and then cutting off a portion horizontally, to represent the effects of denudation. The exposed edges of the paper will then have the form of long semi-ellipses. It is evident that the outcrop of the lodes will be dependent upon the nature of the intersecting anticlinals, and the extent of denudation to which they have been subjected. Anyone familiar with the forms produced by the intersection of plain and curved surfaces, will readily understand how the mapping of the outcrop of these bedded lodes becomes a question belonging to stratigraphical geology.

In the autumn of 1868, the accompanying map of the Waverley district was prepared, and a lithographed reduction accompanies my report on that district. One of the most important lodes there is the Tudor lode, which was "lost," so to speak, at the point where the continuous line ceases on the map. This lode had yielded 8,727 ounces of gold from 6,972 tons of quartz, in 1865, averaging 1 oz. and 6 dwts. per ton. From a study of the structure of the district, the details of which are given in my official report, I indicated the course of the "lost" Tudor, as represented by the dotted line on the plan. Operations were commenced, late in the autumn of 1868, to discover this lode on the south side of the anticlinal, about 770 feet from the place where its alleged disappearance had occurred. In January, 1870, it had been traced, and in part worked back to the area where it had been "lost," through a distance on the curve of about 1,100 feet, connection with the original lode being broken by a small fault. The mean difference between the ascertained outcrop and the theoretical outcrop is 25 feet 9 inches in 1,100 feet horizontally.

The north lode is also a valuable lode at Waverley. This lode runs parallel to the Tudor on the north side of tho anticlinal, and it has also been recently traced, and in part worked, parallel to the Tudor lode on the south side of the anticlinal, through a horizontal distance of 900 feet, the mean difference between the theoretical outcrop and the actual outcrop discovered being 25 feet 7 inches. The rocks throughout these distances of 1,100 and 900 feet are deeply covered with boulder drift, and of uneven surface, so that I may reasonably claim a closer approximation between theory and fact than a mean

* The details of the structure of this district are given in my "Report on the Waverley Gold District." Halifax, N.S., 1869.

† Waverley gold district is thirteen miles from Halifax, on th line of railway from Halifax to Windsor.

difference of in outcrop of 25 feet 8 inches over a horizontal space of 2,000 feet.*

The geological structure of the Waverley gold district being the type of the structure of most of the other known districts, the importance of ascertaining the correctness of the views I had expressed respecting the origin, distribution, and general course of the lodes, and the laws to which they were subjected, acquired some interest, for, if generally true, some mining operations would be much facilitated in a country sometimes deeply covered with drift clays and gravels. Hence I quote, with much satisfaction, the following testimony from the Chief Commissioner of Mines, taken from his official report for the year 1869, p. 9:—

"*Waverley.*—Operations have been carried on in this district by the Lake Major, Rockland, American Hill, and Waverley Gold Mining Companies, and by Leopold Burkner, Esq. The most noticeable feature in this district is the tracing of the southern outcrop of the celebrated Tudor lode, by a series of openings connecting two points eleven hundred feet distant, and thus proving the correctness of the views entertained by Professor Hind, of the geological structure of this district, as described in his report, and fully exemplified in the map accompanying that report. The South Tudor has been now traced for upwards of eleven hundred feet, and the mean difference between the outcrop assigned by Professor Hind and the actual outcrop, disclosed by shafts, does not exceed twenty-five feet six inches throughout that horizontal distance."

Mr. Rutherford, the Provincial Inspector of Mines, also states as follows in his official report for 1869:— "A short distance west of his workings on the Tudor lode, Mr. Burkner has sunk a series of shafts on a lode ranging in a somewhat parallel direction with the South or Nigger lode, formerly worked by him. Five shafts are being sunk on this lode, their present depth being about 50 feet, and the lode is taken out, by underhand stoping, the entire range of the shafts, with the exception of a bulkhead or divisional piece, four feet thick, which is left in the centre of space between each shaft. The lode varies in thickness from twelve to five inches; it dips to the north-west. The trending of the strike of this lode towards the north and east has been followed from the shafts to within a few feet of the old workings on the Tudor lode, and its identification with that lode been established, and the construction assigned by Professor Hind to this part of the Waverley district confirmed."

The so-called barrel quartz, at Waverley, is a fair representation of a corrugated lode occurring on the crown of an anticlinal. In nearly all the gold districts the same form of quartz beds may be seen, and in similar relative positions. The corrugated structure is not confined to the quartz, but spreads fan-like into the overlying rocks, and appears to be in part the result of unequal pressure during the folding of the strata.

The foregoing observations apply to the old contemporaneous beds of auriferous quartz; but there is another class of lodes which have generally a bedded structure, but are of subsequent origin, and may be styled intercalated beds. These will be noticed in subsequent paragraphs.

In every district in Nova Scotia, it is remarked that the gold frequently "runs in streaks," that is to say a zone of rich auriferous quartz occupies a certain breadth as the lode, while to the east and west of that zone the quartz is comparatively poor in the precious metal. It is also found in different districts that the "gold streak" has a different angle with the horizon, and that sometimes the course of the rich zone corresponds, or is coincident with the ripples or swells in the lodes, and also that the gold streak varies in direction in different leads.

* For details, see letters entitled "Theory and Practice at Waverley," appended to a "Preliminary Report on a Gneissoid Series, underlying the Gold-bearing Rocks of Nova Scotia." G. M. Anther, Halifax, 1870.

The position and dip of the gold streak being found on one side of the anticlinal, it can be traced to corresponding lodes on the other side, with such variations in dip as agree with the section of the curve of the anticlinal.

The term "gold streak," in Nova Scotia, is synonymous with the term "chimneys," in California, and "pipes," in Australia.

IV.—Structure of Sherbrooke Gold District.*

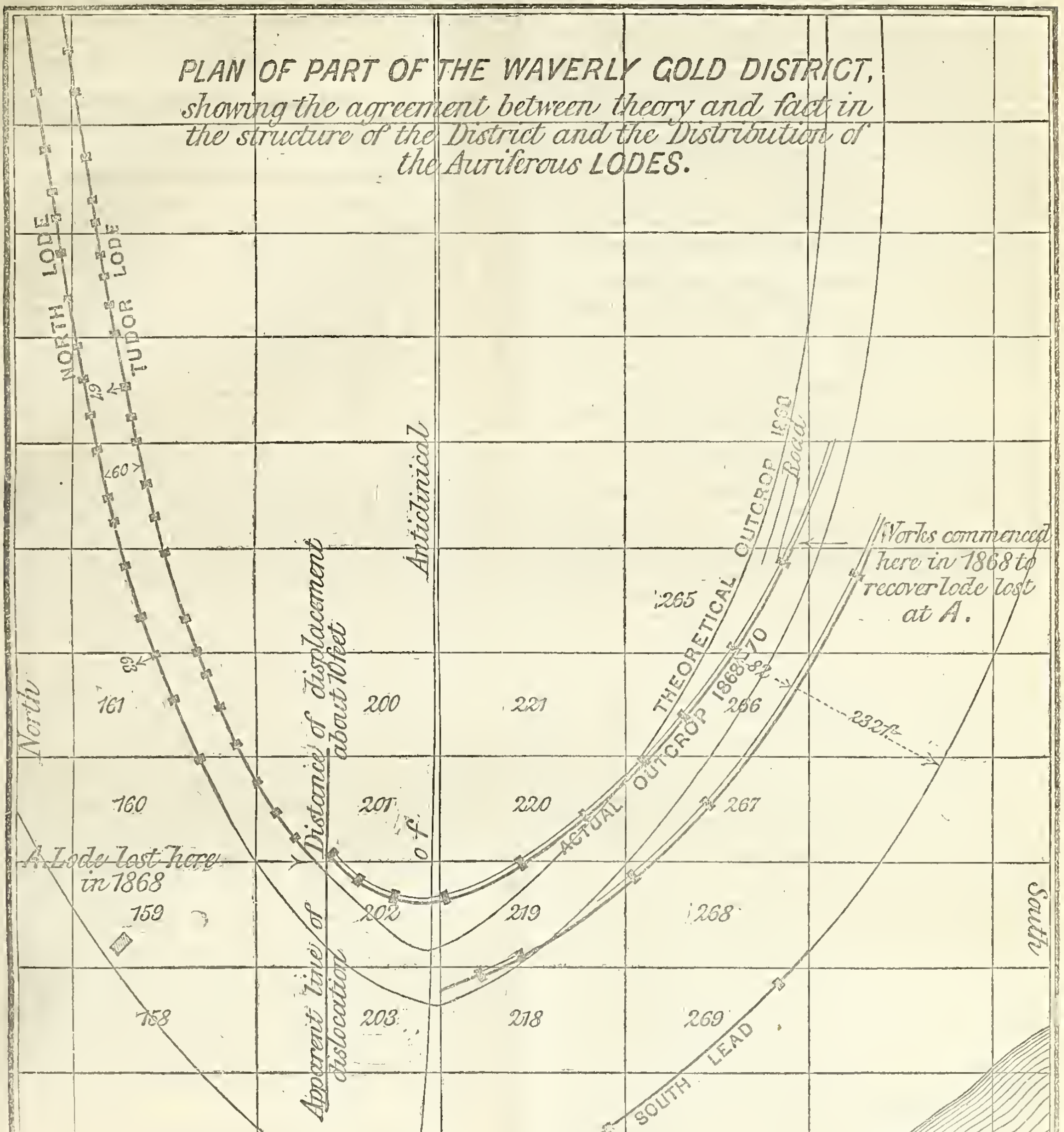
If a slightly undulating line be drawn on a course S. 83° West (true), or N. 75° W. magnetic, from area 775, on the east side of the St. Mary's River, it will represent part of the axis of the Sherbrooke anticlinal. On the north side of the axis, the lodes dip to the north, at an angle generally of about 45 degrees, except when approaching the axis, where they commence to curve. On the south side, the dip varies from 80 degrees to vertical, except when making the curve. Proceeding south from the axis, the lodes become more persistently vertical, until they acquire a slight northerly dip, thus showing that the form of the anticlinal is that of a slight overturn to the south, as represented in the sections. On making the curve, some of the lodes sweep gradually round with a dip, varying from 80 degrees south to 60° S.W., 35° S.W. by W., 26° W., then gradually increasing until they acquire the normal dip on the north side of the anticlinal, of about 45 degrees north. The plan of the Root-hog lode shows this curvature with some degree of detail. The strata and contemporaneous lodes at Sherbrooke, like those at Waverley, may be described as beds of slate and quartzite, with thin sheets of auriferous quartz folded in an overturn anticlinal form, and subsequently tilted to the east by a cross anticlinal. The denuded crest of the intersection of the anticlinals has exposed the sheets of quartz in the form of long semi-ellipses, whose bases rest upon Cambrian gneiss, from which the Silurian quartzites and slates have been removed by denudation. Numerous dislocations, having generally a north and south course, occur at Sherbrooke. These appear, like those at Waverley, † to have taken place during the north and south folding; some of them are represented on the plans and in the sections.

V.—The Auriferous Lodes.

As much misapprehension might arise from the broad statement that all the auriferous lodes in Nova Scotia are sheets of quartz, generally traceable from one side of a tilted anticlinal to the other side, in unbroken continuity, it is necessary to state distinctly that, although the sections exhibit this relation, yet it holds good only with reference to certain lodes which have been so traced, and to groups of lodes. This arises from the structure of the lodes. In many instances they are not continuous for very long distances, that is to say, they "thin out" and "take up again." In some instances the same lodes can be traced at the surface for many hundred yards, and even for miles, but it is safe to assume that generally, as stated in my report on Waverley gold district, they resemble thin lenticular sheets of quartz, whose edges overlap one another, especially in bands of slate. In making cross-cuts at some distance below the surface, lodes are frequently cut which do not appear in the surface trenchers, and in broad bands of slate, lodes thicken to the breadth of 10 to 12 inches, and thin out to a film of quartz, or disappear altogether in the space of a few hundred feet. But before they thin out altogether, another lode begins to appear, separated from the first by a few inches, more or less, of slate or quartzite. This cannot be strictly regarded as a continuation of the lode which has "thinned out," although

* The gold district of Sherbrooke is situated about twelve miles from the mouth of St. Mary's River, in the county of Guysborough. It is eighty miles east of Halifax in an air line.

† For a description of the dislocations at Waverley see report on that district.



The thick lines represent the worked portion of the lode; the thin lines indicate the supposed outcrop under a deeper deposit of drift in October, 1868. The double black lines show the continuation of the lodes discovered and worked since publication of the map up to January 7, 1870.

it also may thin out and be in part overlapped by another lode in the strike, and in the place of the first one which had disappeared. Some lodes of this description appear to belong to the class of intercalated lodes, that is to say, they are sheets of quartz which have been formed at a later date than the enclosing rock, and were produced by the replacement, particle by particle, of a of pre-existing bed of some other soluble material. In lodes of this class, which generally occur in slate, the slate itself is found to be auriferous, and the whole mass is frequently worth crushing.

The strong persistent contemporaneous lodes, such as the Tudor and North lodes at Waverley, generally occur in quartzite, or with quartzite on one side and slate on the other. The intercalated lodes now frequently occur in slate, and are often associated with thin lenticular beds of slate and quartzite, which also "thin out" and "take up" again.*

We have, then, in Nova Scotia, the following description of lodes, all of which are more or less worked:—

1. The bedded lodes of the same age as the quartzites, and slates with which they are interstatified.
2. The intercalated lodes of subsequent age.
3. The gash lodes (free claim, Renfrew).
4. The true veins. A few worked. Most of the gold is obtained from the bedded and the intercalated lodes.

The origin of the intercalated lodes is obscure, but the conditions required for the formation of some of these appear to be in great part satisfied, if we suppose that they represent lines of minimum pressure during the folding, denudation, and faulting of the strata. Along such lines the flow of aqueous currents would be determined, and particle by particle of soluble strata be removed and replaced by other minerals. This would also account for the regular arrangement of crystals of arsenical iron pyrites in slates and quartzites, in certain lines of direction, over wide areas. According to this view, the formation of intercalated lodes is continually going on, for the pressure upon any given point, at any given depth, is constantly changing, owing to denudation and other causes constantly operating, although in no form perceptible to the senses.†

The passage of a bed of quartz from one plane to another plane, on a short zig-zag course (seen at Mount Uniacke), may be referable to this class of intercalated lodes. The same reasoning which is applicable to explain the formation of intercalated lodes, may render it doubtful whether any bedded lode can strictly be regarded as a lode altogether of contemporaneous age with the enclosing rock. The statement that it is so may apply to certain portions of such a lode, and to the *locus* of the lode, but it is difficult to conceive that during the infinity of changes of pressure which must have occurred in any given subterraneous area, aqueous currents may not have been successively determined towards every part, and caused a greater or less replacement of particles. Under the term aqueous currents, it is scarcely necessary to say that I allude more particularly to the water absorbed by different strata under different conditions of temperature and pressure.

VI.—MINING ECONOMIES IN NOVA SCOTIA.

I propose now to glance briefly at the condition of mining in Nova Scotia, and then to furnish some facts from official returns, which will enable a correct appreciation of the gold wealth of the Nova Scotian lodes to be formed.

From the most reliable information accessible, it appears that there are now some seventy companies or associations engaged, actually or nominally, in gold-mining in Nova Scotia:—

No. of Companies.	Where organised.	Estimated cost and actual working capital.
16	Montreal	480,000 dols.
6	Toronto	240,000 "
7	Kingston	210,000 "
2	New York	250,000 "
10	Boston	500,000 "
2	St. John, N.B.	50,000 "
12	Halifax, N.S.	134,000 "
3	United States	60,000 "
3	Ontario	60,000 "
3	Nova Scotia	10,000 "
1	Liverpool, Eng.	25,000 "
2	London "	85,000 "
6	Private	20,000 "

Some of these are of a purely speculative character, some have ceased working, others are profitably carrying on the business, but, as shown in succeeding paragraphs, in a very unscientific and wasteful manner. A few are working with comparative economy, but no approach is made to the admirable system which frequently obtains in Victoria, where that best of mining schools, experience, has taught miners to conduct gold mining with the same attention to detail as is thought absolutely essential to success in any other branch of industry.

In very many cases, mismanagement has been the cause of the suspension of works, which, with ordinary care in the hands of an experienced agent, would have proved successful.

Local companies have been often formed in the following manner:—A prospector finds a lode showing numerous specks of gold at the surface. Three or four speculators join together and form a company, purchasing the property for a nominal sum, and a considerable portion of so-called paid-up stock. They put the capital at 100,000 dollars (100,000 shares at one dollar a share). The shares are sold at two cents and upwards. With the money thus obtained, work is commenced, and if the quartz continues promising, enough capital is raised to erect a mill, and there is a prospect that the speculation may turn out profitably; but if the auriferous character of the quartz diminishes, the collapse of the company becomes a mere question of time, for the shareholders almost invariably refuse to submit to a call.

The following tables show the average yield of gold from quartz in Nova Scotia and in Victoria (Australia):—

*Average Yield of Gold in Victoria from the year 1859 to 1868 inclusive.**

Year.	Quantity crushed.		Total produce.		Average yield per ton.		
	tons.	cwts.	oz.	dwts.	oz.	dwts.	grs.
1859	39,034	0	47,524	14	1	4	8·4
1860	86,594	16	81,905	2	0	18	22
1861	350,409	0	299,482	13	0	17	2
1862	567,208	0	310,725	4	0	10	22
1863	523,226	0	323,190	14	0	12	8·5
1864	843,515	10	433,981	16	0	10	6·9
1865	705,134	0	419,325	3	0	11	21·4
1866	861,468	13	459,895	7	0	10	16·2
1867	948,850	12	498,677	12	0	10	12·2
1868	886,228	18	471,493	3	0	10	15·37
Totals ..	5,811,669	9	3,346,201	8	0	11	12·37

* The intercalated lodes are to be distinguished from segregated lodes occupying fissures produced by a crush in the strata, as on the free claim at Renfrew gold district. (See report on Waverley.)

† For a discussion of this subject see "Report on the Gold District of Sherbrooke," now in the press.

* "The Gold Fields of Australia." By R. Brough Smyth, F.G.S.

Statement showing the number of tons of Quartz crushed, the yield of Gold, and the average yield per ton, in the Province of Nova Scotia, during the years 1862 *to* 1869 *inclusive.*

Year.	Quartz crushed.	Yield of gold.			Yield per ton.		
	tons.	oz.	dwts.	grs.	oz.	dwts.	grs.
1862	6,727	6,799	0	0	1	0	5
1863	17,001	13,973	14	17	0	16	12
1864*	15,316	14,526	18	5	0	19	0
1865	23,835	24,725	22	22	1	0	21
1866	30,963	24,125	13	18	0	15	14
1867	30,673	27,534	4	14	0	17	23
1868	31,242	20,518	10	14	0	13	3
1869	35,424	17,690	2	8	0	10	2
Totals ..	191,181	149,894	7	2	0	15	16

In Victoria, the yield of gold from 5,811,669 $\frac{9}{20}$ tons of quartz crushed during a period of ten years (1859 to 1868) has averaged 11 dwts. 12·37 grains.† In Nova Scotia, the yield from 191,181 tons of quartz has averaged 15 dwts. 16 grs. The excess of the average in Nova Scotia over that of Victoria amounts to more than 4 dwts. per ton. Notwithstanding this large average in favour of Nova Scotian quartz, yet the mining interests are depressed, while those of Victoria are buoyant. The cause of this apparent anomaly is readily explained. In Nova Scotia, we are passing through that stage of blundering incompetency which has already visited Australia and California, and from which those countries have emerged with wonderful strength and aptitude for the circumstances in which they are placed.

The economy displayed in the management of the mine, and in the manipulation of the quartz now common in Australia and California, is utterly unknown in Nova Scotia. It will appear almost incredible that the tailings alone in many mining districts contain, on an average, as much gold as the material crushed, with a profit at some of the mines at Ballarat. Numerous and reliable assays show that, in Nova Scotia, from 25 to 35 per cent. of the gold escapes in the tailings, and is lost.

The arsenical pyrites, which abound in some districts, is frequently rich in gold, but no attempts are made to separate it, or even store the pyrites.

The following table shows the result of assays of pure arsenical pyrites from different lodes at Sherbrooke‡:—

	Yielding gold per ton.			Yielding silver per ton.		
	oz.	dwt.	gr.	oz.	dwt.	gr.
Pyrites and galena from Boulder Lot	4	1	16	8	19	10
" " " Coburg Co.	1	12	16	6	10	16
" Kingston and Sherbrooke Company	4	18	0	5	14	8
" Canada Company	45	0	0	0	0	0
" Wentworth Company (Ferguson Lode)	0	16	8	0	0	0
" Meridian Company (Sears Lode)	1	12	16	9	0	0
" average of concentrated tailings	2	10	0	0	0	0
Assay of pure pyrites from the Provincial Company, at Wine Harbour	11	8	16	0	0	0

* Nine months.
† "The Gold Fields of Victoria." By R. Brough Smyth, F.G.S.
‡ Mr. Kirkpatrick.

From careful assays of numerous parcels of tailings in Nova Scotia, as they came from the mill, and selected indiscriminately, the average quantity of gold contained was found to exceed 4 dwts. per ton. In many instances the assay gave a very much larger yield. These tailings lie around the mills in every direction, or are allowed to run into the nearest stream; in no instance known to me are they concentrated, even to save the pyrites, or are any really valuable appliances used to save the free gold they contain, which has escaped from the stamping boxes on the amalgamating tables.

At one mine, near Ballarat, 7,453 tons of quartz yielded no more than 2 dwt. 10½ grains per ton, yet the company paid in dividends £2,101 10s. The quartz was easily obtained, and at small cost, but the manipulation was very economically conducted.

At the Black Hill mine, Ballarat, the total quantity of quartz crushed, up to 1868, was 190,118 tons, yielding 22,801 oz. 15 dwts. 13 grains, the average yield being 2 dwts. 9·7 grains per ton.*

A year ago, attention having been called to the escaped gold in the tailings at one of the mills at Waverley, portions were re-crushed and passed over the amalgamating tables; and in the official returns for 1869 we find the following statements:—288 tons of waste from dump gave 32 oz. 5 dwts. 11 grains; 63 tons of waste from dump gave 13 oz. 12 dwt. 16 grains. From this experiment some idea may be formed of the amount of gold allowed to escape in the tailings from upwards of 190,000 tons of quartz, the quantity already crushed in Nova Scotia.†

VII.—MINING ECONOMIES AT WAVERLEY.

The mine which I shall select, as an illustration of gold-mining at Waverley, is the one where part of Tudor lode is worked. The following extracts from my official report in 1868, compared with what is now being done in 1870, will afford a fair example of the improvement of which Nova Scotia mining is susceptible:—The mill at this mine is driven by water; it has sixteen stamps; amalgamation takes place in the battery and on tables; no blankets are used, or concentrating apparatus of any kind to save the pyrites of free gold which have escaped amalgamation; the tailings flow into the stream and are lost. In the year 1865, 6,972 tons of quartz were crushed and treated in the manner described. The yield of gold amounted to 8,727 ounces, or 1 oz. 6 dwts. 12 grains per ton. The total cost of getting the gold, up to the close of 1866, averaged 12 dwts. (12 dollars) a ton. In 1867, the works were carried on with greater economy, and the lode, at a depth of 300 feet, averaged 15 inches in thickness, and yielded (not including the tailings) 8 dwts. a ton, and was worked with a small profit. When the average yield fell to 7 dwts. a ton, the works were stopped, on account of not paying expenses. This was the condition of the mine during my visit in the autumn of 1868.

The following are abstracts from my report on this district:—

"The skill which makes a difference of one pennyweight per ton frequently determines the fate of a valuable mining property. In the case of the fine water-power mill at Waverley, seven pennyweights to the ton is stated not to pay expenses; eight pennyweights would leave a small profit; and nine pennyweights, it is said, would secure a profit of forty dollars a day. Operations are now suspended, because the quartz is said to yield only 7 dwts. per ton, according to the present system of working. Subsequently, it will be shown that there is every probability that the quartz now contains upwards of 10 dwts. to the ton, although it yields only 7 dwts., and that by system and machinery, and consequent reduction of expenses, it might be made

* Mr. Brough Smyth.
† See also tables showing returns from Sherbrooke district for remarks on gold in the tailings.

to give an equivalent to 10 dwts. to the ton. The same observation applies in other forms to all the other properties in the district.

"At a depth of 330 feet on the Tudor lode, the yield was 7 dwts. per ton, and the mineral not paying expenses, the work was stopped. It has been shown that it is probable that one-third of the gold was lost in the tailings, which were allowed to escape from the copper plates in front of the battery directly into the river. This would give a total average of gold in the quartz of 10 dwts. 12 gr., of which 7 dwts. was saved, and 3 dwts. 12 grs. lost. Assuming that 76 per cent. of the gold in the tailings could be recovered by the usual processes, at a cost of one-fourth, this would leave a profit on the tailings of 1 dwt. 16½ grs., and swell the total yield to 9 dwts. 15 grains per ton. A round buddle, with a bed 18 feet in diameter, and whose axis revolves at the rate of 3 or 4 revolutions per minute, will work up from 35 to 40 tons of tailings in 24 hours. A rotating buddle will do the same amount of work in much less time, and may consequently be made of smaller diameter. By the substitution of proper machinery, much manual labour in milling could be saved. Ten men were employed during 24 hours in breaking and feeding 35 tons of quartz; why should not this work be done by 4 men feeding a 'breaker' with hopper, and moved by the surplus water-power? Each of the stone-breaking machines at the Port Philip Company's mines break 8 tons of quartz per hour, at a cost, including wear and tear, of about 10d. per ton. One of these machines would break 35 tons of quartz in 4½ hours, at a cost of about 5 dols. by water-power, the estimate 10d. (stg.) a ton being based on steam power. Hence, with a 'breaker' and 'hopper,' instead of manual labour, a saving of at least 3 dols. a day might be effected, and the risk of gold being stolen during this part of the treatment reduced to a minimum, by which it is not improbable a still greater saving might be effected.

"I have selected as an illustration of mining economics at Waverley the method of treating the quartz at the cheapest mill, namely, one driven by ample water-power. All the other mills in operation are driven by steam-power, amalgamation takes place in the battery and on tables; but no effort is made to concentrate the tailings. As long as quartz continues to yield the unusual average of 1 oz. to 1 oz. and 10 dwt. to the ton, the economical treatment of the tailings is not a matter of vital importance, but when the average diminishes to 9, 8, and even 7 dwts. per ton, it becomes one on which, other things being equal, the continuance of active operations depends, provided that those operations are necessarily limited to one or two leads."*

Let these statements of facts in 1868 be contrasted with the following in March, 1870. My authority is one of the mine-owners at Waverley, to whom I applied for information respecting the progress of his works, in February of the present year. The mill and mine are the same as referred to in the preceding paragraphs:—

"I work at present four shafts on the south side, on tribute, which leaves my men with a yield of 3 dwts. per ton on average, from 1 dol. to 1 dol. 50 c. clear wages for every working day, and to me something over 50 cents per ton. The difference between 1 dol. and 1 dol. 50 c. wages depends entirely upon the greater or smaller ability and industry of the miners, by which they will raise larger or smaller quantities of quartz per day, which, with such a small yield as 3 dwts. per ton is all important.

"My arrangement with the miners is, that they get for their labour and the expenses, except crushing and hauling, all the gold, and pay me for crushing and hauling 1 dol. 25 c. per ton.

* Report on the Waverley gold district, 1869.

"The lode is from twelve to eighteen inches thick, and three men raise, on an average, from fifty to sixty odd tons of quartz per month. That the lode works extraordinarily easy is a matter of course; deducting the crushing and hauling, there remains not much more for the raising of the quartz than a little over 1 dol. 50 c. per ton.

"In proof of my own profit of at least 50 cents per ton, you will find the following calculations:—I crush with eight stampers, in twenty-four hours, at least 13 tons on the average, and for this work I employ two very experienced feeders, who have, at the same time, charge of the mill, and two breakers. Of the feeders, one receives 1 dol. 40 c., and the other, 1 dol. 35 c. a day; and of the breakers, one 1 dol. 25 c., and the other, a boy, 1 dollar per day, that is altogether 5 dollars. This makes, with 13 tons, 38 dols. 5 c. per ton. The whole expenses of wear and tear (in the main part stampers' shoes) and loss of quicksilver, are under no circumstances higher than 15c. per ton, which would bring the crushing expenses up to 53 dols. 5 c. per ton. The hauling costs 20c. per ton, and this shows that I make at least 50c. per ton clear.

"I think this is the first instance that a lode of this thickness has ever been worked with a profit, at a yield of 3 dwts.

"Quite different is it with the South Tudor lode, which works very hard, a great deal harder than ever the north dip worked. The two reasons of this are, first, that the south dip is so very much flatter than the north dip, and, second, that the small band of soft slate (goudge) which was nearly everywhere (with some interruptions) on the north dip, is nearly entirely wanting on the south dip, which makes the stripping of the lode a by far more difficult task. Nevertheless, I work the lode as cheap as I ever worked the north dip in the cheapest time; but the men had to work harder to make a living by it than they ever worked before. If it was not for the great scarcity of work, they scarcely would endure it long, particularly in this humid winter, where half their time is lost by water-pailing (hoisting water in buckets).

"I pay 10 dollars for sinking and 40 cents for stopping, the men to find everything, which brings up the cost, crushing and hauling included, to about 9 dollars per ton. I am putting up now a gin, and commence to sink down one shaft in advance of the others, preparatory to dispensing with all sinking except in the one shaft, which will always be the deepest point, and from which the lode is stopped out east and west, in the form of terraces. I have no doubt that this arrangement will bring down the expenses to 8 dollars per ton, everything included. How long I shall be able to work without a pump I cannot say, but Lake Major Company has worked without it down to 300 feet, though I have at present by far more water than there was in this part of the north dip.

"My experience on the north dip has convinced me that, as long as the formation remains the same, the mining expenses do not increase, down to at least 300 feet, and I am sure a good deal further, except in expenses of the pump. Where there is a pump, a horse gin will raise from two shafts all the quartz that can be mined, just as well from 300 feet depth as from 100 feet. I do not save the pyrites yet, because I have not yet put up a German buddle."

The system of mining generally adopted in Nova Scotia greatly increases the expenses of raising the quartz.

On the plan, page 615, the positions are marked of the shafts on part of the Tudor and north lodes.

The north lead and the Tudor lode are, on an average, 60 feet apart at their outcrops, their dips being nearly the same. The number of shafts sunk by different companies on these leads, within a mean distance of 2,000 feet, is 54, having a mean depth of 200 feet. This is equivalent to a shaft to every superficial area of 47 feet square.

On area 155,* for example, there are four shafts on the Tudor lode, and three shafts on the north lead, the breadth of the area being 150 feet. On area 102, there are three shafts on the Tudor, and three on the north lode, the same on areas 164 and 102. On the property of one company there are eight shafts on the north lead, in the space of 450 feet, and nine shafts on the Tudor lode within the same distance. The lodes being but 60 feet apart, two main shafts, with suitable hoisting and pumping machinery, and cross galleries, would have been ample, and the saving in labour and time would have greatly reduced the cost of mining the quartz.

A remarkable instance of want of foresight, in a most important department of mining economics, is presented in the construction of one of the largest steam crushing mills at Waverley, and this is but a fair illustration of inattention to important details, which are common in the Nova Scotian mining districts. The site selected for this mill is so low that the tailings, as they leave the mill, are now required to be hoisted by a revolving wheel, furnished with buckets, to a sluice, where they have an opportunity of escaping over the accumulated heaps near the mill, but without any attempt at concentration, or saving any of the gold which they undoubtedly contain. This is equivalent to employing power, machinery and labour, to get rid of 1 dwt. 16½ grains of gold per ton. A buddle, to concentrate the tailings and save the gold, could have been constructed at far less cost than the present ingenious contrivance to hoist the tailings out of the way.

The reasons why failure and collapse, in place of continued prosperity, has characterised some mining properties in Waverley, and indeed throughout Nova Scotia, I have already officially stated to be as follows† :—

1. The absorption of all returns to pay large dividends.
2. The small size of some of the properties.
3. Insufficient working capital at the outset.
4. A uniform neglect in preserving records and plans in detail of the works.
5. Inadequate machinery and appliances to save gold.
6. The want of labour-saving machinery.
7. Ignorance respecting mining operations, the "gold-streak," or "chimneys," or "pipes," or zone of auriferous quartz.
8. General neglect of the contract and tribute system.
9. And, as a necessary result of the foregoing, the frequent incompetency of some of the so-called managers.

VIII.—MINING STATISTICS.

The following tables have been kindly supplied by the Commissioners of Mines at Halifax, and they have all the seal of the office attached to them. A glance at these tables will show that the gold yield from quartz of some of the Nova Scotian districts is in excess of the average of gold-mining countries generally. Tables are also given of the yield of certain mines in each district, from which some ideas may be formed of the productiveness of the quartz, and of the extent to which the returns might be increased if the same economy in mining, skill in manipulation, and eagerness to adopt improvements existed in Nova Scotia which are now common in Australia and California. The decrease in the general annual average at Sherbrooke is due to the cessation of the process of culling the quartz, which was to a large extent common in the infancy of mining in Nova Scotia. At the present time, not only in the quartz of the lode crushed, but also some inches of the adjoining slate, and at Musquodoboit, and Isaacs Harbour, broad bands, from 14 to 20 feet of mixed slate and quartz, are crushed with returns shown in tables.

* A mining area in Nova Scotia is 150 feet on the lode, by 250 at right angles to it. The original course of area lines is established by the Government District Surveyor

† *Vide* report on the Waverley Gold District.

SHERBROOKE GOLD DISTRICT.

Statement of Quartz crushed, and Gold obtained from the Sherbrooke Gold District, during the years 1863 *to* 1869 *inclusive, together with the average and maximum yield of Gold per ton, as shown by the Quarterly Returns rendered the Department of Mines.*

Year.	Quartz raised.	Gold obtained.			Average yield.			Maximum yield.		
1863	3,454	3,304	14	12	..			12	0	0
1864*	1,909	2,611	6	22	..			20	0	0
1865	2,637	3,137	9	5	..			8	3	0
1866	2,684	5,157	14	17	1	22	0	16	6	16
1867	5,809	8,522	8	11	1	9	8	11	13	5
3 mos. do.	2,376	2,708	8	18	1	2	19	5	0	0
1868	8,880	7,070	0	5	0	16	0	12	15	0
1869	11,500	5,546	11	16	0	9	15	6	9	13
Total..	39,249	38,058	14	10	0	19	9	20	0	0

* Nine months to September 30.

In 1862 there was obtained 2,023 ounces (as near as could be ascertained).

Statement of labour performed on areas 650, 651, 652, 680, 681, 682, *block* 3, *Sherbrooke District, the property of the Wellington Gold Mining Company, during the years* 1863 *to* 1869 *inclusive, and results.*

Days.	Date.	Quartz crushed.		Yield of Gold.		
		tons.	cwts.	oz.	dwts.	grs.
1,800	1863. Dec. 31..	149	16	222	15	2
500	1864. Mar. 31..	32	15	95	10	22
300	June 30..	40	4	71	5	5
780	Sept. 30..	16	1	39	12	2
666	Dec. 31..	13	0	27	10	12
459	1865. Mar. 31..	18	19	13	11	16
710	June 30..	109	0	107	17	19
737	Sept. 30..	107	0	428	15	0
1,297	Dec. 31..	285	18	766	15	2
1,400	1866. Mar. 31..	219	10	298	0	12
1,244	June 30..	409	14	991	6	3
700	Sept. 30..	389	0	871	18	22
1,650	Dec. 31..	266	18	864	4	15
3,000	1867. Mar. 31..	400	0	940	0	0
3,004	June 30..	465	0	634	6	0
2,800	Sept. 30..	335	10	314	14	0
2,000	Dec. 31..	312	10	507	0	0
3,600	1868. Mar. 31..	596	10	1,061	18	6
4,600	June 30..	550	16	456	11	16
3,510	Sept. 30..	844	12	644	5	0
3,500	Dec. 31..	448	12	515	11	10
4,000	1869. Mar. 31..	682	0	600	0	12
4,000	June 30..	1,059	0	794	3	5
3,244	Sept. 30..	731	10	281	2	18
3,800	Dec. 31..	500	17	666	17	0
53,301	..	8,984	12	12,215	13	7

Renfrew District.

Table showing the date, tons of Quartz crushed, and Gold obtained from the Ophir Mine, in Renfrew District, County of Hants.

Date.	tons	cwt.	oz.	dwts.	grs.
1866. Sept. 30......	677	0	1,000	10	0
Dec. 31......	1,208	0	2,142	4	0
1867. March 31......	1,395	0	1,885	15	0
June 30......	1,503	0	1,674	0	0
Sept. 30......	1,656	0	1,587	5	0
Dec. 31......	946	15	907	0	0
1868. March 31......	704	0	571	10	0
June 30......	1,317	0	736	3	0
Sept. 30......	1,385	0	706	15	0
Dec. 31......	2,029	0	1,046	10	0
1869. March 31......	1,562	0	724	18	0
June 30......	1,285	0	612	10	0
Sept. 30......	850	0	302	0	0
Dec. 31......	1,915	0	571	10	10
Total	18,432	15	14,468	10	10

Waverley District.

Table showing the quantity of Quartz crushed, and amount of Gold obtained from the German Mines on the Tudor and North Lodes, Waverley District, County of Halifax.

Date.	Days' labour.	tons.	cwt.	ozs.	dwts.	grs.
1863. Dec. 31..	3,370	381	15	151	7	9
" " ..	338	47	9	33	18	12
1864. Mar. 31..	1,360	212	10	125	16	14
" " ..	3,083	263	0	134	5	14
June 30..	1,700	162	15	132	8	3
" " ..	4,800	331	0	224	12	17
" " ..	2,550	40	0	30	0	0
Sept. 30..	5,100	759	0	704	11	3
" " ..	2,300	294	0	317	12	0
" " ..	4,700	306	0	216	15	3
Dec. 31..	5,000	757	0	608	5	5
" " ..	2,000	263	0	316	5	16
" " ..	4,900	278	0	228	15	12
1865. Mar. 31..	2,500	274	0	375	15	10
" " ..	1,800	218	0	491	3	0
" " ..	5,000	795	0	811	0	10
June 30..	1,400	305	0	829	11	0
" " ..	4,100	1,049	0	1,253	2	2
" " ..	2,000	357	0	680	18	1
Sept. 30..	1,700	443	0	772	19	7
" " ..	2,300	396	0	517	4	0
" " ..	4,000	1,352	0	1,226	12	21
Dec. 31..	1,100	355	0	432	18	0
" " ..	1,300	250	0	225	3	0
" " ..	3,000	1,611	0	1,253	2	12
1866. Mar. 31..	1,400	350	0	188	3	0
" " ..	500	70	0	23	6	0
" " ..	3,000	1,210	0	609	1	0
June 30..	6,080	1,500	0	995	0	0
" " ..	2,000	245	0	141	18	0
Sept. 30..	2,300	293	0	235	9	15
" " ..	5,415	1,406	0	923	0	0
Dec. 31..	1,800	248	0	172	15	0
" " ..	3,000	833	0	316	0	0
Total	96,896	17,655	9	15,698	15	18

Stormont District (Isaacs Harbour).

Table showing the quantity of Quartz crushed, and amount of Gold obtained from areas 12 and 13, and other mines on the Mulgreen lode, Stormont district, Guysborough County.

Date.	Days.	tons.	oz.	dwts.	grs.	Remarks.
1863. Jan. 30	468	20	120	0	0	
Sept. 30	780	55	119	0	0	Area No. 12.*
Dec. 31	750	57	126	0	0	150 ft. on lode.
1864. Mar. 30	700	..	..			250 ft. across.
Jan. 30	1,026	160	368	0	22	
Sept. 30	650	..	..			
Dec. 31	720	90	210	6	4	
1865. Mar. 31	900	42	95	18	0	
Jan. 30	80	13	17	3	16	
Total	6,074	437	1,056	8	18	
1863. June 30	416	22	145	0	0	
Sept. 30	208	48	228	0	0	Area No. 13.*
1864. Mar. 31	600	..	..			
June 30	650	64	260	12	16	
Sept. 30	350	42	97	7	18	
Dec. 31	127	..	..			
1865. April 1	52	8	1	13	6	
Total	2,403	184	722	13	16	

Other mines on shoot (see Report for 1868).

Date.	Days.	tons.	oz.	dwts.	grs.
1864........	..	59	183	3	11
1865........	..	535	924	8	12

* These areas were mined in 1862, but there was no regular system of return until May, 1863.

Musquodoboit.

Table showing the quantity of Quartz crushed, and amount of Gold obtained at the Bushing Mine, at the Musquodoboit "Jenney" district, in the county of Halifax.

Date.	tons.	ozs.	dwts.	grs.	Remarks.
1869.					
April........	56	37	10	0	Area 19, 20, 21, 22, and 23. Large lode, about 20 ft. in thickness, composed of quartz and slate; about half quartz.
May........	116	46	8	0	
June........	158	53	10	0	
July........	10	19	0	0	
"	155	46	2	0	
August......	190	51	0	0	
"	5	9	0	0	
September ..	102	32	2	0	
October	94	26	9	0	
November ..	124	35	2	0	
December ..	7	12	15	0	
Total	1,017	368	18	0	
April	10	8	10	0	Hyde lode; area 221 and 231; about 5 in. thickness.
June........	34	28	5	0	
July........	14	7	17	0	
September ..	7	1	18	0	
November ..	7	1	15	0	
Total	72	48	5	0	
August	22	71	0	0	Drunbrack lode; 15 in.; area 327.
September ..	23	31	17	0	
October	52	28	10	0	
Total	97	131	7	0	

Hyde's Mine on Areas 221, 222, 223, 224.

1869.	tons.	oz.	dwts.	grs.
October	92	142	11	0
November ..	137	126	0	13
December ..	79	60	19	8
1870.				
January	90	93	1	0
Total	398	422	11	21

DISCUSSION.

The Chairman, in inviting discussion, said he desired to point out that the paper divided the subject of gold-mining into two important points, one being the question as to the occurrence of the gold, for it must be known first whether there was a sufficient quantity of gold in the district to make it worth while for companies to sub, scribe capital, and expend money in a series of operations carried on for many years; and the second question referred to the method of, and economy in, extracting the gold. On the former question he should have some-to say himself; and with regard to the latter, Professor Hind had gone pretty fully into it, pointing out nine distinct causes of failure which had come under his own notice. If any gentleman present had had any experience in works of this kind it would be desirable that they should give additional information or confirmation of Mr. Hind's statements, particularly with regard to the stratification of auriferous quartz in Nova Scotia.

Mr. Robinson said he might venture to make one or two remarks on the method of mining adopted in Nova Scotia, having recently visited that country, and being acquainted with the progress of operations there. With reference to the theoretical part of the question, he might refer those interested in it to a paper which was read before the Geological Society, a short time previously, by Professor Hind, giving a very elaborate account of the structure of the province. Having visited Waverley with that gentleman, he could confirm generally what was stated with respect to the imperfect arrangements made for mining; in fact, it was not so much mining as tinkering or surface work, as was shown by the fact that for a lode 1,500 feet in length 54 shafts were sunk to extract quartz. As to the arrangements of the strata also, he quite agreed with what had been stated, and in one district with which he had most to do, Lawrence-town, the strata was proved to be a synclinal fold. In fact, after working there for six months, the result showed that the form of the lode was as nearly as possible exactly what was predicted in the first investigation of the district. With regard to Waverley, the lode there was lost by reason of a fault, and when he visited the place with Professor Hind, in 1868, its position was of great importance, inasmuch as the whole settlement was at a standstill for want of employment. Subsequently to his investigation it was again discovered, and operations were doubtless now in full swing again. One of the districts, not specially alluded to in the paper, Montague, was very remarkable for the very large yield which had been found from the commencement, the returns of the Chief Gold Commissioner showing that, for a series of years, there had been a yield of 1 oz. 5 dwts. per ton, which was the highest on record. The tailings there had also been assayed, when it appeared that 13 dwts. per ton were being thrown away. Those acquainted with gold mining knew that in a well managed mine, with good mill-power and proper machinery, the cost of getting did not exceed 4 dwts. to 5 dwts., so that when they found that 13 dwts. were absolutely wasted, in addition to the $1\frac{1}{4}$ oz. obtained, it was abundantly evident that the importance of Nova Scotia, as a gold-field, could hardly be over-estimated. Oldham was another part which he visited, and there he found the yield of gold exceeded 1 oz. per ton at some small workings, which were now being considerably extended with the aid of English capital. In conclusion, he thought Professor Hind was entitled to the thanks of the public for bringing this matter forward, for it was now evident that, with such a supply of gold in the nearest of England's dependencies, there was an enormous source of wealth only awaiting the operation of English enterprise and capital. He held a decided opinion, which he had often expressed both in public and private, that Nova Scotia would be found to be one of the most important gold fields in the world when its resources were properly developed.

Mr. Arthur Sopwith said he had just returned from Nova Scotia, and he could to the utmost corroborate the statements made by Professor Hind, as to the manner in which mining was conducted there. One of the most important points in any large gold-producing country was the treatment of the tailings and arsenical pyrites, from which the gold was more difficult to separate than from any other metals with which it was found combined. It was not exactly within the scope of the paper, which treated principally of the other district, but he might mention that in the Montague mine, which was one of the most interesting in the province, and was in the neighbourhood of Waverley, there were found in the foot sole of the lode masses of arsenical pyrites about the size of two fists joined together, at very short intervals, and this really amounted to a considerable portion of the lode, which was only two inches thick; but the persons working that mine were so ignorant of anything like the assaying of ores, that they were actually storing it, and proposing to send it over to Swansea, paying heavy freight to have it smelted there. It was very probable that this pyrites would give from £80 to £120 per ton, at any rate if the statements made were anything like correct, as it was in appearance exceedingly rich. With regard to the cost of mining, the Nova Scotian methods of working were very limited; but, on the other hand, it must be remembered that unless sufficient capital were subscribed to carry on operations, for a long time it would not pay to erect good machinery and pumping gear, which would have to be abandoned in case of meeting with barren ground. It was the case in all metalliferous mines, that a large proportion of barren ground had to be opened, and unless there were plenty of capital, a person might be ruined at once by setting up expensive machinery. The fact was not a single mine in Nova Scotia had been started with anything like what would be considered in England a sufficient capital. That the lodes were in some parts exceedingly auriferous might be gathered from this fact:—he had himself been down nearly 200 feet, working a lode of only four inches, which was worked a length of about 300 or 400 feet, which had necessarily required the taking away of a large part of the adjoining rock, but, nevertheless, the work had been successful. Not only were there these position beds, for there could be no doubt they were true beds, but also a great number of cross leads, and at some points the intersections of these cross leads was the richest part of the lode. This was a point which required a good deal of attention, because if the cross lead were struck, it might cut through two or three lodes without being cut out, and at all points of intersection it might be very rich. By striking on a length of cross lead, and through the main leads, which, as a rule, lay pretty close together, the work would be found much more productive than trying here and there in a main lode, trusting to chance to get a nest of gold.

Dr. Boycott said it appeared, after all, that what was wanted for working these mines was, not so much money as more information and skill. It seemed a great pity that these operations should be undertaken by such ignorant people, for it appeared pretty plain that many of the miners lacked the commonest information, which was now distributed pretty well all over the world, through the influence of the School of Mines in Jermyn-

street. He was, therefore, astonished to find that there was so much waste of money and labour still going on, and that some means were not adopted for securing information. The mere statement of such facts sufficed to show the necessity for education being extended in a greater measure to our colonies, and, if possible, he thought government should send out inspectors to see that these mines were properly worked. He should like to know whether the Chairman's opinion coincided with that of Professor Hind as to the gold being deposited from sea water.

Mr. Botly said society at large must be indebted to Mr. Hind for the paper he had prepared, and particularly for calling attention to the nine causes which had produced failure and collapse in so many cases. Several of them, such as the absorption of the whole of the returns to pay large dividends, the smallness of the operations, the want of labour-saving machinery, and the incompetency of so-called managers, had been fruitful sources of loss in England, particularly the last, and therefore he could well believe that no successful gold mining operations could be carried on while they continued to exist.

Mr. Robinson, in reference to what had fallen from Dr. Boycott, said that mining in Nova Scotia was of very recent date, and, of course, as in the case of all other countries, they had to go through a sort of apprenticeship before much progress was made. There was an inspector of mines in Nova Scotia, who was well qualified to give every information, but he did not apprehend it came within his department to tell persons when they were spending their money foolishly.

The Chairman said that, as an old dabbler in gold mines in various parts, he could not help feeling much interested in the paper, following up as it did the accounts which had been received from other sources, with regard to a colony so near to the seaboard, and which appeared to offer so many inducements to the capitalists to embark in mining enterprise. There was nothing so pleasant as gold mining, if you could only get a sufficient yield, for there was no trouble whatever in disposing of the product, as was sometimes the case with large quantities of bulky produce. But on the other hand there were certain disadvantages, amongst the principal of which were the great uncertainty and the great proneness to accident amongst the veins which produced the gold. On this part of the subject he could not help saying that, although Mr. Hind had appeared to make good his statement as to the structure of this part of Nova Scotia, he could not help being still a little sceptical as to the fact of gold being distributed so regularly throughout a series of beds of quartz. It was true, in a later part of the paper, this statement was somewhat "hedged," and it was pointed out that there were irregularities, which one would have been scarcely induced to expect from the first account of what appeared to be regularly stratified beds. For himself, he could not help coupling what was said about synclinal and anticlinal beds as a certain amount of theory, and bringing it to bear upon the explanation which was suggested of these facts, viz., that the gold had been deposited contemporaneously with the quartz by the sea-water. If this were so, why was not all the gold deposited at the bottom of the sediment, by reason of its greater specific gravity? But by another part of the paper it appeared that the gold ran only in streaks, and that it seemed to be accumulated near certain crossing of these beds by other lines of quartz, which looked more like true veins. At present, therefore, he could not help saying he thought there was a good deal more to be made out. He had on former occasions visited certain localities, though not in Nova Scotia, where it was said that minerals occurred regularly throughout a stratified mass, but he had usually found such a statement to be the result of deficient observation. In a certain part of the stratified-looking mass there had been a dissemination of mineral matter, but very frequently this apparently stratified mass was nothing else but a mass of stratified material, ground and rubbed together, and existing between two walls resembling those of a regular vein; or again, that the mineral matter had been most decidedly intercalated at a period long subsequent to the original formation of the beds. He could not help thinking, in spite of all the excellent accounts which had been brought forward, that this would prove to be the real explanation of the occurrence of the gold in a great part of these Nova Scotia deposits. With regard to the second part of the question, it appeared quite clear that there was, throughout a great part of this district, a sufficiently large proportion of gold extending throughout these quartzose deposits, whether beds or veins, to pay well for mining enterprise, and the question might therefore be asked why had it not succeeded better? For a number of years, 600 or 800 men had been engaged in this work, but only a few mines had been successful, and therefore they were much indebted to Professor Hind for the valuable statistics he had brought forward, because the question seemed to be—Given that this was really a gold-containing district, was it not possible, instead of these 600 or 800 men, to employ 6,000 or 8,000, or even more, in raising gold, to the advantage of all parties concerned? Undoubtedly it ought to be so, for there was no doubt that here there was a gold-field such as was seldom to be met with; and if the proportion laid down from the statistics furnished by the Commissioner of Mines were to be depended upon, there ought to be machinery and appliances brought to bear upon these mines such as would ensure a very handsome return, to capital invested in undertakings intended to last over a long series of years. This was really a point of almost imperial importance, for it appeared that, up to the present time, the resources of the country had been developed to a pitifully small extent; and no doubt that this was because the undertakings had been conducted by persons unprovided with money, or with that intelligent guidance which it might be presumed they would have had if the matter had been taken in hand by persons better provided with money, without a good supply of which nothing could be successfully carried on. He could not help remembering, when mention was made of the large quantities of ore which had been stamped or crushed in order to extract the gold, that it was not above two-thirds of the quantity which one single tin mine in Cornwall was in the habit of stamping per annum by means of its efficient machinery, worked by steam or water-power, for the purpose of extracting a small modicum of tin ore, and that showed that the work had not been undertaken upon such a scale as to render any great success probable. Again, he noticed that from the large quantities of ore raised in different places, the proportion of gold was from 1 oz. to 1 oz. 4 dwt., or even 1 oz. 16 dwts. per ton, and that in the Waverley district it was found that a proportion of 7 dwts. per ton would not yield a profit. On the other hand, in travelling through the Tyrol into Italy, a few miles from Innspruck, there was to be found a mine at Heinzenberg, at Zell in the Zillerthal, worked for gold only, a mine worked to a much greater depth than any in Nova Scotia (where the richer material would produce perhaps 10 dwts. to the ton), but where the proportion of gold present in the bulk of the ore was not more than about 2 dwts. per ton. It would have been very interesting if there had been any gentleman present, conversant with the practical details of the process by which gold was extracted, to have heard a few words upon the actual contrivances employed in this case, but it would be almost foreign to the question brought forward in the paper, the principal object of which was to show, first, that gold existed in large quantities in Nova Scotia; and, secondly, that it afforded a field for the advantageous employment of capital from abroad. In spite of the nine causes of failure which had been mentioned, it was evident that many of them would disappear the moment that large

capitalists were prepared to go into the matter, because if large companies were formed in England, they would of course employ agents familiar with the machinery and appliances requisite for successful mining, who would open workings upon a very different scale from anything which had yet been attempted. One point he might venture particularly to call attention to. A great deal of attention was given apparently, as had been well pointed out by Mr. Robinson, to the sinking of a great number of shafts. But any one familiar with mining operations must know, that sinking so many shafts in one lode, was like opening so many different mines at once, and exposed the company to such expense that it was extremely unlikely it could succeed. Again, it appeared that these shaftings and levels were mere little holes, as compared with what were called shafts in many old-established mining districts. They had been open for eight or nine years, but yet they still measured the depth only by 100 or 120 feet, or in some cases as much as 200 feet. In this country however, mines were accustomed to go by fathoms, or yards at least, and they would think very little of the depth of a shaft of 200 feet, when it came to be reduced to fathoms. Then, again, there was the question of opening the ground horizontally by drifts. It was very well known that even in copper, lead, or tin veins in this country it was useless to exceed any great depth, until by perseverance, continued over several years, a large quantity of ground had been opened, for the purpose of passing through the different lodes, and discovering what were called pipes, shoots, or by various names in different localities. Until a work of this sort had been fairly accomplished, nobody could say that a mine, whether tin, silver, lead, or still less so in the case of gold, was worth working or not. He hoped the information which had been so well put together in the paper would lead to the establishment of a better state of things than had yet been the case in the colony, and, in conclusion, begged to propose a hearty vote of thanks to Professor Hind for the paper which he had read.

The vote of thanks was passed unanimously.

The paper was illustrated by specimens kindly lent by Professor Tennant, consisting of a large number of gold specimens in the matrix from Nova Scotia, Canada, British Columbia, Australia, the West Coast of South America, North Wales, Cornwall, Scotland, and other localities, also some crystals of gold figured in Mawe's "Travels in Brazil."

HOW TO DEVELOP THE PASSENGER TRAFFIC ON RAILWAYS, WITH SPECIAL REFERENCE TO THE MIDLAND RAILWAY.

By G. W. Jones, Esq.

The following paper was read at a meeting of the Social Science Association, on Monday, the 23rd instant, Seymour Teulon, Esq., in the chair. The author said:—

In a paper which I had the honour to read before the Society of Arts in March last, I endeavoured to trace the causes of the high charges now demanded for the conveyance of passengers by railway, and they resolved themselves into to following facts:—

Parliament, in ignorance of the very small cost at which passengers could be conveyed by steam on railways, fixed a maximum charge a little below that which had been found remunerative by horse-power; and, unintentionally, made railway companies monopolists of the conveyance on their own lines. Shareholders delegate to directors, and directors to managers, the scale to be adopted; and, lastly, managers, being engineers rather than merchants, look at the cost of the plant instead of the cost of the disposable article; charge as high for the conveyance of a passenger as external competition will permit them; and study to reduce the number of passenger-trains, so as to produce the largest return per train, instead of adopting the principle by which merchants obtain their wealth, viz., increasing facilities, charging a fair and reasonable profit on the cost of the disposable article, and aiming at an enormous trade on the principle of small profits and quick returns.

In that same paper also, I pointed out, as one of the greatest impediments to a large reduction in railway fares, the novel custom of charging by the mile. A farthing is our smallest coin, and a farthing is more than the average a poor man should be charged for being carried a mile by railway. Besides, the principle is foreign to the mode of charging by public conveyances. It is not customary to charge so much a mile by omnibus or by steam-boat. It was never the custom to charge so much a mile by the old stage-coach, or by any other public conveyance before railways were introduced. The custom was to charge a given sum from place to place—so much a stage—and nothing would so much tend to the advantage of railway companies themselves, as well as to the public, as to revert to the good old custom. A decimal coinage would render calculations more minute than the object requires; so that even a decimal coinage which should give us a coin worth the 1-100th part of a shilling, or the 1-10th part of a penny, would not be equal to reverting to the good old custom. It is a matter of no moment to the railway company whether a poor man travels one mile or five miles in a train. He requires no porter to lift him to his seat; he walks into the carriage, takes his place, and walks out again at the end of his journey, with his bundle under his arm, without trouble or expense to the company, and if conveyed only at a moderate rate of speed, by an engine of light weight, the cost in wear and tear of his train is small indeed, either of engine, carriages, or rails. These remarks apply, of course, with greatest force and truth to the lowest class of passengers; that class which the railway staff of England have taught themselves to loathe; to look upon with disgust and aversion; that class which English railway directors seem bent on practising every available device to shut out from the advantages which they so eagerly pant for; that class which even now forms two-thirds of their customers; which, even under the present disadvantages, pays to the companies 40 per cent. of all the money they receive from passengers; that class whose patronage is capable of unlimited expansion, the extent of whose dealings is limited only by the charge; that class which, if the means of transit were opened to them liberally, would save many of the companies from insolvency, and double the dividends of those now doing well.

Before leaving this part of my subject, as tending very forcibly to illustrate the difference of treatment accorded to, and the difference of profit obtained from, the first and the third-class passenger, I crave your attention to an extract from the speech of Mr. Watson, of Peterborough, on the occasion of a lecture delivered there by Mr. Brandon, in March last:—"The journey from London to Portsmouth by the Brighton and South Coast line," said Mr. Watson, "is 85 miles. The charge for an annual season ticket, available by all trains, is £33 15s. By taking four tickets for the same family a reduction of 20 per cent. is made. By travelling one journey in each direction per day it would amount to less than $\frac{7}{16}$ of a farthing per mile. From London to Brighton, the favourite resort of the 'upper ten,' and where many of the leading bankers, brokers and merchants reside, the distance is 50 miles. A second-class annual ticket costs £28, or, with 20 per cent. off, £22 8s. The first-class is £40, or, with the deduction named, £32, the former being 7¼d. per journey, and the latter 10½d. It appeared to him (Mr. Watson) that the charges were made to suit the pockets and the conveniences of the

few, the humbler classes having to pay for it. The third-class passenger must leave Brighton at 6.25 in the morning—too early to get breakfast, arriving in London at 8.35—no breakfast, paid 4s. 2d. The gentleman, with his first-class ticket, leaves Brighton by express at 8.45, giving him plenty of time for breakfast, and arrives in London at 10 o'clock, paid 10½d. The gentleman returns in the afternoon at 5 o'clock by express, arriving at Brighton at 6.15, in time for dinner, having paid 1s. 9d. for the double journey. The third-class passenger leaves London at 6 o'clock, due at Brighton at 8.24, too late for tea, having paid 8s. 4d. for travelling the same distance—6s. 7d. more than the first-class passenger—and he sits down delighted to think there was a third-class back."

I will only add, respecting the Brighton line, that, according to the last return, the Brighton Company issued 8,181 season tickets in the year; and if the holder of each ticket made only one journey a day, six days a week, it would make 5,105,000 journeys. The season tickets produced £68,000, or rather more than 3d. a journey, and the season ticket holders occupied one-fourth of all the occupied seats in every train, including the very choicest. By the same return 12,280,000 tickets were issued to third-class passengers, and produced £310,000, or about 6⅗d. a journey. It would be rash to conclude, therefore, because a passenger occupies a seat in a first-class carriage that he is the most profitable customer to the railway company, or even that he pays most for his journey.

Sir D. Gooch, and other eminent railway managers, maintain that "people will not constantly travel because they can go cheaply." A more erroneous opinion than this perhaps was never entertained, or an assertion uttered that is more easily refuted. Look at the travellers that have been created by the introduction of omnibuses and penny steamboats into London and the other large towns of the country. Look at the progress which the labourers' trains are making, as evidenced on the Metropolitan Railway. In the paper before alluded to, I showed that in the first year the Metropolitan Company ran those trains at 1d. the journey, 151,000 workmen only used them; in the next year, 350,000; the next year, 455,000; in 1868, 580,000; and last year, 765,000, being a five-fold increase in little more than five years. Could anything more convincingly demonstrate the fact that people will travel if they can go cheaply? In the discussion which followed the reading of that paper, Mr. Allport, of the Midland Railway, asserted, and attempted to prove, that "the company must have lost by them considerably." A correspondence followed between that gentleman and me, which was subsequently published in the *Society of Arts Journal*, 8th April, 1870, in which I proved, by extracts from the company's books, that my statement was strictly accurate, and that no less than 200 per cent. profit was obtained by the company from running the workmen's trains.

The paper read by me before the Society of Arts, and to which I have just alluded, was well and fully canvassed in many of the daily and weekly journals, but in none other which I have seen with such a practical tendency as in a leading article of the *Leeds Mercury*, of the 22nd March last, to a short extract from which I must beg your attention, as it perfectly coincides with my own views, and with the plan of action which I am about to lay before you. The article concludes thus:—"Surely this is a matter of the greatest importance to railway shareholders. In many businesses in which a virtual monopoly has enabled the person who provides a certain class of commodities to charge his own prices, he has maintained, and proved by arguments and figures of the most conclusive character, that the rate he charges is absolutely necessary, and that he would not get a farthing of profit if it were lowered. Yet, when competition has compelled him to lower to half, or less than half the amount, he has found his profits, on the whole, larger than they were before. Now, we do not say that this could be the case with railways, and we can well understand why a company paying five or six per cent. should decline to try an experiment which, if it were to fail—if it were even to produce a considerable temporary reduction of receipts—might involve the concern in serious embarrassment. But is it not worth the while of some company to try the experiment on a small scale? Take, for example, the Midland system. Might it not be a wise step for that company to take some branch line on which the traffic seems capable of development, and try the experiment for two or three years? The loss would not be very great if the experiment failed; while, if it succeeded, it would open a source of revenue whose gradual development might, in the end, be highly profitable to the company, and of great value to the public. If the experimental branch were put under the charge of a clever engineer, whose special instructions were to make it pay if possible, his own interests being concerned in the matter, means of saving would probably be discovered which hitherto nobody has suspected, because no person has had a sufficiently direct interest in the matter to search diligently for them. Experience shows that low charges are sometimes far more profitable than high ones; and it would be foolish of railway companies, when they might try the experiment at little cost, to neglect putting the matter to a practical test. Nor can we imagine how that practical test can be applied except in some such manner as we have already suggested."

Will the people travel because they can go cheaply? Conviction can scarcely fail to reach the mind of every-one, in presence of the fact that, notwithstanding the impediments which are purposely interposed to deter the third-class passengers, 62 per cent. of all who travel are third-class passengers, and more than £40 out of every £100 received from passengers is paid by them.

On the European continent, in Germany and Belgium especially, the passenger fares are infinitely less than here in England. In Belgium, for long distances, the charge is (0·46) less than a halfpenny a mile first-class, (0·32) less than one-third of a penny second-class, and (0·23) less than a farthing a mile third-class. And a witness before the Royal Commission on railways says:—"In Germany, you see the women coming in with large baskets of vegetables or fruit a distance of 10 or 15 miles into a market town, at a cost of ⅜ of a penny a mile, and they make their marketing before 12 o'clock in the day, and go away in crowds." And why is it not so here? The only answer I have ever heard given to this inquiry is, that railways abroad have cost so much less than they have cost in this country; that here the average cost is about £35,000 a mile, whilst there it is only £12,000 or £14,000, and the companies are obliged, therefore, to charge higher fares to meet that additional outlay. Now let us for a moment deal with that argument, and see if there is any thing in it.

The gas companies of London, a few years back, charged 12s. a thousand for their gas, and declined to reduce the charge, for at that price they could pay only four per cent. dividend, and they would be ruined to charge less, because their plant had cost so much. "Pooh!" said the citizen, "what have we to do with the cost of the plant. A ton of coals will make 8,000 or 9,000 feet of gas, and unless you reduce the charge we shall erect works and supply ourselves." In this dilemma, the companies were compelled to reduce the charge to 7s., 5s., 4s. a thousand—and, at 4s., they paid dividends of 10 per cent. owing to the vastly increased consumption; and the same companies are now expending a million sterling to improve their plant, and simultaneously, within the last six months, they have reduced the charge from 4s. to 3s. 9d. a thousand.

The average cost of English railways is £35,000 a mile, but the cost of constructing the Metropolitan Railway is more than twenty times that sum. Twenty times £35,000 is £700,000, and the cost of constructing the Metropolitan Railway is nearly a million sterling

a mile; and they carry their long-distance passengers at a lower rate than any other railway in the kingdom—at a little over a halfpenny a mile first-class, and a farthing a mile third-class. From Moorgate-street to Westminster-bridge is $9\frac{1}{2}$ miles, and the cost of a return ticket first-class is 1s.; second-class, 9d.; third-class, 6d., for 19 miles; and when the railway is open to Blackfriars-bridge the distance will be 22 miles for the same money. It is true they have been driven to these charges by competition with the omnibuses; but, nevertheless, the Metropolitan Railway has paid larger dividends than almost any other railway in the country.

Now, this is a stock argument, adopted by Mr. Allport, of the Midland Railway. Mr. Allport says, "It is most unfair to compare foreign railways with English, which have cost an average of £35,000 a mile." Well, this argument would seem to afford some reason why the Metropolitan, which has cost twenty times as much per mile as the Midland, should charge more than the Midland, but, certainly, it gives no valid reason why the Midland should charge more than the Metropolitan. Let us see, then, what are the relative charges made by these two companies.

The extreme length of railway at present worked by the Metropolitan Company is, from Moorgate-street to Westminster-bridge, $9\frac{1}{2}$ miles. From London to Mill-hill, by the Midland Railway, is 9 miles. The fares by the Metropolitan Railway is 8d., 6d., and 4d.; by the Midland, 1s. 6d., 1s., and 9d.

Twice the length by the Metropolitan is 19 miles; London to St. Albans, by Midland, is 19 miles. Fares by the Metropolitan, 1s. 4d., 1s., and 8d.; by the Midland, 3s. 6d., 2s. 6d., and 1s. 7d.

Three times the length by the Metropolitan, $28\frac{1}{2}$ miles; London to Luton, by Midland, 30 miles. Fares by the Metropolitan, 2s., 1s. 6d., and 1s.; by the Midland, 5s., 3s., and 2s. 6d.

Four times the length by the Metropolitan 38 miles; London to Harlington, by Midland, 37 miles. Fares by the Metropolitan 2s. 8d., 2s., and 1s. 4d.; by the Midland, 6s. 6d., 4s. 3d., 3s. 1d.

Five times the length by the Metropolitan, $47\frac{1}{2}$ miles; London to Bedford, by Midland, $47\frac{1}{2}$ miles. Fares by the Metropolitan, 3s. 4d., 2s. 6d., and 1s. 8d.; by the Midland, 8s. 6d., 6s. 6d., and 3s. $11\frac{1}{2}$d.

What, then, has the cost of the plant to do with the charge for passengers? With equal reason the manufacturer should charge more profit per yard for his calico than the small retailer, because the machinery by which it is made, and the premises in which he makes it, are so much more costly than that of the small retailer. But that is not to view the subject with commercial eyes. It is by a large consumption of the article manufactured, by keeping the costly machinery by which it is produced well and constantly at work, making it produce the largest quantity of the disposable article that large profits are produced. A manufacturer cares little about the cost of a machine. If it will turn out more work and better work than his competitors, so that he can supply the market more cheaply, more extensively, and more satisfactorily with the disposable article, that is what he aims at. It is by that means his annual income is increased, and ultimately his fortune made.

The managers of English railway companies act as if they were incapable of comprehending the first principles of commercial economy; yet, that can hardly be the case, for there are among them men of very great ability; but they must be judged of by their acts.

Sir Daniel Gooch, of the Great Western, says:—"If there was a considerable reduction in the number of passengers, we might diminish the number of trains, and the saving to us would become very palpable." And upon this principle he conducts the business of the Great Western Railway. Was ever such an unbusinesslike expression used by a commercial man, and especially by a man in command of plant capable of doing ten or twenty times the work that is now done, in the most profitable department of his business?

Mr. Allport, of the Midland, says:—"If a system anything approaching that laid down by Mr. Jones (myself) were adopted, it would be utter ruin." And what is that profitable system, then, that is pursued by Mr. Allport on the Midland Railway?

The capital of the Midland Company is forty millions sterling; the present annual revenue nearly four millions. The average cost of constructing the line is about £35,000 a-mile, and scores of these miles of railway, costing £35,000 a-mile, have been laid down for the purpose of developing the least profitable branch of the company's business—the great mineral produce of the country. And I am not going to blame either Mr. Allport or the company for having done so. That branch of the trade is profitable, and ought to be developed, although it is not so profitable as either the general merchandise or the passenger branch of the business. But why should they not simultaneously have made productive the most profitable branch of their business—have studied to develop that? The passenger branch is capable of far greater development, with infinitely greater profit than the mineral branch; yet little attention appears to have been given to it by the Midland Company. They carry coals for little over a farthing per ton per mile, notwithstanding the cost of the plant or the greater cost of running goods trains than passenger trains, because they are driven to do so by competition. But Mr. Allport considers that to carry passengers on the Midland Railway at the rates charged by the Metropolitan Company, which are rather less than those proposed by me, would be ruin to them; and consequently they carry $14\frac{1}{2}$ million passengers in the year on 1,153 miles of railway, whilst the Metropolitan Railway carries 37 million passengers within the year on less than 10 miles.

In 1867, the period of the last Parliamentary return, the Midland comprised 831 miles of railway, and the revenue was £3,140,000, one half of which was received for the carriage of 4 million tons of general merchandise, the remaining half being produced in almost equal proportions between $6\frac{1}{2}$ million tons of minerals and 13 million passengers. £422,000 was received for the carriage of $9\frac{1}{2}$ millions of third-class passengers, and £480,000 from $3\frac{1}{2}$ millions of first and second-class passengers combined. Now, of all this revenue, I venture to say, and to challenge contradiction, the most profitable part was the £422,000 received from the third-class passengers, and the least remunerative the £700,000 received for the carriage of minerals.

The Metropolitan Railway has cost more than twenty times as much per mile as the Midland, and that company carry the long-distance passengers at a lower rate than any other railway in the kingdom. "Yes," responds Mr. Allport, "but no other line in the country is so advantageously placed for passenger traffic as the Metropolitan. It would be ruin to the Midland to do as they do! Look at the immense population of the districts it passes through!" Now, this observation of Mr. Allport is made, I think, without due consideration and reflection. In point of fact, as I intend to show, the Midland is far more advantageously placed for passenger traffic than the Metropolitan, and may easily be made to carry by far a greater number of passengers, and to receive a much larger amount for their conveyance than the Metropolitan is receiving now, in addition to all that the passenger traffic now produces to the Midland Company. The Midland, and many others of the English railways, contains within itself, or in connection with other co-existing railways, several Metropolitan lines—lines capable of being made as productive in passenger traffic, and, taking into account the cost, far more profitable than the Metropolitan itself; and in order to institute a fair comparison, let us, in the first place, examine the position of the Metropolitan Railway, the locality in which it stands, and the circumstances by which it is surrounded.

From Moorgate-street to Blackfriars-bridge, as the crow flies, is less than a mile; by the Metropolitan Railway, the distance is eleven miles. This conformation of the line renders the competition with omnibuses most perplexing to the company, and the arrangement of the fares extremely difficult; and, consequently, starting from Moorgate-street, after reaching the sixth station (Portland-road), there is no difference in the fare, however far the passenger may travel on the line. From Moorgate-street to Portland-road—three miles—the fare is 8d., 6d., or 4d.; return tickets, 1s. 9d., or 6d,; and from Moorgate-street to Westminster, and ultimately to Cannon-street, is just the same. Finally, the average amount received from each passenger conveyed on the Metropolitan Railway last half-year was 2d. and a very small fraction of a penny.

I have not yet laid before the directors of the Metropolitan Railway my views of the results which would be likely to follow the adoption of my scale of charges upon the Metropolitan line, but I am about to do so, and I will show you what I consider those results would be. By charging one penny third-class, threepence second-class, and sixpence first-class for any distance on the Metropolitan line, by all trains, I am of opinion that the quantity of third-class passengers would be greatly increased, and, at the same time, their quality so much reduced, that the consequence would be a considerable augmentation in the proportion of riders in the second and first-class carriages. The proportion would probably become 20 first-class, 30 second-class, and 50 third-class in every 100 passengers. And, if this result were produced, the average of receipts would be increased to 2·60d. per passenger, or more than a farthing per passenger in excess of the amount received at the present time, without taking into consideration the increase of numbers. It may avoid calculation if I state that a farthing a passenger on the Metropolitan Railway amounts to £40,000 a-year.

As regards locality, and the advantages which that gives the Metropolitan over all other railways for passenger traffic. This special advantage will be found, on examination, to exist rather in imagination than in fact. When the Metropolitan Railway was first proposed the world said nobody would travel on it. "Through the sewers, amongst the gas-pipes, and surrounded by the rats of London, and shut out from the light of heaven"—Such were the remarks applied to it, and, the day before the line was opened the shares were at 40 per cent. discount. Now, whatever may be said regarding the value of the shares, there cannot be two opinions as to the mistake that was made in thinking that nobody would travel on the line. We know how difficult it is to stand an egg upon its end, but Columbus simplified the matter greatly when he cracked the shell. The shell of the Metropolitan Railway traffic has been cracked; seventeen trains per hour run each way over the line, and yet, at certain hours of the day, the travellers can with difficulty be accommodated; and wherein does it differ in its circumstances from portions of the Midland system? When we crack the shell of that inquiry, perhaps we shall be surprised to find that the differences that exist are all in favour of the Midland Company.

How stands the Metropolitan Railway? It passes through nine of the great and populous districts of London, viz.:—

	Souls.
Kensington, containing....	185,950
Chelsea ,, ...	63,439
Westminster ,, ...	68,213
St. Marylebone ,, ...	161,680
St. Pancras ,, ...	198,788
Islington ,, ...	155,341
Holborn ,, ...	44,862
Clerkenwell ,, ...	65,681
The City ,, ...	45,555
Total	989,509

That is something short of a million, or one-third of the population of all London. And, let it be borne in mind, the inhabitants of the south, the east, and the north of London scarcely know, or care to know, that such a line exists. Many thousands in the districts named have never seen a carriage on the line. The railway is opposed, tooth and nail, in every direction by innumerable omnibuses, which not only convey passengers with more convenience at a cheaper rate than the railway, but actually compete with it in time; and westward and northward—that is in its own domain—it is met in competition by the South-Western, the North London, and other railways. Such are the position and circumstances of the Metropolitan Railway.

First, then, before proceeding to compare the position and circumstances of the Midland Railway with those of the Metropolitan just described, it will be well to call to mind and remember that the fares chargeable under my proposed universal penny railway system are one penny per stage third-class, threepence per stage second-class, and six-pence per stage first-class; and the average proportion of first, second, and third-class passengers throughout the kingdom being 11 first-class, 27 second-class, and 62 third-class in every 100 passengers, the produce of every 100 passengers, at the universal penny railway scale of charges, would be 17s. 5d., that is 2d. and $\frac{8}{100}$th parts of a penny per stage for each passenger, or rather more than the average amount received from passengers on the Metropolitan Railway.

Much has been said, and something is being done, in reference to workmen's trains, and Parliament has done something in their behalf. I have not attended any of the meetings or interested myself specially concerning them, because, if ever my plan be brought about—and I presume to think it will be, because it is to the special advantage of the companies themselves that it should be brought about—every local train will be a workmen's train, a mechanics' train, a shopwomen's train, a clerks' train, a masters' train, a merchants' train, a ladies' train. The fare by every train will be 1d., 3d., and 6d. the stage, according to the class of carriage occupied; and every train will comprise the three classes of carriages. Both as respects cost and convenience, therefore, for local purposes, every local train will suit all classes and everybody's circumstances. I have no feeling opposed to workmen's trains; but if there is anything in the plan proposed by me, it must supersede the necessity for them, and the promoters of workmen's trains will leave that project to promote my plan of universal penny railways.

Now let us consider the position and circumstances of the Midland Railway.

A perfectly good understanding exists between the Midland and its neighbours, the London and North-Western, the Lancashire and Yorkshire, and the East Lancashire companies, as evidenced by their present active co-operation. The Midland and North Western companies are jointly constructing a line from Nuneaton to Ashby, a distance of 20 miles, and the Midland has running powers over a large portion of the other two companies' lines. Co-operation, therefore, it may fairly be presumed, could readily be effected between the Midland and those other companies. For the purposes of our argument, therefore, although each company could do its own share of the work proposed without the co-operation of the others, as an amalgamation of interests and joint action in this particular work would make the operation far more easy, and effectual, and mutually advantageous, we will look upon such joint action as already agreed upon, and base our arguments accordingly.

The diagram A represents the greater portion of the Midland system of railways, and those over which that company has running powers. Diagram B, the red lines represent, on a larger scale, a portion of the Midland Railway, and lines over which the Midland Company has running powers. The black lines, from Burnley to Todmorden, and from Halifax to Bradford,

represent parts of the Lancashire and Yorkshire Railway, and that from Ashton to Normanton is part of the London and North-Western Company's system. That from Blackburn to Bolton is part of the Blackburn, Bolton, and Clitheroe Railway Company. The five divisions, A, B, C, D, and E, for facility of reference, we will call circles. The districts comprised in these five circles, for the purpose of omnibus or local passenger traffic, contain an aggregate of 2,866,000 souls, viz., A, 421,000; B, 370,000; C, 506,000; D, 678,000 and E, 891,000 Now, to thoroughly develop the passenger traffic of those five circles of population, an omnibus train should start to make the tour, each way round, at the rate of about 20 miles an hour, with an interval between each succeeding train not exceeding 20 minutes, and stopping at every station. Experience has proved on the Metropolitan line, that cheapness and speedy conveyance, without frequency of trains, will not produce the traffic; but, with the greater advantage afforded in these circles, of two miles distance between the stations, instead of the half-mile distances on the Metropolitan Railway, trains at 20 minutes' interval, instead of four minutes, may prove sufficient, at all events for the first few years. These trains should start at five in the morning, and run without ceasing until ten o'clock at night, charging one penny per stage third-class, 3d. per stage second-class, and 6d. per stage first-class. The circle C — the Skipton circle —is divided into seven stages; the distance round is 64½ miles. The first stage, from Skipton to Colne is 11½ miles, the towns of Elslack, Thornton, Earby, and Foulridge intervening. Colne contains 21,000 inhabitants. The next stage, from Colne to Burnley, 5½ miles, Nelson, Marsden, or Briarfield, intervening. Burnley contains 43,000 inhabitants. The next stage, from Burnley to Todmorden, 9 miles, Townley, Holme, and Portsmouth intervening. Todmorden contains 31,000 inhabitants. The next stage, Todmorden to Halifax, 13½ miles, Eastwood, Hebden-bridge, Mytholmroyd, Luddenden-foot, Sowerby-bridge, and Copley intervening. Halifax contains 36,000 inhabitants. The next stage, from Halifax to Bradford, 8 miles, Hipperholme, Lightcliffe, Picklebridge, Low Moor, and Bowling Junction intervening. Bradford contains 49,000 inhabitants. The next stage, from Bradford to Keighley, 8½ miles, Manningham, Shipley, Saltaire, and Bingley intervening. Keighley contains 22,000 inhabitants. The next stage, from Keighley to Skipton, 8½ miles, Steeton, Kildwick, and Connonly intervening. Skipton contains 9,000 inhabitants. We have now completed the tour of this circle in seven stages, and now let us imagine for a moment that the system is in active operation—that we have just been round the circle C on a tour of observation. The third-class passenger who has accompanied us all the way will have paid 7d. for his journey of 64½ miles; the second-class passenger, 1s. 9d.; the first-class passenger, 3s. 6d.; and a very cheap and pleasant ride it must have been. The pace, twenty miles an hour, was quick enough not to be tedious, and slow enough to allow the train to pass over the rails at the least possible cost to the company. The average of two miles distance between the stations allowed play to the engines, instead of pulling up at the top of their speed at every half mile, as on the Metropolitan Railway. The passengers were subjected to no inconvenience from sewers, gas pipes, or foul air by the way, as it was predicted would be the case on the Metropolitan line. And how pleasant to see the nice, tidy women with their baskets of fruit, vegetables, and eggs, going to the nearest market town to dispose of them; others returning with the bargains they had purchased at the market town we had just left; boys and girls also, on their way to school five or six miles distant, because the cost by rail was only a penny, to the better school at Bradford than the village school at Lightcliffe; the mechanic, investing 3d. to carry him three stages off in quest of work, because in his line of business work had become slack in the town where he resided; the labourer also, acting in like manner, so as to avoid applying to the parish for relief. But a list of the advantages observed by the way would be so long that to relate them all would occupy more time than I could ask you to afford me. Is it true that this is all a fancy? Are all the railways we have mentioned really made and in active operation? Are there engines and carriages standing idle, and not a single train running on the terms suggested? And did not the *Leeds Mercury* say "This is a matter of the greatest importance to railway shareholders?" Surely this must be the experiment which the *Leeds Mercury* thought it would be worth while for the Midland Company to try. The traffic arrangements which are wanted for the general public convenience; to produce profit to the shareholder; to develop the wealth of the country; to promote education; to reduce pauperism and relieve the poor-rates; to promote health and decency in the cities and large towns, and generally to promote the prosperity of the country, are such as I have just described.

With such local trains established all over the country —which would soon be found to be the most profitable work a company could do—through trains, that most costly part of a railway company's expenditure, and excursion trains—the source of accidents and of doubtful profit to the companies—could for the most part be dispensed with. Those who could afford the luxury would provide themselves with family carriages, kept by the railway companies ready for hire, which would be detached from the train on the main line, and hooked on to the local train, so that their occupants could be saved the inconveniences of changing carriages. And the frequency with which the local trains would run over the local portion of the journey would prevent the occurrence of so much delay as would occasion material inconvenience.

I will not attempt to go so minutely through the other circles, but only hastily run round them, directing attention to a few important facts connected with each one by the way.

The circle A is 36 miles round. It should be divided into five stages. From Blackburn to Over-Darwen, 4 miles; Over-Darwen to Bolton, 8½ miles; Bolton to Bury, 6 miles; Bury to Haslingden, 9 miles; Haslingden to Blackburn, 8½ miles. In all, there are 19 stations in this 36 miles. Over-Darwen has 22,000 inhabitants; Bolton, 68,000; Bury, 31,000; Haslingden, 10,000; Blackburn, 63,000. The towns reached in this 36 miles contain over 250,000 inhabitants, the districts 421,000.

The circle B is 42 miles round. It should be divided into six stages. From Accrington to Haslingden, 3½ miles; Haslingden to Bury, 8½ miles; Bury to Rochdale, 7 miles; Rochdale to Todmorden, 8½ miles; Todmorden to Burnley, 8½ miles; Burnley to Accrington, 6 miles. In all, there are 23 stations in this 42 miles. Haslingden contains 10,000 inhabitants; Bury, 31,000; Rochdale, 92,000; Todmorden, 31,000; Burnley, 43,000; and Accrington, 18,000. The towns reached in this 42 miles contain over 240,000 inhabitants, the districts 370,000.

The circle C has been described.

The circle D is 59 miles round. It should be divided into six stages. From Bradford to Halifax, 8 miles; Halifax to Huddersfield, 10 miles; Huddersfield to Wakefield, 14 miles; Wakefield to Leeds, 14 miles; Leeds to Kirkstall, 3 miles; Kirkstall to Bradford, 10 miles. In all, there are 34 stations in this 59 miles. Halifax contains 36,000 inhabitants; Huddersfield, 35,000; Wakefield, 18,000; Leeds, 118,000; Kirkstall, 10,000; Bradford, 49,000. The towns reached in this 59 miles contain over 360,000 inhabitants; the districts, 678,000.

The circle E is 68 miles round. It should be divided into seven stages. From Todmorden to Rochdale, 8½ miles Rochdale to Manchester, 10½ miles; Manchester to Ash-

ton, $6\frac{1}{2}$ miles; Ashton to Oldham, 4 miles; Oldham to Huddersfield, 17 miles; Huddersfield to Halifax, 10 miles; Halifax to Todmorden, $11\frac{1}{2}$ miles. In all, there are 36 stations in this 68 miles. Rochdale contains 92,000 inhabitants; Manchester, 185,000; Ashton, 41,000; Oldham, 72,000; Huddersfield, 35,000; Halifax, 36,000; Todmorden, 31,000. The towns reached in this 68 miles contain over 606,000 inhabitants. The districts nearly equal the districts passed through by the Metropolitan Railway—they comprise 891,000 souls.

In the next place, let us consider what it would cost to set the five circles of local traffic now before us in active operation on the plan proposed. To run trains at the rate of about twenty miles an hour, at intervals of twenty minutes, both ways round each of the circles described, whereby the experiment would be fairly tested, 83 trains would be required, viz.:—

12	trains	for circle	A.
12	,,	for ,,	B.
18	,,	for ,,	C.
18	,,	for ,,	D.
20	,,	for ,,	E.

And three in reserve for repairs. Light engines, suitable for the purpose, would cost £2,000 a-piece, the carriages for each train £1000; making £3,000 per train. Total for 83 trains, £249,000—say a quarter of a million sterling—the 160th part of the capital of the Midland Company, the cost of seven additional miles of Midland Railway. The lines of railway are complete, the money-takers, clerks, station-masters, porters, and police already are employed and paid. Little additional expense for all their services would be entailed.

I think I have succeeded in showing that, in point of population, for the purpose of omnibus traffic, the districts named are equal to those occupied by the Metropolitan Railway, and there are many other districts equally good upon the Midland, and almost every other system of railways in the kingdom. The average distance of two miles between the stations, instead of half-a-mile only as on the Metropolitan, is a great advantage to the company. It makes a ride more useful or necessary for the people. It affords the company 20 minutes, instead of four minutes, for the collection of passengers without the danger of having them run away with by an omnibus or tram-road conveyance at the same charge as the railway; and the difference of distance is immaterial to the traveller, and equally so to the company. The frequency of communication, and the smallness of the charge, so link the towns together, as, in effect, to render all the towns in the circle one and the same for all commercial, educational, sanitarial, and domestic purposes. And when once the people are accustomed to run from town to town at the cost of a penny, the smallest want will suggest a journey, so that the trains will have to be lengthened, and the number of them ultimately doubled, to enable the company to carry the passengers who will present themselves.

In conclusion, I do not think I can do better in bringing my paper to an end, then by once more quoting the words of the *Leeds Mercury*, which I have before referred to, and say:—"If the experiment fail the loss would not be very great, whilst, if it should succeed, it would open a source of revenue whose gradual development might, in the end, be highly profitable to the company, and of great value to the public."

At the close of the paper,

Mr. Allport said he could not help regarding the paper and plans as a fancy picture and an impracticable scheme. Though the population was about the same in the Midland plan as that of the Metropolitan line, yet the case was entirely different. No one would suppose that the Metropolitan line issued many tickets from Moorgate-street to Blackfriars, a distance of nine miles, to take passengers almost to where they started from. The profit was made on short distances, passengers getting in and alighting at every station on the line. He thought after all that Mr. Jones had not made a happy selection in the Metropolitan line as an example, inasmuch as some time ago shares at £140 were run down to £80. The trains, too, on the Midland system were not so easy to be run on the circle system as Mr. Jones appeared to imagine. It would cost upwards of half-a-million of money to connect the different companies; thus, at Bradford, one company enters the town on one side, and the other on the opposite. Then, when all was complete, what chances would there be of profit? It must be borne in mind that people in country towns and villages do not require to ride short distances so much as Londoners. As to the development of railways, he believed there was none in the world so fully developed as our English ones. During the last twenty years our exports had increased from £50,000,000 to £160,000,000, which was mainly due to the perfection of our railway communication. The companies had done all they could for third-class passengers. Referring to an observation, that the traffic from London to York was a monopoly, he said that could not be so, as there were no less than four railways running from London to that city. What would the railways be in the hands of the government? The telegraphs have not been found to answer well under government. The Belgian system differs altogether from ours. Admitting their fares were lower, the cost of construction was much less, the government made the railways and leased them out to companies, who were thereby enabled to run at very cheap fares. No wonder the fares were higher in this country, when it was considered how much railways in every way were made the objects of plunder. He denied that the mineral traffic was unprofitable; on the other hand, it yielded large returns. In respect of minerals only was the transit of goods in Belgium cheaper than here.

Mr. P. H. Holland feared Mr. Allport was correct in believing that, if railway fares be reduced to the extent proposed, the proceeds will not only not increase profits, but will not pay even working expenses. Railway fares are not the only, and are often not the chief, cost of travelling. Again, the proportion of railway travelling in London is no guide as to the proportion of travellers to population elsewhere. In no other place have so large a proportion of the population to go daily considerable distances between their places of residences and their places of business, and nowhere else, therefore, can there be anything like such a proportion of twice-a-day railway passengers. Why, for instance, should very many more people want to go from Rochdale to Oldham, if they can go for a penny? Although, therefore, he quite agreed that a large reduction of railway fares would probably be beneficial to the companies, and certainly exceedingly so to the country, he could not support a proposal so extravagant as Mr. Jones' seemed to be. Real workmen's trains, *i.e.*, very cheap trains to carry workmen between their places of employment, where wages are good, and their homes, where houses and land are cheap, will effect a most useful, social, moral, sanitary, and political reform.

Mr. Raphael Brandon said that, although, like the reader of the paper, he was only a theorist, and therefore, in Mr. Allport's opinion, wholly ignorant of railways and their management, the audience should bear in mind that but for theorists they would at the present moment be without railways. In reply to Mr. Holland's objection, that it would be impossible to create a sufficiently large increase of passengers, no matter how low the fares, to make the system remunerative, he thought the very establishment of railways, and the consequent increased number of travellers, a conclusive answer; the numbers travelling now were ten times as many as in the best period of the old coaching days, and it was but fair to presume that the low fares proposed would stimulate a corresponding augmentation. It was futile to assert that cheap fares would not induce people to travel;

all experience, here and abroad, proved the very reverse; but it must be remembered that it was not by the increase of passengers only that the system he advocated, which was the general amalgamation of all the railways in the United Kingdom under one central management, would be rendered remunerative; the simple fact of that amalgamation would, according to the opinion of a railway authority of great experience, be equivalent to a saving of at least 10 per cent. on the gross receipts, which, in other words, meant an annual profit of £4,000,000; and a further gain or saving would be made by the government, if the railways were in their hands, by their guarantee of the interest on the debenture loans, &c., which would be equal to at least another £1,500,000 per annum. Another instance of the saving in expense to be made by a central system of management, was the substitution of one for the many railway stations now existing in most of our towns, whereby the public would be very much more conveniently served; as an illustration near home, he named the existence of five separate stations at so comparatively unimportant a place as Croydon, each with its special staff of "employés," and such cases are repeated all over the country, while the abandoned stations would prove a valuable source of revenue.

Mr. Horton, C.E., approved of Mr. Jones's plan for short distances. The North London Railway Company, owing to numerous stations and cheap fares, were obliged to put down two extra lines of rails for the accommodation of the traffic. For long distances the scheme would be impracticable, inasmuch as slow trains would be an obstruction to the ordinary through traffic.

Mr. Hyde Clarke said, if there were alleged fallacies in Mr. Jones's paper, what must be their reflections after the remarks of Mr. Allport. Here was one undoubtedly the oldest and most experienced railway manager in England, one entitled to great weight within his proper functions, and yet what was the real value of the representations made by him. He told them that the increase of the export trade of England, from £51,000,000 to £140,000,000 in twenty-one years, was chiefly owing to the railway companies, and was a measure of their services and of the obligations due to them. He (Mr. Clarke), placing the value of railway transport at a high standard, really thought that the increase of our trade was mainly owing to the concurrent increase of the area of consumption, the advance of Australia and our other colonies, the progress of India, and the development of the countries on the Pacific. He drew another deduction from Mr. Allport's remarks and from his return, and that was, that the railway system is perfect, and admits of no improvement. If that were indeed so, our position must be unfortunate, for the trade of the world will continue to advance by a rate far beyond the increase from £51,000,000 to £140,000,000, and our share of it, in the present state of competition with the Continent, will greatly depend on our having the same economical means of transport for manufacturers, artisans and for goods possessed by our Continental rivals. He would not now enter into the merits of Mr. Jones's plan, for which there was much to be said, nor criticise some of its practical deficiencies, for he preferred presenting to them plainly the question that was really to be solved, how our passenger and goods traffic was to be economically conveyed? That must be done either by Mr. Allport and the railway directors, or by Mr. Jones's plan, or, in the failure of such expedients, by the government, which would discharge its public trust, regard national interest, and be amenable to the voice of opinion. In this respect private enterprise, in the shape of boards of directors, had failed in England, and had notably failed in comparison with management on the Continent, whether that management was conducted by government or by companies. Private enterprise had worked within due limits in the construction of railways, and we had thereby obtained a more rapid development of the railway system in this country, but it failed in their administration. Railway directors had not the requisite training or knowledge, and they looked chiefly after their own interests instead of regarding their duties as traders for the public, which they were expected to observe. He looked, therefore, to the government for the ultimate solution of the matter. There seemed to be an incapability to deal practically with Mr. Jones's paper. The increase of traffic depends upon the better distribution of labour, when adequate facilities are afforded by railways. Whenever railway charges are brought into conformity with the means of the great mass of the population, as determined by their wages, then the increase of travelling would be great. This was a standard to be regarded in fixing the rates of transport in England, in Belgium, or in India. To this point they must come if the resources of the country are to be developed, and, notwithstanding the attitude taken by Mr. Allport, he trusted that, when the time came, Mr. Allport and his colleagues would not be found wanting in the energy and enterprise of Englishmen to accomplish a practicable purpose.

Mr. Frederic Y. Edwards observed that the railways in the United Kingdom were not constructed in the interests of the public, but apparently to suit the convenience of contractors, and to afford places for directors, who have, from the beginning, acted upon the principle of exacting the utmost they could squeeze out of the public, and giving in return the least possible accommodation. In reference to the success attending the increase of travelling facilities, there is no stronger proof of the necessity and expediency of increasing opportunities for travel, in order to create the want, than the experience of the Metropolitan Railway. In regard to the rates for goods being higher on the Continent than at home, he said that that was only the case in countries where the State had no control over the railways, and proved the badness of the company monopoly system everywhere. The fares in Belgium had been for years lower in many cases than those proposed by Mr. Jones, and that, although not entirely agreeing with that gentleman in his theory, this fact sufficiently warranted a thoughtful consideration of the project. While the Belgian State line was earning between 5 and 6 per cent., with fares in many cases lower than ½d. per mile first class, and ¼d. per mile third class, and taking, unlike our illiberal railways, third class passengers by all trains, except a very few special expresses, the companies lines in Belgium, constructed at far lower cost, with fares double and treble those of the State, were often almost on the verge of insolvency. The Baden State Railway pays 15 per cent., although the fares are little higher than 1d., ¾d., ½d. per mile for the three classes, and although the thinness of the population in a mountainous district showed that no increase could be expected in any way approaching that which might be expected were a low scale of fares to be adopted at home. Some railways in Germany paid as much as 24½ per cent., with lower fares and better accommodation than we get in this country. Then as to the 1d. postage, was it not said, in 1839, that no one would write more because the rate was lowered, and has not experience proved to us the fallacy of such reasoning? The great object in view was to place our railways into the hands of the State, all details losing their importance as compared with this first necessity.

Mr. Campin, F.S.A., premising that railway companies, in the conduct of their business, were actuated by the desire to earn the largest amount of profit on the smallest expenditure of capital and labour, stated his belief to be that if that point could be arrived at by the carriage of one passenger daily, one passenger daily would be the complement alone aimed at. Looking at the enormous powers conferred on railway companies, it behoved the Legislature and the public to see and insist that those powers should be so exercised as

to afford to the public the fullest amount of accommodation, consistent with a fair rate of profit. As to the precise details of the scheme laid before the meeting by Mr. Jones, he (Mr. Campkin) contented himself with expressing his simple approval of its main features, and his conviction that very much of it was quite practicable, and would sooner or later be brought about, to the increased accommodation of the public, and the enhanced profit of the companies.

MILITARY LABOUR.

A report of a discussion at the United Service Institution, on a paper on "Military Labour," read by Captain Webber, of the Royal Engineers, has recently been published, which has an important bearing on the discussions held at the Society of Arts on economic questions of army organisation. The paper was pronounced to be a very able one by those present at the discussion. It enumerated the general proposition that every member of the service receiving pay from the public funds, whether he be on the active or non-active list, if his time is unemployed, or wasted on unproductive labour, is a standing evidence of inefficiency; and that every "so-called" non-combatant member of the army, whether he may be styled military or civil, who is paid for the performance of work, while a "so-called" combatant member is available for its execution, represents by his salary a direct waste of public money. He submitted two propositions:—1. That all labour arising out of the soldier's existence shall, if entrusted to him to be performed, be considered as much a regimental duty as any portion of his work. 2. That the superintendence of all labour shall be undertaken by the soldier's own regimental officer; that officer, or these officers, being compelled to qualify for competency, and becoming wholly responsible for the expenditure. Captain Webber commenced the paper by stating that lately, as a member of a court-martial, he was much struck by the following incident:—Three healthy-looking young men were successively convicted of desertion. Each had enlisted in May, and run away in the following December. They had one and all probably tasted the pleasures of soldiering in a garrison town, and eight months was not too short a time for them to have obtained a view of their future career by the experiences to be picked up in a depôt battalion. As each case was rapidly disposed of, the following replies were received to the questions as to what they had been doing while absent:—No. 1. "I have been working in London as a shoemaker, and I'm tired of soldiering." No. 2. "I was helping in a tailor's shop." No. 3. "My mother wanted support, so I worked as waiter at a restaurant." The paper was occupied chiefly with details of regimental organisation, as to the means of superintending and accounting for work, which it was assumed in the terms of the proposition would be chiefly day-work, or duty-work, which he proposed should, for the line, be superintended by a new officer of special qualification, to be called "an officer of industries."

Rear-Admiral Sir John Hay, Bart., M.P., presided at the discussion, which was opened in the following terms:—

Mr. Edwin Chadwick, C.B.—I beg to make some observations upon this very important and interesting paper which Captain Webber has read, because I think I may supply somewhat of what appears to me to be a deficiency of principle in the motive power, namely, the element of self-interest of the workers. I have had some experience in relation to military labour; to trained and systematised military labour, to that of the Ordnance Survey Department, where, as I think, the defect of a deficiency of interest in the work, and its consequent slackness, even under a highly-trained superintendence, was strikingly displayed in connection particularly with the Engineer Corps. Some years ago, when as a sanitary commissioner and member of the first General Board of Health, I had to promote sanitary works for the improvement of towns, I was strongly induced by my friend General Colby, who had charge of the Ordnance Survey, on account of the representations which he made as to the superior eligibility of the Engineer Corps, to press the services of that corps upon the local authorities, to make the requisite surveys for their drainage works. One ground for my doing so was, that the employment of the Engineer Corps was, as he represented, much cheaper, that their surveys would be better, and the corps having a superior division of labour, could be made more responsible for the work than could possibly be the case with civil engineers. The work must, he urged, be much cheaper, because the privates, the chain men, the non-commissioned officers, and the officers, worked at some half the daily pay that civilian engineers could get trained men to do work for. With this ease—which was all set forth in black and white—it was a pleasant duty to urge the employment of the corps upon local work. I encountered the hostility of civil engineers, but a number of towns began with the Ordnance Corps. But the work, instead of being quicker, was, with all the division of labour and disciplined superintendence, dreadfully slower than the civil work. This was a most serious disaster to our board, as it prevented our having the works of several foremost towns completed, as they might and ought to have been, as specimen towns, to show what might be done, in time to submit to Parliament when the period arrived for the renewal of our powers. The failure in point of time was a public disaster. But when the bills did come in, they were greatly beyond what we had been led to expect them, in some instances more than double our estimates, and more than civil engineers were ready to testify they would have done the work for. Towns refused to pay these demands, and defied battle before juries upon them, and I believe that they never did pay the excess beyond the estimates. The *morale* presented was that which is the opprobrium of the building trades, of enormous bills beyond the estimates, on the faith of which the service has been included. Now, what was this disaster due to? To day-work. True, the men were paid at half the rate by the day that civilians were, but they took two or three days to do the work that the civilian does in one. Since this lesson, as I understand, the piece-work principle has been introduced, and I am assured that under it twice and three times the amount of work is now got for the same money. I have seen a great deal of work done by soldiers, and my observation leads me to say that the piece-work principle is of very general application, and of special necessity for application to their labour, if you are to get out economical results equivalent to those from civil work. In the instance of the survey work, the superintendence was systematised. In civil work—in railway work, for example—what constant superintendence would get out from the navvy twenty cube yards of earthwork a day, the gang's "stint," that piece-work gets out? The military superintended-day-work is the ridicule of workmen of the wage class. I happened to be going down the river, and looking through a glass at some work going on at Woolwich; a workman came beside me, and said, "Will you let me look through your spy glass?" He looked, and saw a soldier painting something, when he said, "There is a day-work stroke," and handing the glass to another operative, he said, "Isn't it, Jem?" "Yes," said he, "it is indeed a day-work stroke, and a very poor one of the sort." Operatives, in going about and seeing soldiers at work, speak of it with ridicule; they stop, and laugh, and chaff the soldiers at the way in which the work is done by them. A contractor proposed to reconstruct the huts at Aldershot of concrete and other materials, and declared he would get it

done cheaper than the government or the army could do it, and yet he would get it done by the soldiers if he were allowed to employ them. He would do it, but the officers could not. "And how would you do it?" I asked. "By piece-work," he replied; "I would soon get them into the way of it." What a spectacle had we and Europe of our sending out a civil works corps to construct a road, whilst there were spadesmen in the ranks who saw their brother navvies doing the work for six or seven shillings a-day, which they in the ranks could and would have done if they had been allowed to do it at piece-work! I am confident that if that common principle of self-interest were duly brought into play, you might have an enormous amount of public work done by the ranks of the army. Let the work be put up to contract, to be done at piece-work by the men, and I believe they would form themselves frequently into gangs, or with their officers to overlook them, and would do the work at a great deal less price than the work could be done by civilians. Civil work-masters, by refusing to retain men who fail to return a remunerative task of work in the day, practically convert day-work into piece-work, which ordinary military superintendance fails to do. The piece-work principle is applicable to officers as well as men. If any public work is required, let the engineers' officers of any rank send in plans and estimates for it, and if the plans are accepted, let the planners have the execution, with a percentage on the results; and let them engage the men at piece-work to do it. On this principle much might be got, with great advantage to the public as well as to the force. But the paper does not develop one topic, which I think of very great importance with respect to army work, namely, the out-door work—letting the men out to do civil work. The cases of the men of good character tried by court-martial for desertion—for deserting from mere routine soldiering to real productive work—cited by Captain Webber, are illustrative of the topic. They were men of good character. One of them said, "I have been working in London as a shoemaker, and I am tired of soldiering;" that is to say, they were wearied of the barrack routine, and desired, not idleness, but work. Well, now, might we not let the men out upon long furloughs to do civil work for themselves to a very great extent? Why, in the case of the engineers themselves, I observed some evidence of Colonel Kean, to the effect that they had, from those highly-paid men, frequent desertions; and the cause of the desertions was, that there was some special civil engineering work to be done close at hand, for which the men get, for the time, seven shillings per day. The men of otherwise good character, probably like those mentioned by Captain Webber, deserted from three shillings a day from the soldiering, in order to get seven shillings for vigorous work. Why should they not be allowed to go on furlough, even at some inconvenience, to get that money, and return? Why should we not let men go out on long furloughs who are "tired of soldiering," that is to say, of doing nothing, or only wearisome, and wasting, and enervating routine work, and find profitable employment? Why detain them in the purgatory of a monotonous, wearing, routine, when they would probably return gladly periodically to exercises of active interest, such as volunteers enjoy? That is done abroad—in Sweden, for one example, as I know. I know at one time it was done here. In my inquiries as a Commissioner of Poor-law Inquiry, and and afterwards in Poor-law administration, into the causes of pauperism, I found that the army contributed a heavy contingent of pauperism, and that the disbanding of a military force was attended by an addition to the pauper force, the pensioners included, a great portion of the pension-money being almost worse than wasted from the mode in which the pensions were paid. I found army pensioners a regular item in almost all pauper rolls—so regularly, that on looking over one roll, in one of the suburban parishes, I said, "You have not got any pensioners on the pauper list; have you no pensioners in your parish?" "Yes we have," said the parish officer, "but the pensioners are old guardsmen; they have been used to work in the service, and now they are pensioners they continue to work, and they get their own living." I was struck with this incident, which directed my attention to the subject, on which I made official representations. There are continental examples of the practice—that of Sweden I learned most about—of letting men who can find work for themselves go out on long furloughs, with the condition of coming under colours for a part of the year, to keep up their exercise; being an extension of our militia system. In Sweden, about two-thirds of the force is frequently out on leave, to the great relief of the country, and the benefit of the men, and with anything but detriment to the effective force. If the men of good character who deserted, from being "tired of soldiering," and returned to productive work, had been let out on furlough, they would probably have gladly returned to the ranks for a part of the year, as a change from civil work, or on account of any slackness in it. On such a system, which would be better than the usual short terms of recruitment, you would get a far higher and better order of recruitment than you now get. In the instances of which I have had accounts, the men engaged in productive work are really fresher and stronger for service than those who are kept in barracks, in camps, and cantonments, where they are comparatively enervated and demoralised, as the penal returns and the hospital returns show. Such is much of the experience of Prussia, as well as of Sweden and the Northern States of America, where there will be no lack of force when the trained men are brought again under colours. In Sweden, as I am informed, so systematically is the principle applied, that there are nearly two-thirds of the first regiments always out on furlough. In a city like Stockholm, if a merchant ship comes, and it is required to be unloaded immediately, they go to the guard-house and get a sufficient force—it may be a corporal's guard, or a company with a sergeant—and the ship is unloaded in a very short time. The guard-house is a sort of labour mart for getting a great deal of the miscellaneous labour of the town, and I have no doubt a large amount of the miscellaneous work in this metropolis might be done in this way by soldiers better than by the commissionaires. The men would find out work for themselves which nobody else would find for them. The principle of letting out men systematically for civil service would, I submit, be equally applicable to officers, and especially to officers of the scientific corps, for any length of time, only calling them under colours for short stated periods to maintain their professional habits. I think the restraint to this, by the present practice of seconding, of requiring officers to leave active, and invigorating, and profitable civil work and practice in the direction of labour, and return to inferior barrack-work or no work, and only enervating routine, is proved to be pernicious and indefensible. In India, as well as in America, active civil occupation and productive occupation in peace is proved not to deteriorate, but to augment aptitudes for work in war. In the Northern States of America, after continued trials, they were driven to the scientific corps for commanders, and of their successful and most distinguished generals, I believe there was not one who had spent an exclusively barrack, or camp, or cantonment life, and who had not been engaged in some sort of productive civil work in time of peace. As an all-prevailing principle, that of piece-work is to be contended for in the service as the prime-mover and systematised, and the most free permission to occupation in private service. These principles I venture confidently to assert, from experience and observation, would conduce to our military force, as well as largely to the public economy.

Colonel Schomberg, C.B., R.M.A.—I think in so interesting a question, facts are what we want. During the last three years, I have had an opportunity of having a great many men at my disposal; I speak now of the

Marine Artillery. I have not had the returns of the work done last year, but in the years 1867 and 1868, out of an estimate by contract of £6,500, the soldier labour made a saving of nearly £1,600, about 25 per cent. The work was very various. The barracks were repaired and kept in good order. Two batteries were thoroughly repaired, to represent sections of ships, one battery to carry a 12-ton gun and two 6½-ton guns, the other lighter guns. The guns were pivoted and placed there. One or two stores were roofed. The main drain was extended. New schools were half built. When the reduction of the corps took place, I was obliged to remove the men from the schools in consequence of requiring them for drill. A parade ground was made and levelled, and various other works were carried out.

Dr. Stallard—I thoroughly agree with what has been said by my friend on my right (Mr. Chadwick), that all work in the army must be done on the principle of piecework. I have often, like him, observed and smiled at, as a civilian, the way in which, for example, a fatigue party goes to carry coals from the stores. About twelve or fourteen men are sent to do what two or three would very well accomplish if they are paid for it. A corporal and a certain number of men go along, and as soon as they turn the corner of the parade ground, they set down their baskets and begin to chat. They often stop two or three times. I have often seen this at Aldershot. It is not an unreasonable thing for them to do; the men have no interest in what they are doing, therefore they do not hasten over it as they would do if they were paid for that work. I maintain, therefore, that no system of employment will ever succeed unless it is a regulated system of compensation for actual work done. Then, there are other things which stand in the way of work in the army even far before this, and which I do not think have been sufficiently noted in the paper before us. I allude to the notion of what is necessary in the shape of discipline, parades, guards, and sentries. Now I must say, as a civilian, looking at it from a civilian point of view—I daresay gentlemen will pardon me; I know these are perfectly heretical opinions for me to hold—but it struck me, certainly in two or three cases, it was a ridiculous sight to see an officer with a guard of twenty men at a place like the entrance to one of the barracks at Dover. There is an ascending staircase; there is an officer's guard there of some twenty men. I ask you whether any gentleman thinks it necessary to employ twenty men and an officer to do the business of that particular place? It seems to me a waste of human labour to keep up men for the purpose of doing certain routine work, keeping them up three nights a week from their beds, for doing what would be infinitely better done by two paid men.

Colonel Fletcher (Scots Fusilier Guards)—I have gained some little experience, during the last few months, by watching the course that has been pursued with reference to military labour by a portion of the second battalion of the Scots Fusilier Guards at the Tower. During the time the battalion has been stationed there, many of the men have been employed under the Royal Engineers, both as mechanicians and as labourers, and not only do I think the labour performed has been to their advantage in the way of discipline, but the medical officers have mentioned that, in consequence of the men being so much employed in the open air, their health has improved. The battalion has also attempted another mode of labour, which I think requires some notice. The men have been instructed in the principles of field engineering; they have been employed in the Tower ditch in throwing up portions of redoubts and of batteries, in making gabions and fascines, in constructing portions of the first and second parallels, and in other works comprised under the term of "field engineering." In this way their time has been fully occupied.

Sir Wm. Codrington—Were they paid?

Colonel Fletcher—No, certainly not. The men were selected for the work, two from every company, who, when the course had been completed, were relieved by two others, selected in the same manner, and as a proof that the men liked the work, I would mention that there were many volunteers for it. I have seen the men working in the Tower ditch with hands blistered and sometimes bleeding, and yet there was no grumbling; on the contrary, the men were interested in what they were about. It was something new, and at the same time they felt that they were learning their duties as soldiers. I see a few difficulties in the way of employing soldiers in trades. One is the jealousy it might excite outside. The mechanics are jealous of soldiers working at trades, lest they should take the bread out of their mouths. Another difficulty lies in providing suitable clothes. If men have to be frequently on parade, where they are expected to be smart and clean, they do not like their clothes to get dirty. There is also this difficulty, that there are a great many men who enlist into the army who are constitutionally idle, and who have been forced to enlist from their unwillingness to work in any other way. These men are not necessarily bad soldiers. They may very likely have been fast sort of fellows who would not put their hands to hard labour, and have consequently joined the army under the idea that there would be nothing to perform.

Sir Harry Verney, Bart., M.P.—With regard to the work that can be done by soldiers, I was once visiting a friend in an army of 40,000 men. They had erected all their own huts, they built a theatre for themselves, they painted the scenes; each hut contained, I think the number was seventeen men, and many of the huts were ornamented with drawings made by the men themselves; in short, they provided themselves with their own residences and ornamented them; and one day an officer who conducted me took off a man's shako and said, "Except the ornament on this shako, all the man's clothes were made in the barracks." That is an instance of what soldiers can do. Napoleon used to say that his best army—it was the army that conquered at Wagram and Austerlitz—was the army that had been three or four years at Boulogne, and which there had to provide everything for itself. It was the most working army, I believe, that Napoleon ever had. Colonel Fletcher has referred to the capacity of officers to superintend work of various kinds. I confess I think our army will never be what it ought to be until our officers are capable of many of those duties that Colonel Fletcher has alluded to.

General Lord Napier of Magdala, G.C.B.—With regard to the working of soldiers, that, perhaps, has been practised more in India than in this country. I remember very well her Majesty's 13th Regiment being employed in a hill station. The engineer wanted to remove a number of hills; he gave the work over in contract to the soldiers. They looked very hard at their bargain; they measured the hills, and they considered the matter for two or three days before they would take the contract. They got their oldest heads to examine the contract, and when they had satisfied themselves, they took the contract for better or for worse. They did their work perfectly, and were all the better for it. There are now many miles of road in the Himalayas which have been made by soldiers who are employed there every year. An amount of labour has been obtained which could not have been taken from the civil population, for the people are not very fond of work, and are jealous of any interference, so that by the employment of soldiers a great advantage has been gained, in a military point of view, by connecting two military stations by a line of mountain road. With regard to native troops, I can speak with great confidence, because I have watched the labour of these men. It was formerly the custom to canton the regiments in India, and to make them build their own huts. No one took much pains to see what sort of huts they built. They were built in regular lines, and very

miserable huts they were. But with the gradual progress in sanitary improvements, better huts have become necessary, and the men have been engaged to build them. The class of natives in India which supply the soldier does not like labour. They are often able to put forward religious objections to labour, but they work in their own homes, and the man who in former times would have refused to take up a spade or a basket at the order of his officer, might have been seen in his own home covered with mud in making his hut. Still, they were allowed to put forward the religious objection. But that has now been very much done away with, and they have been engaged, particularly in the Bombay Presidency, in making their own lines. The expense of labour in that presidency is very great, and at the same time the cost of all materials has risen very much. The soldiers were therefore told, "If you will give the labour, we will give you the materials, if you cannot buy them, for the sum allowed by government" (it was rather a small sum). For each set of lines there was an estimate made by the engineer department, and I found, upon calling for a statement of what had been done by about thirteen regiments, that the work was accomplished for £80,000 under the estimate. The men have been stimulated to great emulation, and have built very nice lines indeed. Some of the native officers' houses that I went into, instead of being mere hovels, which they used to be formerly, are really now very nice abodes, and very comfortable inside.

Colonel Evelyn, commandant 1st Royal Surrey Militia —As instances from experience seem to be received with interest this evening, I may as well state another fact concerning a regiment that has already been honourably mentioned—the Rifle Brigade, in which I formerly served. A good many years ago, on the frontier of the Cape of Good Hope, many of these excellent measures which now excite so much interest with reference to the employment of the soldier, were put into practice. The first battalion of the Rifle Brigade built a town, they built excellent barracks, they built houses for their officers, some of "wattle-and-daub," some of bricks, and roofed with various materials. They also made an aqueduct some three or four miles long, to supply the camp with water, and for the purpose of irrigation. When we left, they had more than half built permanent barracks of stone. That was all done entirely by one battalion, without neglecting any of its military duties. Colonel Glyn, who has already been mentioned, was at that time a captain in the regiment. Our commanding officer, poor Sydney Beckwith, gave no unnecessary drills. We had a daily parade, inspected arms, &c., and saw that the men were in proper order, and then dismissed them to their working parties, and almost the whole of the regiment was employed almost every day in working parties. I never heard of a single man objecting to work, although their extra pay was very small, about 4d. per day. They preferred this to lounging about in the barrack-rooms.

Colonel Ewart, C.B., R.E.—The question of piece-work has been adverted to, as if there was something new in it. In every rank in the corps of Royal Engineers, I have been somewhere or other engaged in the employment of military labour. I can only say that, if my friend Mr. Chadwick had been at Gibraltar with me twenty years ago, he would have seen me at six in the morning going to the works and laying out tasks for the men. The men, if employed by task-work in that climate, are able to get away from the works earlier than would otherwise be the case, and are thus less exposed under a hot sun. Therefore, there is nothing new in the idea; we have worked by task-work in the Engineers, we have worked by piece-work, and we have worked by day-work. The key of the position in the matter under discussion is this, that, in order to carry out this system effectually, the commanding officers must be with us. I may mention that I and other commanding officers of Engineers are most anxious to promote this sort of employment for the troops. We find it answers where we get the commanding officer to take it up and work it.

After some discussion, in which Sir William Codrington took part, also Colonel Schomberg and Colonel Lowry, chiefly on the difficulties presented by the existing regimental arrangements, thanks were voted to Captain Webber.

SHORT SERVICE AND INDUSTRIAL TRAINING FOR THE ARMY.

The Secretary at War, who has previously announced the official recognition of the progress of science in the augmentation of defence against offence in war, has this last week announced what is deemed an important advance in the principles of army reform, which, without reducing military force, must lead to the reduction of those fiscal burthens which so powerfully retard the progress of arts, manufactures, and commerce, and which, for that reason, has of late been made the subject of discussion by the Society. The principle of reform advocated by members of Council was short service under colours, and absence under long furloughs, for occupation in productive civil labour. Mr. Cardwell now declares that "a system of short service is at the root of army reform." By the new measure he has introduced, enlistment is to be on a condition of liability to serve for twelve years as part of a reserve force, but for absolute training by service under colours only for three.

"No person," said Mr. Cardwell, "will maintain that a soldier cannot be made a good soldier in three years. When serving in the reserve force, the soldier will receive 4d. a day, which will make his pay equal to that of the Royal Naval Reserve. I hope that, by offering these advantages, we shall succeed in inducing men to join the army for a certain specified period, in which they will acquire habits of discipline and industry, with the view of retiring from it comparatively early in life, and of entering into various industrial pursuits, while they will always be available as a reserve force in case of need. Clause 21 of the Bill intends to provide for the minimum of the drill, in order not to interfere with the industrial occupations of the reserve force. If we were to require the regular and continual training from the reserve force which is required from the Militia, we should incapacitate the men from obtaining industrial employment, and thereby frustrate the object we have in view, whereas, by only requiring for them the same amount of training as is undergone by the pensioners and the volunteers, we shall enable them to follow the various industrial pursuits in which they may be engaged."

The principle adopted by the goverment is a close advance to the Prussian system of three years' service, which was advocated in the Society's discussions by members of the Council. The army may, under the new conditions, be made to consist, as in Prussia, of three years' service men. The progress of opinion on the question of the employment of soldiers in productive service, even when under colours, and the principles on which this should be done, is displayed in the report of a discussion on the subject at the United Service Institution, of which an account is given in this week's *Journal.* A further reduction of the term of military service will no doubt be brought about by the transference of as much as possible of military drill and training from the productive adult stages to the non-productive or school stages of life, as part of a national system of elementary physical as well as mental training, which has been advanced by the Society, and is steadily advancing in public opinion. In the present depressed state of much of the labour market, recruitment may not be unsatisfactory, but it is, nevertheless, found that men of the desirable quality do not come forward for the higher pay of the police force, and it is to be apprehended that, with an improved labour-market, there may be some disappointment with the

recruitment, even under the improved conditions. Under all circumstances, it is held to be expedient to extend the predisposition to recruitment of an improved quality, by the general adoption of military drill in the school stages, of which examples will be afforded by the review of the half-time schools, under military drill, which has been promoted by the Council, and which is arranged to take place on the 21st of next month, at the Crystal Palace.

EXHIBITION OF FANS.

At the South Kensington Museum there has been opened to the public an exhibition of fans. The exhibition is a part of the scheme of the Department of Science and Art for the art instruction of women. To promote this object, the Department offered prizes in competition for fans painted by the students in the female schools of art in 1868, and again in 1869. The fan-mount to which in the first of these years the chief prize was awarded, is included in this exhibition, and it is intended to continue the competition. Her Majesty also purposes to offer a fan prize for competition at the International Exhibition of 1871. The Society of Arts has also offered its gold medal (of the value of 21 guineas) for the second-best fan exhibited. The Lady Cornelia Guest and Baroness Meyer de Rothschild have each offered a prize of £10 for the two next best fans. A sum of £50 will be awarded and spent in various amounts by the Science and Art Department, for fans produced by female students of the schools of art in the United Kingdom.

From the interesting introduction to the catalogue, compiled by Mr. Samuel Redgrave, is gathered that the dress fan of a high character is now exclusively made in Paris. In no other city does a modern fan command a price of £100, and the makers may well claim to have made all Europe tributary to them, admitting, however, that they cannot rival the cheap and remarkable quality of the Chinese fan. This pre-eminence, which we readily grant, is evident in the present collection. It depends upon a combination of skill. The fan-maker (*eventailliste*) calls himself the inventor or designer, and he well merits the title. He employs able artists to paint the principal decoration for the mount, and to carve and decorate the stick. These parts, which are produced under his direction, he combines and fits up, exercising a controlling taste, which gives a name and individuality to the works of the chief Parisian makers. Thus the fan, like the pin, is a work of many hands,—the painter, the carver, the gilder, and the jeweller, with several inferior artisans. In some instances the complete fan is the design of an eminent artist, who thus gives to it a uniform, harmonious character.

Some interesting facts relating to the Paris manufacture of fans appear in the report of the Délégations Ouvrières, Paris Universal Exhibition, 1867. It is stated that the fan-stick is specially made in the Department of the Oise, and that mother-o'-pearl, ivory, bone, sandal-wood, and other domestic and foreign woods are used, the manufacture in mother-o'-pearl being carried on at Andeville, and in other materials at St. Geneviève. The work is chiefly domestic, the artisan, his wife, and children taking a share in it, and frequently attaining great skill by their own untaught industry and talent. The finely painted mount is exclusively Paris work, the most esteemed artists being frequently employed. The fans thus produced are made under the direction of the principal dealers in Paris, and are of the highest quality, usually representing some speciality which belongs to their producer. In England, the trade has not found such a development, and its future extension would seem to depend upon the uprising here of men of taste and capital, who, as producers and sellers, shall occupy the place of the Paris *eventailliste*.

Among the more curious of the fans exhibited is one dated 1650, the mount of which is a landscape and figures embroidered in silk. Some of the carving of the mounts is exceedingly delicate. A fan, one of the wedding presents of the Empress of the French, is especially noticeable for its display of fine open cutting in so brittle a material as mother-o'-pearl. Some of the fans possess historic interest, two or three being associated with the unfortunate Marie Antoinette.

Her Most Gracious Majesty the Queen contributes sixteen examples; Her Imperial Majesty the Empress of the French, thirty-five; and Her Royal Highness the Princess of Wales, Her Royal Highness the Princess Christian, Her Royal Highness Madame la Comtesse de Paris, are among the exhibitors.

A great feature in connection with the exhibition, and, considering the objects for which it is held, perhaps the most important feature, is the immense range of material that seems suitable for fan making and decoration, and the way in which the simplest and homeliest materials may be used with advantage. One fan mount is entirely of cut paper; but paper cut with such delicacy and careful design as to produce a very high artistic effect. Putting on one side the sticks and guards, it affords hope for the success of the attempt to provide a further and profitable employment for women. Those implements and materials which come most handy to their use are capable of producing good results—the needle and thread, the pencil and pallet. Paper, silk, feathers, spangles, cloth, beetles' wings, photographs, all may be made use of, but need artistic skill and taste in their application and arrangement. In proof of this, it is only necessary to point to the tambour-work, and the mounts of lace and embroidery, and the charming paintings, exhibited by Mdlle. Alida Stolk, of Paris. It is a matter of satisfaction that most of the exhibits will be open for the use of those who desire to study or copy them.

EDUCATIONAL NOTES.

Certainly the most important educational event of the week is the passing of the second reading of the University Tests Bill by the House of Commons, the numbers voting being 191 to 66, giving the large majority of 125. The only material difference between the present Bill and the one introduced last year, and passed by large majorities of the House of Commons, is, that this Bill has incorporated into it the substance of the amendment moved last year by the member for Brighton (Professor Fawcett), the effect of which is that, instead of the abolition of the tests being left to the various colleges, to be adopted by them or not at their pleasure, those tests are abolished for them, once for all, by Parliament.

The Solicitor-General, in moving the second reading, expressed his confident hope that the measure would favourably settle at once and for ever the great religious difficulty in the universities and colleges of the country, and that, with that difficulty once put out of the way, the universities would be able to go forward to those educational and academical improvements which he thought no fair man could deny to be wanting, which it was very desirable that the universities themselves should take in hand if it were possible, but the undertaking of which the constant agitation of the religious questions tended most seriously to delay.

A petition, based upon the principle that it is possible to give religious instruction founded upon the reading and explanation of the Scriptures, in such a way as to teach children the cardinal principles of Christian faith and morality, without introducing any element of discord, has been numerously signed by the masters of endowed and public schools. It sets forth "that the exclusion of religious teaching from primary schools would be highly inexpedient, and at variance with the general sentiment of the country; but that it would be desirable, for the sake of justice and harmony, that in rate-aided schoo

no distinctive formulary of any religious body shall be taught; that the school work shall in all cases be arranged according to a time-table, accessible to parents; that any parent shall be at liberty to claim exemption for his child from the religious instruction." It gives up the use of the Church Catechism in rate-aided schools, while it allows to be retained the use of school prayers, the explanation as well as reading of the Scriptures, the use of the Lord's Prayer and Ten Commandments, and the summary of Christian teaching embodied in the Apostles' Creed, as being formularies not "distinctive" of any one denominational body, but common to the whole body of Christians. The petition already has the signatures of the head masters and many of the assistants of the following schoools:—Canterbury, Charterhouse, Cheltenham College, Christ's Hospital, City of London School, Clifton College, Dulwich College, Epsom College, Eton, Haileybury, Harrow, Ipswich, King's College School, King Edward's School, Birmingham, Liverpool College, Marlborough College, Malvern College, Repton, Sherborne, Shrewsbury, Tunbridge, Uppingham, and Winchester. It is also signed by 18 assistant-masters of Rugby.

An important meeting was held, a few days since, at Cambridge, under the presidency of the Master of Trinity, Dr. Thompson, when a branch of the Education Union was formed. The Chairman spoke of the Union as a society more rational in its views, more moderate in its conclusions and means than the Birmingham League, the members of which seemed to think the religious difficulty insuperable, and had come, in his opinion, to a very rash conclusion upon it. He thought that to restrict schoolmasters in the way proposed by the League, would tend to deteriorate the quality of the teachers, which, to his mind, was of more importance than what they taught.

The schoolmasters of South Wales have held a meeting, and expressed their opinion on the religious difficulty. A thorough unanimity prevailed in the meeting as to the impracticability of the Time-table Conscience Clause, and, accordingly, the following resolution was carried:—"That if religion is to be taught at all in our schools, the children must be assembled together and dismissed together." The following resolution was also carried:—"That the Bible alone be the text book in day schools, and that formularies, if any, be taught in Sunday schools."

Several local meetings have been held to discuss the Government Bill, the most important being one at Bradford, at which more than 4,000 persons were present. Though convened by the League, the friends of the Government Bill appeared very strongly in its support. A resolution was proposed in support of amendments in the Bill to prevent sectarian teaching in district schools. An amendment substantially in favour of the Government Bill was also proposed, but after a stormy discussion, the resolution was declared carried, and the amendment negatived.

Mr. J. G. Hubbard, commenting on the letters of Mr. Baines and Mr. Winterbotham, referred to in last week's *Journal*, maintains that a secular system would not be tolerated by the people of this country, and, at the same time, he says that "every attempt to contrive an undenominational religious system of education has proved a failure; the attempt failed in the United States of America; it failed in Canada; and the working of the British and Foreign School Society establishes the same conclusion, that religion cannot exist under a system of compromise. Wisdom and charity alike dictate forbearance in the training of children rendered exceptional by their parents' wishes or their own disqualifications; but the teacher of a religious school must belong to some denomination, and, if conscientious, must teach what he himself knows and believes." He therefore advocates the denominational system.

On Wednesday last, Mr. Gladstone received no less than four deputations, who waited upon him to urge the adoption of religious but undenominational education in rate-aided schools. Mr. Baines, M.P., introduced the first, which was one of Nonconformist members of Parliament. Mr. M'Arthur, M.P., introduced the second, which was one of Wesleyan Methodists. The third was introduced by Lord Shaftesbury, and consisted mainly of the head-masters of some of the public schools, including Dr. Butler, head-master of Harrow. The fourth deputation was introduced by Mr. Mundella, M.P., and consisted of clergymen, ministers, and laymen of various denominations, who were delegates from conferences held in several provincial towns.

The various deputations having expressed their views, Mr. Gladstone, in reply, said he gathered that they considered no further limitation necessary than the prohibition of formularies, but he feared it would be too much to expect that a school board, against its inclination, should conform to a standard of impartiality which was not prescribed in definite terms by an Act of Parliament. About the exclusion of formularies, as a matter of fact there could be no difficulty; but he feared that local boards would not go further than they were bound to go by that exclusion. He thought that the mere exclusion of creeds and a time-table conscience clause would not be all that was fairly due to Roman Catholics when rating was established for common education, and he put it to the deputation whether Nonconformists would like to be taxed for religious instruction in which they did not share.

CORRESPONDENCE.

INTERNATIONAL MONEY OF ACCOUNT, &c.

SIR,—My paper on this subject, read before the Society on the 18th inst., was rather denounced than discussed by those who came to the meeting pledged to reject any monetary unit based upon £1 sterling in its integrity. I had pre-arranged for an adjournment of the debate into the City at some hour convenient to merchants, cambists, bankers, officers of the mint, of the Bank, and others having practical experience of the questions at issue. The managers of the London Institution, in Finsbury-circus — including Mr. Thomas Baring (president), the Governor of the Bank of England, Mr. Goschen, Sir John Lubbock, and like authorities—had consented to afford the spacious theatre of that establishment for the continuance of the discussion, if formally desired by the Council of the Society of Arts, but unfortunately there was not time to get the sanction of our Council to that course. It resulted that only one aspect of the question—the abstract and theoretical—received attention, and the combatants for a universal coinage occupied nearly the whole evening.

I hope still to meet my opponents upon City ground, and I dare challenge them to bring thither one or all of their mutually discordant propositions, such as the franc or its multiple, the ten pence or its multiple, the mètre Français, the dollar, the double standard, the clipped sovereign, &c.

Reverting to your report of attacks made upon my dissertation, I crave leave to indicate their failure to grapple with the evidence adduced. The disappointment expressed by my excellent friend, the leader of those attacks, is scarcely consistent with our former relations, he having been an adherent of the Decimal Association from 1854, and I an active member of its Council. He is free to go over to the other side, but he can scarcely be "disappointed" that I stand fast by our old standards, because he had received special intimation that my new paper was to be in sequence to my former one, dated the 14th July, 1855.

The fate of Sisyphus, which he pleads to be spared, is but a common retribution in like circumstances. I accept his admission that my proposion of bullion or mint notes is not an innovation—indeed, I cited pre-

cedents, and those successful ones. He can find no warrant for ascribing to me a suggestion that banks should indorse such notes, except in the sense of dock-warrants, bills of lading, and like vouchers having a solid basis. My preference for decimals in certain cases does not warrant imposition of them where not desired. I rather accept a recent injunction of Sir Stafford Northcote, "not unduly to sacrifice practical convenience for theoretical symmetry." My exemplifications of the risks incident to acceptance of foreign mintages were abundant. That our own coins have been irregular is at least proof that even honest purpose and home control may not insure accuracy. That M. Chevalier has pronounced against substitution of 25 francs for the £ sterling, shall be proved conclusively in due course, showing that my critic's allegation to the contrary is a mistake. It is also his mistake to disparage Baron Rothschild's remark, at Paris, upon the inevitable rise of professional honoraria to the level of the highest coin. Witness a jubilation in the *Lancet*, last week, which reckons that if Dr. Farr's project of a higher unit for monetary valuation, internationally, be embodied in an English coin, then his medical confrères will get fees higher by nearly 20 per cent.

Mr. Hyde Clarke, who found no opportunity to support me *viva voce*, has, in your last number, well disposed of fallacies and misapprehensions involved in the suggested abstraction of $2\frac{1}{8}$ pence from every sovereign. He has also properly construed an option, vested in every bondholder by original contract, to claim either £1 here or any substituted number of francs elsewhere. He and his colleagues of the Council of Foreign Bondholders help to check dishonest devices for estreating such an option for the debtor's advantage. To allow the £ sterling to be clipped or "adjusted" would be to facilitate like frauds. The two members of the House of Commons who spoke were at least sound in their adhesion to our standard coin, though neither examined the proposition to effect exchanges and to record international statistics by a common measure of the bullion intrinsically contained in various coins, but not to enforce acceptance of various coins as legal tenders outside the jurisdictions under which they are fabricated respectively.

Adjournment into the City would enable practical authorities to dispose of Mr. Brown's misconception that there is special advantage in a $\frac{9}{10}$ assay, or that the marc banco system of Hamburg is one of an international coin, or that I seek "to enforce the British sovereign" outside Britain.

The accomplished chairman of the evening misconceived one of my proposals, which may be dealt with hereafter. Accepting his definition of the clearing-house system, as based upon the fact that the Bank of England is the bank of banks, my intent had been to show that an analogous arrangement might constitute some bullion depôt as the depôt of depôts. In such case, deposits of bullion (private property) now distributed, say in Paris, Amsterdam, &c., and represented (at a small charge) by bank notes, *i.e.*, current money expressed in coin, could be dealt with in a central depôt, and represented by international money expressed not by coin but but units of weight. Under such a system it would be unnecessary, on all occasions, to tranship bullion, a (so to speak) dock-warrant for which could be more readily and economically passed from bank to bank.

I will, in case of adjournment into the City, ask certain eminent monetary authorities, who are, in emergency, prone to compel the Bank of England to exceed its legal issues, whether deposit vouchers for bullion (imported or importable) could not be more legitimate warrants for such expanded issues?—I am, &c.,

JACOB A. FRANKLIN.

STEERING OF SHIPS.

SIR,—In my paper on the steering of ships, &c., read at he Naval Architects' meeting, I never stated that "the invention, so widely known as the Lumley rudder, is copied from Mr. Ruthven's rudder;" so far, therefore, Mr. Lumley's remarks are uncalled for.

But in respect to my statement, that a similar rudder had been patented some time before by Mr. Ruthven, I apologised to Mr. Lumley for this "mistake," as I learnt from Mr. Ruthven, immediately after the reading of my paper, that my remark was correct in regard to Mr. Lumley's second, but not his first patent.

The question is therefore not, whether the invention known as the Lumley rudder is copied from Mr. Ruthven's rudder, but whether Mr. Lumley or Mr. Ruthven can claim priority, which I do not wish to decide.—I am, &c.,

C. G. GUMPEL,
Assoc. Inst. Naval Architects.

May 10, 1870.

GENERAL NOTES.

South Kensington Museum.—To provide space for the examination and exhibition of the national competition drawings of the schools of art in the United Kingdom, the gallery of Raphael's cartoons will be used, and must be closed for a short time.

Preserved Meat.—During a lecture on the preservation of food, at Dresden, Dr. Stein produced a tin cannister, of good size, containing butcher's meat, which had been preserved by Appert's method nineteen years ago. When the cannister was opened, the meat was found to be as fresh and full of flavour as when it was first placed in the cannister.—*Chemical News.*

Coal Brought to London by Railway during the last Month. — The coal thus brought amounted to 293,845 tons, as against 357,451 tons in the corresponding period of last year. The following were the tonnages on the different lines:—Great Northern, 75,851; Midland, 70,550; London and North Western, 69,168; Great Western, 38,742; Great Eastern, 35,113; South Western, 2,961; London, Chatham, and Dover, 1,139; South Eastern, 789; and London, Tilbury, and Southend, 33.—*Engineer.*

MEETINGS FOR THE ENSUING WEEK.

MON......R. United Service Inst., $8\frac{1}{2}$. Capt. John Cochrane Hoseason R.N., "On the Necessity for an Extension of our Naval Transport Fleet for Military Purposes."
Social Science Assoc., 8. Report on the Habitual Criminals Act. The Right Hon. Sir Walter Crofton, C.B., in the chair.
British Architects, 8.
Asiatic, 3. Annual Meeting.
London Inst., 4.

TUES ...Civil Engineers, 9. President's Annual Conversazione.
Royal Inst., 3. Prof. Seeley, "Present English History."
Anthropological, 8.
Social Science Assoc., 8. Consideration of the Prisons Act, 1865, and the Industrial Schools Act.
Ethnological, $8\frac{1}{2}$. (Special Meeting at the Royal United Service Institution, Whitehall-yard.) Mr. C. Spence Bate, "Report on the Prehistoric Antiquities of Dartmoor."

WED ...Obstetrical, 8.

THUR ...Royal Inst., 3. Prof. Tyndall, "Electricity."
Royal, $8\frac{1}{2}$.
Antiquaries, $8\frac{1}{2}$.
Linnæan, 8. Mr. R. McLachlan, "On some New Forms of Trichopterous Insects."
Chemical, 8.
Royal Society Club, 6.
London Inst., $7\frac{1}{2}$.

FRI ......Aëronautical (AT THE SOCIETY OF ARTS' HOUSE), 8.
Geologists' Assoc., 8.
Philological, $8\frac{1}{4}$.
Royal Inst., 8. Prof. Max Müller, "Migration of Fables."
Archæological Inst., 4.

SAT ......Royal Inst., 3. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, JUNE 3, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

DRILL REVIEW.

The Review of Schools will take place on June the 27th, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and Her Royal Highness Princess Mary of Teck.

The Council have requested the following to act as a Committee, to organise the details of this Review:—

R. K. Bowley; Field-Marshal Sir John F. Burgoyne, Bart, G.C.B., F.R.S.; Viscount Bury, M.P.; Edwin Chadwick, C.B.; Henry Cole, C.B.; Major-General F. Eardley-Wilmot, R.A., F.R.S.; Lord Elcho, M.P.; Lieut.-Col. Ewart, R.E.; Major-General Napier; Rear-Admiral Erasmus Ommanney, C.B.; Sir Charles Russell, Bart., V.C.; Rear-Admiral A. P. Ryder; E. Carleton Tufnell; General Sir Fenwick Williams, Bart., K.C.B.; and Captain Donnelly, R.E., Secretary to the Committee.

The following schools have signified their intention to be present:—

Royal Caledonian Asylum, Holloway, N.	40
Lambeth Industrial Schools, Norwood	133
Central London District School, Hanwell, W.	263
St. Mary, Islington, Hornsey-road, N.	60
St. Marylebone School, Southall, W.	100
Children's Establishment, Limehouse, E.	125
Welsh Charity School, Ashford, Staines	50
Royal Naval School, Greenwich	800
S. Metropolitan District School, Sutton, Surrey	300
Royal Military Asylum, Chelsea, S.W.	294
British Schools, Brentford	100
Shoreditch Industrial Schools, Brentwood	85
Mile-end Industrial Schools, Bancroft-road	50
St. Olave's School, Tooley-street, S.E.	230
Strand Union School, Millfield House, Edmonton	100
Chichester Training Ship	200
Marine Society's School, 54½, Bishopsgate-st. Within	120
British School, Richmond	40

The Committee met at the Crystal Palace on Monday, the 30th May, Sir C. Russell, Bart., V.C., in the chair, and a Programme of the arrangements will be issued forthwith.

It is the intention not only to have a display of military and naval drill, but also of swimming and gymnastics.

After the review, the members of the Society and their friends will partake of a cold Collation, during which the schools will sing and their bands play. The price of tickets for the Collation will be announced in a future number of the *Journal.*

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

LIBRARY.

The following works have been presented to the Library, and the thanks of the Society have been communicated to the donors:—

Science for the People. By Thomas Twining.

A Report on the Economy of Road Maintenance and Horse Draught through Steam Road Rolling. By F. W. Paget, C.E.

Exhaustion of the Soil in relation to Landlords' Covenants, and the Valuation of Unexhausted Improvements. By J. B. Lawes, F.R.S. Presented by the author.

A Sketch of various Plans which have been Proposed as a Means to effect Puddling Iron by Machinery. By William Yates.

The Thirty-seventh Annual Report of the Royal Cornwall Polytechnic Society, 1869.

The Neilgherry Tea Planter. By James Macpherson.

India to England: Proposed New Overland Route *via* Turkish Arabia. By George Latham, C.E. Presented by the author.

The Goldfields and Mineral Districts of Victoria. By R. Brough Smyth. Presented by G. Verdon, C.B.

Discussion of the Meteorological and Magnetical Observations made at the Flagstaff Observatory, Melbourne, during the years 1856-1863, by George Newmayer, Ph.D. Presented by G. Verdon, C.B.

Report of the Cattle Plague in Great Britain, during the years 1865, 1866, and 1867.

ANNUAL INTERNATIONAL EXHIBITIONS.

EXHIBITION OF 1871.

The year 1871 will see the first of a series of annual International Exhibitions, which, while formed on such basis as the experience gained by the many exhibitions that have been held during the last twenty years has shown to be right and desirable, are yet due to, and actually spring from, the success of the great Universal Exhibition of 1851. The close of that undertaking found the Commissioners incorporated to carry it out possessed of a surplus amounting, in round numbers, to £180,000. This surplus the Commissioners bound themselves by charter to deal with according to the spirit in which the Exhibition had been conceived, and the object for which the public money had been asked for and received—that is, in the encouragement of art and industry. It was therefore invested in such a manner as should render it available, at some future time, for the establishment of permanent exhibitions.

That time has now arrived, and the series that commences next year is therefore the direct result of the Exhibition of 1851, and the Commissioners intend to bear the whole cost and responsibility, without either government money or public guarantee.

Permanent exhibitions must of necessity be established on a different basis than those which are temporary, if they are to be successful. The promoters of the Exhibition of 1851 had no statistics by which they could be guided into the right course of action. The many exhibitions that have, however, been held since in this and other countries have afforded proof that there are certain limits of time, space, and expense which cannot be exceeded without loss and failure. To hold them at any other period than between the months of May and September, is practically to shut out many of the productions of Northern Europe, where the ports are closed by the rigours of winter. The expense of the erection of temporary buildings for decennial exhibitions was constantly increasing, and, with other charges, rendered it necessary for those who undertook their promotion to incur a heavy pecuniary liability, which,

coupled with the limits as to the time during which the exhibition could remain open, rendered financial success, at each succeeding exhibition, more difficult of attainment.

Generally, the exhibitions outgrew their limits. For the fulfilment of their legitimate purpose, which was to show from time to time the progress made by art and industry, in connection with the staple manufactures of the country in which they were held, necessitated that a large number of objects should be received, requiring enormous space for their exhibition, though in themselves possesssing but little merit as objects of artistic industry.

With these facts before them, the Commissioners propose, in the first place, to make an International Exhibition a permanent institution of the country, giving to industrial art the same opportunity that is afforded to fine art by the annual exhibitions of the Royal Academy. In the second place, they propose to reduce the area over which the exhibition shall spread itself, by reducing the various industries into groups, and taking certain of these each year, bring the entire industry of the country under review every seven or eight years, fine art being a standing division of the programme. And, in the third place, to restrict the conditions under which exhibits have hitherto been received, by making all articles undergo a preliminary sifting, through appointed committees of selection, thus excluding all works that do not possess sufficient artistic merit to warrant their exhibition, and by the further exclusion of mere masses of natural products.

The great aim of the early periodical exhibitions established by the Society of Arts was the closer union of art and industry; this was also the object which H.R.H. the Prince Consort had so much at heart in promoting the first Great Exhibition. The Commissioners now propose, in these permanent exhibitions, to carry on the work of bringing about a closer alliance between artistic design and usefulness of purpose, by, to use their own words, "stimulating the application of the artists' talents, to give beauty and refinement to every description of object of utility."

His Royal Highness Prince Christian of Schleswig-Holstein presided on Thursday, at 32, Abingdon-street, Westminster, over a meeting of the General Purposes Committee. The other members present were Sir Francis Sandford, Mr. Edgar Bowring, Mr. Cole, Mr. Gibson, Colonel Ponsonby, Mr. Thring, and Lieut.-Colonel Scott (Secretary).

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

PUBLIC LIBRARIES AND MUSEUMS.

The following is an abstract of the return showing all the boroughs and places in England and Wales that have adopted the Act for establishing Public Libraries and Museums, and Schools of Science and Art:—

England.

Ashton-under-Lyne.—Adopted, so far as relates to the establishment of a Free Library, on the 28th January, 1869, by the unanimous resolution of the inhabitants, at a public meeting duly convened. No library has yet been formed, but the General Purposes Committee have been authorised to take steps to form one. No subscriptions have yet been made, but several promises of contributions in money and books have been received. No rate has yet been levied, nor has any sum been appropriated by the Corporation.

Barnstaple.—Not adopted, the town having the benefit of an excellent library, containing more than 6,000 volumes, in connection with the Literary and Scientific Institution; and, through the liberality of Mr. F. W. Rock, 100 free members have the use of the library and newsroom, and of the classes formed for instruction in languages, elementary art, and science.

Bath.—Not yet adopted; but it is intended, at the next meeting of the Council, to take the preliminary steps, with a view to the establishment of one or more libraries in Bath. There is already established a free library, consisting of 2,400 volumes, three-fourths of which, however, are theological works.

Beccles.—Not adopted; is well provided with libraries from other sources.

Berwick-on-Tweed.—Adopted for this borough, on 26th November, 1867, but, owing to the subsequent opposition of many of the ratepayers, the committee appointed by the Town Council all declined to act, and no further steps have been taken.

Birmingham.—The libraries establishment in Birmingham consist of—(1) Art Gallery (a small collection of pictures and sculpture); (2) Reference Library; (3) Central Lending Library; (4) Branch Lending Library (North) Constitution-hill; (5) Branch Lending Library (South), Deritend; Branch Lending Library (East), Gosta-green; Branch Lending Library, Adderley-park. A newsroom is attached to each lending library. Act adopted 21st of February, 1860, by a majority of upwards of two-thirds of the burgesses in public meeting. Number of readers and visitors admitted monthly, during 1868, to all the libraries, 121,500. It is only during the last two years that full and reliable statistics have been obtained. Amount of rate appropriated, one penny in the pound, producing (1868) £4,250.

Blackburn.—Adopted on the 11th of August, 1853, when 430 voted for and 2 against the introduction of the Act. The library was established in 1860. The average number of readers monthly, for the year 1868, was 2,800, and the visitors to the library and museum would average an equal number. For the last year, the average number of volumes issued monthly to readers in the library was 300. The number of volumes issued out of the lending library was 2,500. Amount of rate levied, one halfpenny in the pound.

Bolton.—Date of adoption of Act, 26th March, 1852. 662 polled for and 55 against it. Number of volumes contained in reference library, 15,946; lending library, 8,634. Number of volumes issued to readers in the room, monthly, 3,147; number of volumes issued to readers out of the room, 5,636. Annual cost, £400. Amount of rate levied, one halfpenny in the pound.

Bradford.—Not adopted. The subject has, however, been fully considered by the Council, on a report being presented to them by the General Purposes Committee, in March, 1868, when resolutions were passed to the effect that a beginning should be made at the earliest possible opportunity, by opening a library department only, and on hired premises.

Bridport.—Not adopted.

Brighton.—Not adopted.

Bristol.—Not adopted. There is, and has been for many years, a library, the property of the Corporation, open to the use of the inhabitants of the city. It contains upwards of 8,300 volumes, is much frequented, and the average number of volumes issued monthly to readers at the library, during the past year, has been 2,761.

Cambridge.—Library formed 28th June, 1855. Poll taken 1st March, 1853; for the adoption of the Act, 873; against, 78; majority, 795. Total number of volumes in libraries, 14,097. Total issues from reference and lending libraries, 435,706. The yearly borough rate appropriated to the library amounts to £300. At the present time, a rate of one penny in the pound produces about £450 per annum.

Canterbury.—The museum and library were purchased by the town council, in 1846, from a private society. Monthly average of visitors and readers 1,050. About 2,600 (some very old) volumes in library. The average number of volumes issued per month is 60. Annual cost about £190. The amount of borough rate appropriated thereto is about equal to a rate of three farthings in the pound.

Carlisle.—Partially adopted. In the 12 institutions

existing in this city the aggregate number of members is 1,604; and of volumes in their libraries, 21,850, exclusive of 850 volumes supplied by the Commissioners of Patents for Inventions.

Chippenham.—Never been adopted.

Coventry.—Number of volumes in lending and reference departments (with those presented), 11,508; total daily average of issues, 231. Act unanimously adopted, 17th September, 1867; library opened to public, 1st September, 1868. Borough rate of 1d. in the £ produced £362.

Derby.—Not adopted.

Dover.—Museum established in 1847. There were no subscriptions for its promotion. Number of visitors, from 1,000 to 1,200 monthly. The amount of the borough rate appropriated to the support of the museum has been £200 per annum. This sum has just met the expenses, and there is a balance of a few pounds in hand. No public library.

Exeter.—Adopted, but the institution has not yet been handed over to the corporate authorities, though this will probably be done early next year.

Gateshead.—Not adopted.

Gloucester.—Not adopted.

Hertford.—Library established in 1855. No polling. Act adopted at a public meeting. The reading room free to all the inhabitants and visitors. Library contains 1,800 volumes. Average issue of volumes to readers, 500 monthly in and out of library. Several volumes have been presented. No bequests. Library is maintained out of rate for library, at 1d. in the £, producing £95 per annum.

Huddersfield.—Not adopted. A good library in connection with the Mechanics Institution, has a large circulation amongst the working classes.

Ipswich.—Museum or library established 1847. Act adopted by 709 votes against 69. Average monthly number of readers and visitors, 5,000. 2,340 volumes in library, and 1,989 volumes of specifications of patents. Annual cost between £400 and £500. Amount of borough rate for the year ending 31st July, 1869, £474.

Lancaster.—Not adopted. There is a museum in connection with the Mechanics' Library, also a school of art and one of science in connection with that Institution, and with that of South Kensington, but deriving no support from the borough rate.

Leamington Priors (Warwick).—Adopted.

Leeds.—Adopted, but only committee appointed at present.

Leicester.—A museum has been opened for more than twenty years, and the amount of a halfpenny rate applied in its support. The council, by a resolution passed on the 11th day of May, 1869, resolved upon establishing a public library, and to apply the amount to be raised by a halfpenny rate in its support, thus apportioning the penny rate authorised by the Act equally between the museum and the library. The amount raised by a penny rate is £863 9s. 4d.

Liverpool. — Not adopted, but library and museum maintained under a local Act (15 Vict., c. 63). Average number of visitors to museum per month, 27,800. Average number of volumes issued per month, 707,000. Number of volumes contained in reference and lending library, 100,000. Average cost, including purchase of books, &c., £4,808 8s. 6d. A penny rate yields £8,660.

London.—Not adopted in the City of London, although the subject has been duly entertained and considered. The Corporation has, for many years past, established a valuable and extensive reference, reading, and lending library, as well as a museum, at the Guildhall, to which access is easily attainable by any respectable person.

Lynn.—Not adopted. There is a public library called the "Stanley Library," founded by Lord Stanley, formerly Member of Parliament for the borough, and a museum, and a society in connection with the Society of Arts; but none of these institutions are under the Acts referred to.

Macclesfield.—Not adopted.

Maidstone.—Adopted by a majority of more than two-thirds, 30th August, 1855. Number of readers and visitors monthly, 324 and 2,830 respectively; number of volumes in library, 3,500; number of volumes issued monthly, 540. Annual cost of maintaining averages £300 per annum. Amount of borough rate appropriated thereto averages £300 per annum.

Manchester.—Adopted. The Public Free Library was opened on the 6th of September, 1852; the public subscription amounted to £12,823, of which £813 18s. was contributed by artisans and workpeople, numbering upwards of 20,000 persons, employed in the various industrial establishments in the city and neighbourhood. On the question of maintaining the library, the number of votes recorded in favour of the adoption of the Act was 3,962; against its adoption, 40. The news-rooms during the evening hours are constantly crowded; from the published tables it appears that the total number of readers had increased from 39,944, in 1853, to 135,877, in 1868. Between 1863 and 1864 the numbers fell from 91,121 to 58,589, showing to how great an extent the libraries are used by the classes affected by the cotton famine. The number of borrowers, though subject to a slight fluctuation at the same period, has shown a comparatively steady increase from 2,000, in 1853, to 27,749, in 1868. The daily average of visitors, in 1868, was 5,575, or upwards of 1,700,000 during the year. The total number of volumes in the library in June, 1869, was 40,498 in the reference library, and 49,791 in the lending department.

Margate.—Not adopted.

Northampton.—Adopted unanimously, the 3rd day of September, 1860. Museum established 6th of March, 1865. Average visitors at museum monthly, from 1,000 to 1,500. Annual cost varies according to income. The 1d. rate produced, in 1868, £386 5s. 8d. Amount of the borough rate appropriated thereto, £386 5s. 8d., for the year ending 31st August, 1868.

Norwich.—Adopted, by 150 against 7, in 1854; library opened 16th March, 1857. Number of readers and visitors monthly to library averages 800. Number of visitors monthly to the Norfolk and Norwich Museum, open free to the public two days in the week, average, to 1867, 2,147. Number of volumes in the library, about 4,000; number issued monthly to readers in the library averages 760; number issued monthly to readers out of the library averages 1,333; annual cost of maintaining library, average £141 2s. 0d., beyond interest and instalments of loans; amount of borough rate appropriated, one penny in the pound.

Nottingham.—Adopted, 29th May, 1867, with only one dissentient. A small library already existing was bought, and has been supplemented by the purchase of additional books, and the number of volumes on 31st May, 1869, was 13,500. The numbers of volumes issued to readers out of the library, from middle of April, 1868, to end of May, 1869, 160,984. The cost of forming and maintaining the library and the Natural History Museum has been at the rate of £1,000 per year, which is taken directly from the borough rate, to the amount of which it bears the proportion of one penny in the pound of the rateable value of the property assessed.

Oswestry. — Not adopted. There is a subscription library.

Penzance.—Not adopted.

Poole.—Not adopted. The Poole Library and Literary Institution has a museum of local natural history, geology, and antiquities, but no room to display them.

Portsmouth.—Not adopted.

Preston.—Not adopted. There is a Literary and Philosophical Institution; this library contains about 5,000 volumes, the subscribers being from the higher class of residents in the town. The Mechanics' Institution contains 8,381 volumes, and a School of Art is established in connection therewith. There is a Free Library, containing 8,000 volumes. Very suitable rooms for the

library and reading-room are also provided, and all respectable persons admitted by ticket on application to the mayor or aldermen. This library costs the Corporation about £100 a year.

Saint Helens.—Not adopted.

Salford.—Established before the Act (May, 1849), and £7,523 subscribed. Total number of visitors to museum, 9,593,995; average number of readers in reading-room monthly, 7,000; number of volumes in library, 31,614; number of volumes issued monthly in reference library, 5,300; from lending library (out), 5,000; average annual cost of maintenance, including investments, books, specimens, &c., £1,565. Amount of borough rate appropriated thereto, seven-eighths of a penny in the pound.

Sheffield.—Adopted 26th October, 1853, by 837 against 232 votes; opened 1st February, 1856. Number of readers and visitors monthly, 300; number of volumes in library (reference and lending departments), 29,692; number of volumes issued monthly in library, 3,450; number of volumes issued monthly out of library, 13,757; number of volumes given to library, 1,350; cost of maintaining the library for the year 1867-8, £1,293 15s. 7d.; amount of borough rate appropriated thereto in 1868, £1,774 (a sum equal to three farthings in the pound on the rateable annual value). A branch library is in course of formation at Upperthorpe, in the borough.

Southmoulton.—Not adopted. There is a good lending library and reading-room for the poor, which is entirely supported by voluntary contributions.

Stafford.—Not adopted. There is a mechanics' institute and library in the town, supported by voluntary subscriptions, consisting of about 250 members.

Stockport.—Adopted on the 28th February, 1861, unanimously. A museum has been established, and an average rate of three farthings in the pound has been levied since for its support. The rate since 1861 has been about three farthings in the pound, paid out of the borough fund.

Stoke-upon-Trent.—Not adopted. There is a public library, with museum attached, and also a school of art in the town, but both these institutions are supported by the subscriptions of their respective members, aided by voluntary contributions.

Tynemouth.—Only very recently adopted.

Walsall.—Adopted by show of hands. Lending library and reading-room; established April, 1859, at a cost of £256. Number of volumes contained in library 5,500. Number of volumes issued monthly to readers out of the library, 3,500. Annual cost of maintaining the library and reading-room, about £270. Amount of borough rate appropriated thereto, about £270.

Warminster (Wilts).—Adopted.

Warrington.—The Warrington Museum and Library was established in 1848. The sum furnished by private subscription was £1,774 9s. 2d. The amount of rate then levied was one halfpenny in the pound. The number of readers and visitors admitted monthly is—readers, 109; visitors, 1,433. The number of volumes contained in the library is 7,957, and 1,413 pamphlets. The number of volumes issued monthly to readers in the library is 123 (average of 1868). The number of volumes issued to readers out of the library is 479 (average of 1868). The annual cost of maintaining the library and museum is £250. The amount of borough rate apportioned now is £285, the result of 1d. per pound rating. The halfpenny increase was voted unanimously in 1865.

Warwick.—Adopted unanimously. Date of establishment, 2nd October, 1865. The average number of readers and visitors admitted monthly is 3,900. The number of volumes contained in the library is 2,237. The monthly average of volumes issued to readers out of the library is 1,300. Average annual cost of maintaining the library, £142 8s. 6d. Amount of the borough rate appropriated (average), £144 3s. 7d.

Wigan—Not adopted. A mechanics' institution library here.

Wolverhampton.—Adopted on the 8th February, 1869, by a very large majority, at a public meeting, called on the request in writing of upwards of 1,000 persons.

Wales.

Brecon.—Not adopted. The only reading rooms that exist are a Mechanics' Institute and a public reading room, both supported by subscription.

Cardiff.—Adopted unanimously in October, 1862. Books and other property to the value £190, purchased by voluntary subscriptions, was handed over to the committee. The number of visitors to the magazine and newspaper room have been, for 1864-65, 222,500; the numbers have not since been registered. The library contains 4,842 volumes. Number issued from lending library for 1868, 17,333. The value of donations to the library and museum may be approximately estimated at from £300 to £350. The grant from the borough rate for public library and museum for the year 1868-69 was £500.

Carnarvon.—Not adopted.

Swansea.—Not adopted.

Returns have been received from the following cities and boroughs, stating that they have not adopted the Acts in question:—

England.—Abingdon, Andover, Arundel, Banbury, Barrow-in-Furness, Basingstoke, Batley, Bedford, Beverley, Bewdley, Bideford, Bilston, Bingley, Bodmin, Bognor, Bootle-cum-Linacre, Boston, Bournemouth, Bradford-on-Avon, Bridgenorth, Brighouse, Buckingham, Burnley, Burton-upon-Trent, Bury (Lancashire), Bury St. Edmunds, Calne, Chard, Chester, Chesterfield, Chichester, Chipping Norton, Chipping Wycombe, Chiswick, Chorley, Cirencester, Clitheroe, Colchester, Congleton, Crediton, Darlington, Dartmouth, Daventry, Deal, Devizes, Devonport, Dewsbury, Dorchester, Downham Market, Droitwich, Dudley, Dunstable, Durham, Ely-place (London), Evesham, Eye, Falmouth, Faversham, Fleetwood, Folkestone, Glastonbury, Glossop, Godalming, Godmanchester, Gosport, Grantham, Gravesend, Great Grimsby, Guildford, Halifax, Hanley, Harrogate, Hartlepool, Hartlepool (West), Harwich, Hastings, Haverfordwest, Hereford, Honiton, Hove (West), Huntingdon, Hythe, Kendal, Kingston-upon-Hull, Kingston-upon-Thames, Kington, Knaresborough, Launceston, Leek, Leominster, Lewes, Lincoln, Liskeard, Longton, Louth, Lowestoft, Ludlow, Lyme Regis, Lymington, Lynn, Lytham, Maidenhead, Maldon, Malmesbury, Malvern, Mansfield, Marlborough, Maryport, Melksham, Middlesborough, Milton-next-Sittingbourne, Monmouth, Morpeth, Newark, Newbury, Newcastle-under-Lyme, Newcastle-upon-Tyne, Newport (Isle of Wight), Newport (Monmouthshire), Newton-in-Mackerfield, Oldham, Oundle, Penryn, Peterborough, Plymouth, Pontefract, Ramsgate, Reading, Reigate, Retford (East), Rhyl, Richmond, Ripon, Rochdale, Rochester, Romsey, Ross, Runcorn, Ruthin, Ryde, Rye, Saffron Walden, St. Albans, St. Ives, St. Neots, Salisbury, Sandwich, Scarborough, Shaftesbury, Shrewsbury, Sittingbourne, Southport, South Shields, Southwold, Spalding, Speenhamland, Stalybridge, Stamford, Stockton-on-Tees, Stoke Damerell, Stourbridge, Stratford-upon-Avon, Sudbury, Surbiton, Tamworth, Tenterden, Tetbury, Tewkesbury, Thetford, Tiverton, Tonbridge Wells, Torrington (Great), Totnes, Truro, Ventnor (Isle of Wight), Wakefield, Wallingford, Wantago, Wath-upon-Dearne, Wellington, Wells, Wenlock, West Bromwich, Weymouth, Whitby, Windsor, Wisbeach, Worcester, Wrexham, and York.

Wales.—Abergavenny, Aberystwith, Beaumaris, Cardigan, Carmarthen, Denbigh, Flint, Llandovery, Llanidloes, Neath, Pembroke, Pwllheli, Tenby, and Welchpool.

Scotland.

Aberdeen.—Not adopted. There is, however, in connection with the Mechanics' Institution (1) a school of

science and art under the Science and Art Department of Government; (2) a library open to those of the public who are subscribers, on payment of from 5s. to 10s. 6d. per annum; and (3) the nucleus of a museum, but no adequate accommodation for a museum.

Airdrie.—Adopted by 211 against 20 votes. Library established in November, 1853. It is a lending library only. Contains 2,260 volumes, and there are issued monthly to readers, on an average, 1,200 volumes. Last year the number of readers was 700; giving an average of $58\frac{4}{12}$ a month. The library is founded from and maintained by the burgh rates, under the Act, which, at 1d. per pound, has, on an average of the last five years, been £81 18s. 3d., and the cost of maintaining the library, exclusive of amount paid for new books, is £42 6s. 5d.

Ayr.—Not adopted. There is a public library, and rather an extensive museum, established upwards of 40 years ago. The library contains upwards of 6,000 volumes, has about 100 members, and is open two days in the week. The terms of admission, according to circumstances, are 2s., 2s. 6d., and 3s. yearly.

Dundee.—Adopted. A rate of 1d. has been levied for two years, for the purposes of tho Library Acts; this produces about £1,350 per annum.

Edinburgh.—Not adopted.

Kirkcudbright—Not adopted. A public library is in existence, in connection with the reading-room, originated at first and since maintained by voluntary subscription.

Paisley.—Adopted, at a public meeting held on 28th March, 1867, by 483 against 21 votes. Upon the library being opened, at the end of 1869, there will be transferred to it from 12,000 to 14,000 volumes, at present the property of the Paisley Library, and 5,000 volumes belonging to the Paisley Philosophical Society. Subscriptions have also been received for the purpose of making purchases for the museum. No rate has yet been imposed, but it is intended, in the course of the present year, to impose a rate of 3d. in the pound for the maintenance of the library and museum for the year ending May, 1870.

Stirling.—Not adopted. A free public library was founded in 1855. It consists of about 2,000 volumes, only given out when specially applied for. The library is open to the public without charge, and is well attended by the working classes and others. Newspapers are also connected with the library. There is also a museum connected with the library. The annual cost of maintaining the library and museum is about £36, which has hitherto been paid out of the funds left by the founder.

Returns have been received from the following cities and burghs stating that they have not adopted the Acts in question:—Annan, Anstruther Easter, Anstruther Wester, Arbroath, Banff, Bervie, Brechin, Burntisland, Campbleton, Crail, Cromarty, Cullen, Culross, Cupar, Dingwall, Dornoch, Dumbarton, Dumfries, Dunfermline, Dysart, Elgin, Falkirk, Forfar, Forres, Galashiels, Glasgow, Greenock, Haddington, Hamilton, Hawick, Inveraray, Inverkeithing, Inverness, Inverurie, Irvine, Jedburgh, Kilmarnock, Kilrenny, Kintore, Kirkcaldy, Kirkwall, Lanark, Lauder, Leith, Linlithgow, Montrose, Musselburgh, Nairn, New Galloway, North Berwick, Oban, Peebles, Perth, Peterhead, Pittenweem, Port Glasgow, Portobello, Queensferry, Renfrew, Rothesay, Rutherglen, St. Andrew, Sanquhar, Selkirk, Stranraer, Tain, Whithorn, Wick, and Wigtown.

AUSTRALIAN MEAT PRESERVING.

The following is taken from the letter of the Australian correspondent of the *Times*, May 17th:—

"Only some two years ago it was an unsolved problem whether Victorian sheep and cattle, then becoming rapidly of little more worth to the breeders than so much walking tallow (even when fat), could have an exchangeable value given to them as butchers' meat in distant and more populous markets. Science took the subject in hand, and patent after patent was applied for, for tho preservation of meat both in the cooked and uncooked states. Was the thing practicable? and, if so, would it pay? The first answer to both these questions, and in a very practical and satisfactory form, has been afforded within the last few days by the report and balance-sheet of the Melbourne Meat-Preserving Company, for the half-year ending the 28th of last month. Within that period the company have worked off 160,752 sheep and 590 head of cattle, the former costing £58,313, and the latter £3,298. The expenditure in wages during the half-year was £84,213, and the profit, as far as computable at present—the precise amount depending on the results of sales in England, of which we are not yet informed—is set down at £11,265 14s. 3d. The directors were desirous of declaring a dividend in proportion to their profits, but being advised that they could only, by the deed of settlement, pay a dividend out of balances in hand, they divide ten per cent. on this occasion, and will probably be able to announce a still more satisfactory result next half-year. Several other companies have recently commenced operations, and one, as I learn from a prospectus just published, with a large number of very respectable names attached to it, is about to place a portion of its shares on the London market. The demand for these meats is rapidly increasing, not merely in England and on the Continent, but even for local consumption in our own colony, showing pretty clearly that the products of the company are regarded by a numerous class rather as a luxury than as a mere substitute for ordinary butchers' meat.

"I confess that when I first read of Mr. Tallerman's penny dinners of Australian preserved meats, I could only regard thom as a clap-trap sort of advertisement, likely to do the Australian meat interest more harm than good. I am informed, however, by the gentlemen here, managing the establishment which consigns to Mr. Tallerman, that as these penny dinners are principally carried away in the customers' own dishes, the purveyors are at small expense for establishment and plant, and that a profit, though not large, may actually be made at the price. Besides, as appetites vary, I believe that the charges vary accordingly, as it is not reasonable to suppose that an English navvy could be filled oven with Australian meat, supplemented by English vegetables, at the cost of one penny. All reasonable doubts, however, being satisfied, it does look as if we have achieved a sort of revolution in the home food market—a revolution, too, which must have not only a direct, but a reflex action on English interests.

"For every penny dinner eaten in England, our squatters, graziers, farmers, and labourers, will possess some proportionate command over English manufactures. Before the starting of these preserved meat factories, it was a commonly expressed opinion that squatting had seen its best days, and that some of the less valuable runs would have to be abandoned as unprofitable. This new interest, judging from the price the Melbourne Company have during the past six months been paying for sheep, viz., an average of 7s. 3d. a-head, has fixed a minimum below which it is not very likely the price of the animal will fall. The ordinary consumption of Melbourne and the suburbs is reported to be about 10,000 a week. The 6,000 a week further demanded by the company arrested at once the downward tendency in the price of stock, and has probably saved not a few squatters from ruin. The squatters as a body, however, have neither done nor attempted much in the starting of this new business. The work has been achieved principally by a few spirited and methodical Melbourne merchants, some of whom may yet live to see our city as remarkable for the export of her sheep and cattle as are Cincinnati and Chicago for their export of hogs. To show how a food-supplying manufacture of this kind grows, we read in Sir Morton Peto's book that while only 52,849 hogs were killed in the latter place for

export in the year 1853, the number had increased to 904,159 in the year 1863. 'They are all killed by machinery,' we are told, 'in the quickest and most scientific way. Within twenty minutes of the time of your hearing the pig squeak, he is killed, cut up, packed in barrels, and on his way to Europe.' It thus appears to be the natural work of new countries, in a large measure, to feed the old, a happy consequence of that spontaneous division of labour which sustains all the civilised nations of the globe.

"I must not quit this subject without informing you of the result of a recent shipment of meats to this colony, preserved, as the consignees informed us, under Professor Gamgee's process. A special convocation of persons interested in the subject attended by invitation last week at Messrs. Goldsborough and Co.'s wool stores, to witness the opening of the packages, a ceremonial which caused as great a sensation as that which Smollett's hero, curious in the refinements of old Roman cookery, produced on the olfactories of his assembled classical guests on the occasion of opening the Roman pie. Professor Gamgee's meat had become so thoroughly putrid, that few persons cared to stay in the room with it any longer than civility to the conveners demanded. The livid colour of many portions showed that decomposition must long since have set in, notwithstanding which some of the most respectable judges in the room inclined to the opinion that the ill-success of this experiment is by no means conclusive against Professor Gamgee's process. Whether, as some surmise, the fat-enclosing wrappage neutralises the effect of the previous treatment —intended to arrest decomposition—or whether the failure is merely exceptional, and arises from some accidental slip in the manipulation, is as yet a mystery. Additional light may be thrown upon the subject in a few weeks, as a second shipment of meats, preserved by the same process, is reported to be now on its way to this country."

REPORT ON THE BELGIAN POSTAL SERVICE.

Inland Postage.

The rate of postage on all inland letters is regulated by weight and distance, and is as follows:—

For localities situated within a radius of 30 kilometres of each other (about 19 miles):—

				frs.	cents.
Prepaid Letters.—Not exceeding		15	grammes	0	10*
Above 15	,,	30	,,	0	20
,, 30	,,	50	,,	0	30
,, 50	,,	100	,,	0	40

and 10 cents for every additional 50 grammes.

For localities beyond a radius of 30 kilometers the ratio is doubled.

Unpaid Letters are charged a fixed rate of 10 cents. in addition to the above. An exception, however, is made in the case of private and non-commissioned officers of the army, letters addressed to them being only charged 10 c., if under 15 gr. in weight, irrespective of distance.

Letters insufficiently stamped are charged 10 cents. in addition to the amount required to make up the original postage due.

Papiers d'Affaires.—Under this class are included all law papers, policies of assurance, all kinds of manuscript not containing a personal correspondence, manuscript music, drawings in pencil or colour, printed proof-sheets (when accompanied by the original MSS.), manuscript catalogues and lists of prizes, &c., &c. The charge for the above is 30 centimes per parcel not exceeding 300† grammes in weight, and 10 centimes for every additional 100 or fraction of 100 grammes. Papiers d'affaires insufficiently stamped are charged double the amount of the insufficiency. To benefit by this scale of postage, the *papiers* must be in covers open at the ends, and a declaration of the contents must be legibly written on the covers, together with the name and residence of the sender, and be prepaid by means of postage stamps, otherwise they will be taxed as unpaid letters. A penalty of 50 frs. to 200 frs. is inflicted when any writing having the character of a personal correspondence is found in or upon the papers or covers or papers.

Patterns and Samples.—The rates for this class are 10 cents. per parcel not exceeding 100 grammes in weight; 20 cents. per parcel between 100 and 200 grammes; 30 cents. per parcel between 200 and 300 grammes, 300 grammes being the maximum weight. Parcels insufficiently stamped are charged double the above rates, a deduction being made for the stamps on the covers. Parcels unpaid are taxed as letters. The maximum size of each parcel is 30 centimetres (12 inches) square. The samples may not possess any mercantile or intrinsic value; they must be so packed that the covers may be easily removed, to allow the contents to be verified. No parcels will be forwarded which contain—(1) jewellery or metallic objects of value; (2) objects liable to cause any damage to letters or injury to the employés, such as any inflammable matter, cutting instruments, or samples packed in glass.

Newspapers and Printed Matter.—The rate of postage for newspapers, periodicals, books, music, photographs, prospectuses, notices of all kinds, visiting cards not in envelopes, is one centime (prepaid) per sheet of any size. Newspapers with their supplements must be enclosed separately, or an additional rate will be charged in proportion to the number under the same cover. Newspapers unstamped, or insufficiently stamped, are charged as letters, less the amount of stamps that may be on the covers.

The following table shows the manner in which the rate of postage on books, bound or sewed, is calculated:—

Size of books.		Dimensions of book.		Pages in one Sheet of Printing.
32mo.	....	142 × 92 millimetres	....	64
18mo.	....	192 × 122 ,,	....	36
12mo.	....	250 × 144 ,,	....	24
8vo.	....	284 × 185 ,,	....	16
4to.	....	370 × 285 ,,	....	8
Folio	....	570 × 368 ,,	....	4

Thus, to prepay a book, size 32mo., containing 680 pages, divide 680 by 64, the result is 10 and a fraction of 10, the rate therefore is 11 centimes.

Printed proof-sheets may bear upon them manuscript corrections, but no notes or remarks, either on the sheets themselves or on separate sheets.

Circulars to be forwarded through the post-office must contain the name of either the author or printer.

Registered Lettres.—There are two kinds of registered letters, *lettres chargées* and *lettres recommandées.*

Lettres Chargées.—Papers of value, such as bills to bearer, bank notes, coupons of interest or dividend, shares, &c., may be enclosed in *lettres chargées*, on a declaration of the contents being made, and a proportionate rate paid. Post-office orders and values less than 5 francs are excepted. The maximum value allowed to be declared is 10,000 francs. In case of loss, the administration is responsible for the values, when all the proper formalities have been fulfilled, unless the loss happen either through "*force majeure*" or through the negligence of the sender. A penalty of 26 to 500 francs, and imprisonment, varying from one month to a year, is inflicted in cases where any fraud is attempted, as well as

1. When objects of gold, silver, and jewellery are enclosed.

2. When values to bearer are inserted without being declared, excepting, as before stated, post-office orders and value of less than 5 francs.

Lettres chargées may be given to rural postmen on their rounds; the authorities, however, are only responsible from the moment that the letters have been handed in at an office.

* 15 grammes is equivalent to ½ oz. English. (See note at end of report.)

† 300 grammes = ⅔ lb. (about).

The letters must have five seals attached to the envelope, and the seals must bear the same stamp. No ordinary device, such as a flower or wafer stamp, is accepted. The amount of the values must be written legibly on the exterior of the envelope, either in Flemish or French, without stating the nature of the values.

The rates of postage for *lettres chargées* are:—

1. The ordinary rate for weight.
2. A fixed rate of 20 centimes.
3. An additional tax of 10 centimes for every value of 100 francs, or fraction of 100 francs, contained in the letters.

Receipts are given for such payments, which must be made in coin, not stamps.

Letters containing values above 500 francs are not distributed in rural districts at the residences of the persons to whom they are addressed, but must be claimed at the office of the district, unless a special request be made, when, in case of loss, the post-office is freed from all responsibility. The formality of "*chargement*" is exclusively reserved for letters containing values to bearer and declared by the sender.

Lettres et Objets recommandées.—All letters, newspapers, printed papers, patterns, &c., may be *recommandés*, on payment of 20 centimes in addition to the ordinary rate of postage. A receipt is given to the sender on payment, but the Post-office is not responsible in case of loss. No values to bearer, jewellery, or coins may be forwarded in such letters. There are no regulations as to seals, &c.

Express.—The Post-office also undertakes to forward by express all letters and "*objets de correspondance*" on payment, in addition to the ordinary rate, of a fixed tax of 30 centimes for parishes in which there is an office, and 1½ franc for all other parishes.

Notice of delivery of *lettres chargées*, or *recommandées*, as well as those forwarded by express, may be obtained by the sender on payment in advance of the postal rate of an ordinary letter.

Subscription for Newspapers.—All the post-offices, and, in rural districts, the postmen, are bound to receive subscriptions for any of the newspapers published in the kingdom.

Private Boxes.—Any person may have a private box at an office, or claim his letters immediately after the arrival of the mails; for this a fee of 2 francs a month is charged.

Money Orders are charged as follows:—Not exceeding 20 francs, 10 centimes; above 20 and not exceeding 100 francs, 30 centimes; and 30 centimes for every additional 100 francs, or fraction of 100 francs. They may be made payable to bearer, or to persons named in the order. Those to bearer are payable at an office; those to persons named may be made payable at their residence, provided the amount be under 300 francs. Orders may also be forwarded by telegraph, the amount so forwarded not to exceed 1,000 francs.

Lapsed and Void Orders.—Payment of a money order must be obtained before the end of the second month from the date of issue, otherwise a new order will be necessary. If the order be not paid within five years, all claim to the money will be lost.

Savings Bank.—Deposits not less than 1 franc may be made at any office. No single account may exceed 5,000 francs, without a special authorisation from the administration of the "Caisse d'épargne." Interest is calculated from the 1st or 16th of each month following the deposit. It ceases on the 1st and 16th of each month preceding the withdrawal of any sum. Sums under 20 francs may be drawn out without any previous notice. The post-office undertakes the collection of bills not exceeding 300 francs, on prepayment of 1 per cent., such payments not to be less than 20 centimes.

Foreign Postage.

Printed Matter. — This class includes newspapers, periodicals, books, music, notices, engravings, lithographs, photographs, &c. Prepayment is obligatory for all foreign countries. The regulations respecting covers are the same as those for inland transport. Printed proof-sheets, with the original MSS., for Great Britain, France, Algeria, Switzerland, Italy, Holland, Luxembourg, Austria, and Germany, may contain written corrections, but no personal correspondence.

Papiers d'Affaires (see inland postage) at reduced postage can only be sent to Great Britain, France, Algeria, Holland, Germany, and Luxembourg.

Patterns and Samples are subject to the same regulations with regard to their nature and packing as for inland transport; they must have no mercantile or intrinsic value, nor be liable to duty.

Table Showing the Rate of Postage.

Between Belgium and—	Letters.			Newspapers and Printed Matter.		
	Unit of Weight.	Paid.	Unpaid.	Unit of Weight.	Newspapers.	Printed Matter.
	grs.	fr. c.	fr. c.	grs.	fr. c.	fr. c.
Germany	15	*0 20	†0 40	40	0 5	0 5
Great Britain, By Ostend	15	0 30	0 60	50	0 5	0 5
Great Britain, By Calais	15	0 40	0 70	50	0 7	0 7
Austria	15	0 20	0 40	40	0 5	0 5
Brazils, Direct	10	1 0	1 0	50	0 10	0 10
Brazils, By England	15	1 50	1 50	50	0 15	0 15
Brazils, By France	7½	1 0	1 0	40	0 16	0 16
Denmark	15	0 40	0 70	40	0 10	0 10
Spain and Gibraltar	7½	0 60	0 90	40	0 12	0 12
States of the Church, By France	7½	0 70	0 70	40	0 1	0 1
States of the Church, By Germany	15	0 40	0 70	40	0 8	0 8
United States	15	0 80	1 10	50	0 10	0 10
France	10	†0 30	0 50	40	0 8	0 5
Italy	10	0 40	0 60	40	0 10	0 10
Luxemburg	15	*0 20	0 30	40	0 2	0 2
Holland	10	*0 20	0 30	40	0 4	0 4
Montevideo, Buenos Ayres, Direct	10	0 80	0 80	50	0 10	0 10
Montevideo, Buenos Ayres, By England	15	1 50	1 50	50	0 15	0 15
Montevideo, Buenos Ayres, By France	7½	1 0	1 6	40	0 16	0 16
Norway	15	0 50	0 80	40	0 14	0 14
Sweden	15	0 40	0 70	40	0 12	0 12
Portugal	10	0 60	0 80	20	...	0 15
Roumania	15	0 30	0 60	40	0 9	0 9
Prussia	15	0 40	0 70	40	0 9	0 9
Switzerland, By Germany	10	0 30	0 40	40	0 5	0 5
Switzerland, By France	10	0 30	0 40	40	0 5	0 10

Money Orders may be obtained at all inland offices, for Great Britain, France, Algeria, Holland, and Germany. The orders for France, Algeria, and Holland must be forwarded by the remitter; those to Great Britain are paid to the post-office authorities at the address of the person to whom the money is made payable. On the other hand, those from Great Britain are forwarded by the remitter, and are made payable at the office indicated on the order. The following shows the commission on money orders:—

From Belgium to France and Algeria, 20 cents. for every 10 frs., the maximum amount of order issued being 200 frs.

To Holland, 20 cents. for every 10 frs., the maximum amount of order issued being 211 frs. 64 cents.

To Great Britain, 50 cents., not exceeding 100 frs.; 1 fr. above 100 frs., and not exceeding 200f.; and 1 fr. 30 cents. above 200 frs., and not exceeding 252 frs. 50 cents., the maximum amount of order issued being 252 frs. 50 cents.

To Germany, 50 cents., not exceeding 25 thalers; 1 fr. above 25 thalers, and not exceeding 50 thalers, the maximum amount of order issued being 50 thalers (185 francs).

* This rate is reduced to 10 centimes for places within 30 kilometres of each other.

† This rate is reduced to 20 centimes for places within 30 kilometres of each other.

Orders obtained in Belgium for Great Britain are calculated at 25 frs. 25 cents. per £1, whereas English orders received in Belgium are only paid at the rate of 25 francs per £1.

Lettres chargées (*or recommendées*), without declaration of the values contained, but with five seals attached to the envelopes, are received at all inland offices for transmission abroad. The rate of postage between Belgium and Great Britain is 20 cents., in addition to the ordinary rate for weight.

The charges for registering letters between Belgium and Great Britain, Germany, Russia, Austria, and Holland, are the ordinary rates for weight, with an additional fixed rate of 20 cents. Between Belgium and France, *lettres chargées* with values declared, the ordinary rate, with 50 cents. extra, and 20 cents. per 100 francs or fraction of 100 francs. *Lettres recommandées* the ordinary rate, with additional fixed tax of 50 cents.

Patterns, Samples, Papiers d'Affaires, &c., are charged as follows:—Between Belgium and

Great Britain.—Patterns and samples, 30 centimes per 120 grammes (maximum weight 250 grammes). Proof sheets (with the original MSS.), *papiers d'affaires*, and manuscripts, by Ostend, 10 cents per 50 grammes; by Calais, 12 cents. per 50 grammes.

France. — Patterns and samples, 10 cents. per 40 grammes; *papiers de commerce ou d'affaires*, proof-sheets &c. (corrected), 50 cents. per 200 grammes.

Germany.—Patterns, MSS. of all kinds, 5 cents. per 40 grammes.

Russia.—Patterns, &c., 9 cents. per 40 grammes.

Austria.—Patterns, MSS., &c., 5 cents. per 40 grammes.

Holland.—Patterns, 10 cents. per 40 grammes. *Papiers d'affairs* and MSS., 30 cents. per 200 grammes.

Among Continental nations Belgium certainly occupies a foremost position as regards the postal arrangements, and every year adds to the facilities for inland and foreign correspondence. The latest report published states that, in 1867, there were:—

13	localities having	.. 7	daily deliveries.
3	" "	.. 6	"
29	" "	.. 5	"
64	" "	.. 4	"

Every parish and rural district has at present one daily delivery, at least. In 1857, it was decided that all parishes receiving on an average 25 letters a day should have a second delivery. In 1867, 306 parishes (about one-ninth of the total number in the kingdom) had a second delivery. The increase in the transport of newspapers and *imprimés* between 1847 and 1867, was, for newspapers, from 4,200,000 to 38,400,000; for *imprimés*, from 1,300,000 to 14,664,000. In 1867, the number of letters that passed through the post-office was 42,500,000, of which only 1,120 were lost. 20,236 were refused by the persons to whom they were addressed, and 20,610 never reached their destination, owing to defective addresses or to their remaining unclaimed.

The total receipts of the post-office were 6,520,167 francs against expenses 4,090,400 francs. The surplus being above 2,000,000 francs, it is expected that the government will soon give the public the benefit of a uniform tax of 10 centimes for all inland letters under 15 grammes weight. A promise to this effect was made some years back.*

EDUCATIONAL NOTES.

The amendments to the Education Bill that are to be proposed on the part of the Government, have been laid on the table of the House of Commons. That to clause 3 proposes to omit the definition of the term "vestry," which allowed persons acting "by virtue of acts of Parliament, prescription, custom, or otherwise, as a select vestry," to elect the school Boards; and provides that only such select vestries as are elected by the parishioners shall have that power, and where there is no elected vestry the general body of parishioners shall be the vestry. The amendment to clause 7 provides that every elementary school shall be conducted in accordance with the following regulations, viz.:—"No child shall be required, as a condition of being admitted into or continuing in the school, to attend or abstain from attending any Sunday-school, or any place of religious worship, or any religious observance, or any instruction in religious subjects in the school or elsewhere. The time or times during which any religious observance is practised or instruction in religious subjects is given at any meeting of the school shall be either at the beginning or at the end, or at the beginning and at the end of such meeting, and shall be inserted in a time-table, to be approved by the Education Department, and to be kept permanently and conspicuously affixed in every schoolroom; and any scholar may be withdrawn by his parent from such observance or instruction without forfeiting any of the other benefits of the school." The amendment also omits the permission to the inspectors to examine the religious instruction at the request of the managers, and provides that "it shall be no part of the duties of such inspector to inquire into any instruction in religious subjects." The two new subdivisions proposed to be inserted, and quoted above, supersede the present third subdivision of this clause; and a further provision is inserted in clause 66, providing that no bye-law shall prevent the withdrawal of any child from any religious observance or instruction in religious subjects.

The third important amendment provides that the election of the school board by the parishioners in vestry shall be by ballot, each ratepayer delivering to the inspectors a folded paper, containing the names of the persons for whom he votes, such paper to be deposited, without being previously opened, in a balloting-box, and the inspectors are not to make known to any person, except by order of some competent court, the manner in which any person has voted at the poll. Each ratepayer is to have one vote only for each member of the board. In case of an equality of votes, the inspectors are to decide by lot upon the person to be elected.

The other amendments are of less importance, and are chiefly verbal.

The *Daily News*, commenting on these amendments, observes that "it was scarcely to be expected that the government would go the whole length that we believe the country will have to go before the final settlement is arrived at, though the time-table conscience clause, as it is called, may possibly supply, not indeed a solution of the religious difficulty, but a stepping-stone to the only final settlement."

Various questions on these amendments have been asked in the House, one of which drew from Mr. Forster the statement that they had been brought forward in fulfilment of Mr. Gladstone's promise at the close of the debate on the second reading. "That debate seemed to show that the clauses of the Bill were by some members supposed not to fully carry out two important principles which we had always intended to embody in it, viz., the most complete protection of the conscientious scruples or feelings of the parent, and the utmost possible security that the boards which have to deal with the education of the children should be freely elected by the parents. We have therefore replaced sub-section 3 of clause 7, which is the conscience clause of the Bill, by a self-working time-table clause, and we have secured that, in the election of the vestry school boards, there should be no plural voting, and that there should be ballot."

The committee of the League have issued a circular to all their branches, nearly 200 in number, urging continued opposition to the Government Bill, on the ground

* Since the report was written this promise has been carried out. The inland postage is now 10 centimes for 15 grammes, equivalent to one penny for an English half ounce.—[Ed.]

that the amendments proposed fail to meet the objections of the League, and that they leave untouched the religious difficulty, Nonconformists being still subjected to the payment of rates for the teaching of tenets from which they dissent.

The Central Nonconformist Committee have passed resolutions affirming that the Government amendments fail to remove the essential objections urged against the Bill by the Nonconformists, inasmuch as it is still left in the power of the school boards to require the schoolmaster to teach sectarian dogmas, and that unless such amendments are introduced as shall secure that the religious instruction given in schools supported or aided by the rates is confined to the reading of the Scriptures, it will be the duty of the Nonconformists to do their utmost to prevent the passing of the measure.

The Manchester Education Bill Committee have passed resolutions, on the Government amendments, expressing their satisfaction with that proposed to be inserted in Clause 7, which will establish a strict time-table conscience clause in all schools receiving public aid, and adequately secure the rights of minorities, and thus remove the most serious objections which have been taken on religious grounds; but, inasmuch as tho amendments proposed do not touch any of the following points—1, the creation of school boards in every district; 2, the unsectarian character of rate-provided schools; 3, the substitution of positive provisions respecting attendance at school for permissive bye-laws drawn up by school boards—they determine to persevere in supporting the amendments to secure those objects which Mr. Hibbert, Mr. Jacob Bright, and Sir Thomas Bazley have placed on the notice paper of the House.

The subject of compulsion was revived by Mr. Fawcett, in a speech made on Friday evening, on the report of the commission appointed to inquire into the condition of children employed in agriculture. He said this report conclusively proved that it was not enough to bring the means of education within the reach of every child, but they must also secure that these advantages were availed of. The report showed that the age at which children were taken from school was gradually dropping, owing to the demand for juvenile labour, and the provision of good schools was powerless to counteract it. He thought there was only one way to cure the evil—by placing some restriction on the age at which children might go to work; and, in conclusion, he moved a resolution to the effect, that the ignorance which prevailed in the rural districts was in a far greater degree due to the early age at which children are taken from school to be sent to work, than to any general deficiency in the means of education. He was answered by Mr. Bruce, who maintained that the Education Bill, if passed in its present form, would provide all the compulsion that was practicable or desirable.

The *Times*, commenting on Mr. Fawcett's speech, says:—"One fact Mr. Fawcett mentions should alone have taught him the futility of an attempt to repress the labour of children by a uniform law. He says the demand for such labour is gradually increasing, and the average age at which children leave school is proportionately diminishing. If so, it is hopeless to stop this natural process by a single stroke of legislation. The Government Bill provides for trying compulsion gradually, and, for once, we appreciate Mr. Bruce's desire to wait. It remains to be seen how compulsion in any degree can be carried out in the country. If a compulsory law be not in harmony with the wishes of the people, it will inevitably become a dead letter." It goes on to recommend night schools for boys when of an age to be at work. "Boys lose more knowledge and learn more mischief in the years between 12 and 20 than at any other time of their lives. Winter evenings, with no amusement and no shelter but the public-house, are their ruin. If the hours after dark were turned to good account during those years, lads would have ample means for learning all necessary scholarship, and would escape numerous temptations."

The *Beehive*, the organ of associations of the industrial classes, states that the following resolutions on national education have been prepared by a number of gentlemen, who have taken much practical interest in the solution of this question. It suggests that they would furnish admirable resolutions for public meetings on the Education Bill:—"1. That the working classes desire that any system of free national education shall be on the same basis as the parochial schools of Scotland, in which the children of all classes of society are received on an equal footing. 2. That under a system of national free schools, as proposed for elementary instruction, to be supported, as in the United States, by a school-rate, whilst the free admission of the children of all classes of ratepayers would be equitable, it would be expedient, as creating a common interest, to provide education of the best quality for all. 3. That it is expedient and necessary that the initiation of an improved system of national training and education should, subject to local examination and power of objection, mainly be with competent and respectable public officers, independent of narrow local prejudices or of sinister and local class interests. 4. That this is the more necessary, inasmuch as, according to competent testimony, the art of educating and training children has of late times been greatly improved and is improving, especially mixed mental and physical training; and that this new teaching art requires great skill and special knowledge of administrative organisation for its application, beyond any knowledge that is usually possessed by existing local authorities, who are conversant only with old methods. 5. That the State is bound to apply the best knowledge that may be obtained, and to require the most efficient application of all State aid and all public funds for national education. 6. That any local authority for the supervision of permanent executive officers, school teachers, or others engaged in training and educating children, should be specially constituted, and should comprise as *ex-officio* members, with elected members, the parochial clergy, ministers of religious communities, and school managers, and persons who have displayed zeal for the improvement of the working classes. 7. That, to guard against local jobbing and mistakes, all new appointments to school teacherships should be by open competitive examinations, and for periods of probation, subject to the examination of the government school inspector of the district. 8. That any system of national education is essentially defective which omits to provide for the physical as well as the mental training of children. 9. That any system of compulsory education should be on the principle of the half-time system of the first Factory Act, in which three hours' daily attendance in a good school was provided as a security against a child being overworked by working the same stages as an adult, as well as a security against being so worked as to be excluded from the benefits of a common education."

CORRESPONDENCE.

THE SPELLING DIFFICULTY.

Sir,—Perhaps you will allow me a little space to supplement my somewhat unconnected remarks at the discussion on this subject, on the 20th April, by a more consecutive statement as to the manner in which, in my opinion, the spelling difficulty can be met.

The Objects are—First, and principally, to facilitate the teaching of reading and spelling in schools; secondly, to introduce desirable improvements in orthography gradually into the general literature of the country; and, thirdly, to make literary men the arbiters of spelling, and not printers.

It is impossible to conceive that the orthography in its present form should be stereotyped for generations to come, when we consider that from the days of Johnson 10 per cent. of the words in the language have changed their spelling; from the date of the Authorised Version, 20 per cent.; from Tyndal, 40 per cent.; and from Wiclif, 60 per cent. It is desirable, however, that these changes should take place on some system, and under the direction of some recognised authority.

Basis of the Proposed Plan.—(1.) It is found that about 90 per cent. of the words in the English language are formed, as to their vowel sounds, on the principle that a final *e* lengthens the preceding vowel, and that two consonants shorten the preceding vowel, as in the following examples:—*Hat, hate; hatter, hater; hop, hope; hopping, hoping*, &c. Most of the difficulties of spelling arise from a comparatively small number of words which deviate from this rule, as *door, head*, &c. Before the time of Johnson, these words were often spelt *dore, hed*, &c. It is proposed to revert, in these cases, to the old spelling, in accordance with analogy.

2. Many words are now contracted in spelling, both in writing and printing, as *though, tho; through, throo; borough, boro*, &c.

3. Many words have been corrupted from their original simplicity, so as to obscure their etymology, and make their spelling more difficult, as *parlement, parliament; sovran* or *sovrein, sovereign; foren, foreign; delite, delight*, &c., &c.

4. There are now above 2,000 words, the spelling of which is doubtful, as *honour, honor; realize, realise; stopped, stopt; ache, ake*, &c.

5. There is equal reason for spelling *rough, ruf; tongue, tung*, &c., as there is for spelling *draught, draft; cheque, check*, which is common.

By carrying out these principles, in about 10 per cent. or 20 per cent. of the words in the language, the principal difficulties of spelling would be removed.

Means of Introducing the Change.—It is proposed to obtain a public recognition of the simpler modes of spelling, in order that those who desire to use this mode may be able to do so without being open to the charge of bad spelling, or of singularity, in the following manner:—

1. To obtain the approval of teachers, examiners, literary men, and printers, to the general principles, as stated above.

2. To appoint a committee, consisting of representatives of the various educational societies, teachers' associations, heads of training colleges, and printers, to determine upon matters of detail, such as what words ought to be changed, &c.

3. To ask the government to permit the use of such simplified modes of spelling as may be agreed upon, in schools, or if considered necessary, to institute an inquiry into the whole question.

4. Within the limits defined, the alternative modes of spelling would be considered as equally correct in all examinations.

The Advantages of the Change would be:—1. That a far greater number of children would be taught to read than at present. 2. The time saved in teaching reading and spelling would be devoted to other useful and necessary subjects of instruction.—I am, &c.,

E. Jones.

Hibernian Schools, Liverpool.

RAILWAYS IN INDIA.

Sir,—In the account of the discussion which took place, at the Society of Arts, on Mr. W. P. Andrew's paper on "Indian Railways," I am reported in your *Journal* to have expressed myself as follows:—"Twenty-five years ago Parliament would not have thought of sanctioning £50,000,000 being raised for Indian railways, but through the instrumentality of companies, the money has been raised, and he did not think for a moment that a single sixpence of that money had been misspent. On the contrary, he believed that every shilling would produce its return, and in time to come nobody would regret what had been done."

In case this should be quoted as my opinion, I shall feel obliged by your allowing me to explain that the report does not convey the meaning of what I think I said. I did not intend to express the opinion that not a single sixpence of the money expended on railways in India had been misspent, but that the money advanced by the government for guaranteed interest on the capital raised by the companies had been well spent, and that in course of time it would be recovered. This was in my mind, but I have no doubt that I expressed myself imperfectly, and that the mistake was mine more than the reporter's.—I am, &c.,

Juland Danvers.

23rd May, 1870.

THE METRIC SYSTEM.

Sir,—Mr. Hyde Clarke, in his letter appended to the discussion on Mr. Franklin's paper, appears to deny the assertion, which he attributes to Mr. Hendriks, that "all enlightened men of all nations have determined to enforce the metric system and reject all others," and is rather disposed to affirm that "enlightened men, and probably a majority," are of an opposite opinion. As the question is of much importance, permit me to lay before you the following facts.

The Commissioners Lagrange, Laplace, Borda, Monge, and Condorcet, mathematicians of the first order, having met to select the best unit of length, after discussing the relative merits of the invariable length which is known to be required for the exactness of a seconds pendulum at any given time, and of a unit taken from the dimensions of one planet, decided upon preferring the latter, as not involving the hetereogeneous element of time, and being also necessarily of a more cosmopolitan character, and the French Academy sanctioned the choice. The metric system was introduced in France during evil times. The great Napoleon was hostile to it, and it was by French arms that it was extended to Belgium, Italy, the Rhenish provinces, and other States. Yet, when France had a settled government, and the other countries became free, the metric system was left undisturbed. Its intrinsic excellence secured the respect and admiration of all who once adopted it.

In later times, one country after another chose the metre as the basis of a new system of weights and measures. The Germans, wedded as they were to the foot, discarded it for the metre. The North German Confederation made the use of it permissive from the 1st January, 1870, and compulsory from the 1st January, 1872. The International Statistical Congress, comprising the best statisticians of all nations, again and again recommended it. The commissioners and juries of the International Exhibitions came to the same conclusion. The conference held in Paris, in 1867, did the same. In this country, the Committee of the House of Commons, of 1862, was unanimous in recommending it. Parliament sanctioned the same by its many votes and the permissive Act, and the Standards Commissioners have recently confirmed the same recommendation. The British Association, especially sections B, F, and G, including chemists, statisticians, and mechanics, expressed themselves in favour of it. Men of science of all nations generally use the metric equivalents in all their expressions of quantities. And now the Duke of Argyll, Secretary of State for India, sanctioned the proposal of the Indian government, to adopt the kilogramme, with its decimal divisions and multiples, as a unit of weight for India, in preference to the lb. avoirdupois. Other units and other systems have been suggested with more or less weight, but the metric only commended itself to the learning and intelligence of the age, and steadily it is becoming the only one in use in the civilised world.—I am, &c.,

Leone Levi.

GENERAL NOTES.

The Mineral Wealth of China.—Tring Foota has received permission to open up the coal-fields at Nanking and Kinthaing, where coal of a very superior quality is obtainable. He intends to send to England for competent engineers and the requisite machinery. Good specimens of coal have also been obtained at San-ti, some 200 miles above Hankow.

An Academy of Sciences at Baltimore.—A natural history society has been organised in Baltimore, United States, under the title of "Maryland Academy of Sciences," to promote scientific research, and to collect, preserve, and diffuse information relating to the sciences, especially those connected with the natural history of Maryland.

Milk a Preservative against Lead Poisoning.—M. Didierjeau, a red-lead manufacturer, has discovered that the use of milk at their meals, which he has made obligatory on his workmen to the extent of one litre daily, preserves those employed in lead-works free from any symptom of lead disease. He vouches for the truth and correctness of this communication.

North German Confederation Railways.—The extent of line in operation, at the close of 1867, was 3,052 German miles, or about 14,300 English miles. Of this whole length, 792 German miles were constructed with a double set of rails. 995 German miles belonged to the State, and 2,057 German miles to companies. The various administrators possessed, at the close of 1867, 5,814 locomotives, which ran during the year an aggregate distance of 16,639,884 German miles, and consumed 22,610,397 English cwt. of coal.

Suez Canal.—At a meeting of the Royal Geological Society, Professor Haughton read a paper on the "Probable Geological Effects of the Permanent Opening of the Suez and Darien Canals. He described the Suez Canal as an interference with nature. He gave a graphic description of the Atlantic and Indian Oceans, with their two great off-shoots—the Mediterranean and the Red Sea—seas with not a very limited rainfall area, and subject to immense evaporation; in fact, having all the circumstances in their favour to make them the seat of strong currents, the natural tendency of the meeting of which is to build up that vast sand or mud bar, the Isthmus of Suez. The new canal he regarded as a scratch of a spade, by the hand of a child, across the bar of the two oceans; and the re-formation of that bar he regarded as certain—it would probably be re-formed beyond Port Said. He thought the Darien Canal would have a totally different success. The idea of forming this canal originated with Dr. Cullen, of Dublin. Nature, in scooping out the great gulf in which the West Indian Islands lie, showed her determination to break through the isthmus somewhere, and the great South Atlantic current would keep any canal open that was cut. The Americans thought that they would lower the temperature of Europe by removing so much of the Gulf-stream from us. But if their canal was one mile wide and 100 feet deep they would take from us but 1-1000 part of the heat we already possessed, and to make up this deficiency would cost the inhabitants of Dublin not more than 2s. 4d. for additional fuel to each family—a sum they might well lose for the good of the whole race. The palæontological effects would not be of much interest in the case of either canal; a few Red Sea cockles might wander into the Mediterranean, and even this would not occur to the Darien Canal, as the same species of fish and mollusca were found on both sides of the Isthmus of Panama; and man must not forget that he has no power over nature.

Anæsthetics.—M. Sauer, a surgeon-dentist of Berlin, after various experiments, has come to the conclusion that the very best of these is a mixture of protoxide of nitrogen, chloroform, and atmospheric air, as being free from the dangers attending the use of each of the two former alone. The proportions he advises and employs are—Liquid chloroform, 6 grammes; atmospheric air, $\frac{3}{4}$ litre; and 16 litres of protoxide of nitrogen.

Chemical Investigation of Condensed Milk.—L. Kofler gives the following tables as the result of his researches. Each of the samples he has examined also contains sugar (purposely added) to an extent of from 25 to 30 per cent., and milk sugar to from 14 to 18 per cent.

	Anglo-Swiss Condensed Milk Company.	Milk from Sassin (Prussia).	Milk from Vivis (Switzerland).	Milk from Kempten (Bavaria).	Milk prepared by L. Kofler himself.
Water	22·180	18·824	22·421	18·810	20·770
Fatty matter (butter)	12·260	12·625	12·030	13·650	12·830
Caseine and albumine......	28·100	24·240	25·960	24·900	29·600
Ash	2·180	2·482	2·673	2·430	2·865

All these articles were submitted to microscopic investigation and found to be genuine, fit in every respect, when diluted with cold water (in which liquid all these substances were readily soluble), to be used as milk.

Recommendations of the Council of the Statistical Society with respect to the Census of 1871.—The minute printed below has been adopted by the Council, and a copy of it forwarded to the Secretary of State for the Home Department:—" 1. That it is not desirable to suggest any arrangements of detail in the mode of collecting the information, differing from those which have been observed generally, with great success, in the taking of the census on the last two occasions. 2. That it is advisable that the census of 1871 should be taken at the same time of the year as the last census. 3. Two collateral branches of inquiry were prosecuted in 1851, by means of the census machinery, but not under the compulsory powers of the statute. These related to—(a.) The provision existing for religious worship, and the attendance thereon. (b.) The means existing for education, and the attendance at schools and places of instruction. The Council, in 1860, were of opinion that both these collateral subjects should be inquired into at the census of 1861, and made their recommendation accordingly in April, 1860. This recommendation was not adopted by the government of the day. The Council having again considered this part of the inquiry, and having regard to the lapse of time since the investigation of 1851, think it expedient that the same subjects should, in like manner be inquired, into at the census of 1871. " 4. They also are of opinion that the statute to be passed on the present occasion should further contain an express enactment, requiring that a distinct question should be inserted in every census schedule as to the religious persuasion of the persons included in that schedule. 5. That the statute should also require that the person filling up the schedule should state whether every individual mentioned therein, above the age of seven years, can read or write. 6. That inquiries to show the state of the house-accommodation of the people, on the basis adopted with so much success in the last census of Scotland, should be embodied in the next census returns for England."

To separate Animal from Vegetable Fibre.—The goods are suspended in an atmosphere of nitrogen or carbonic acid, and the vapours of perfectly dry sulphuric, phosphoric, or hydrocloric acid caused to enter the room. These fumes disintegrate the vegetable fibre, and leave intact the animal; the two fibres can thus be separated and appropriated to their respective uses.

Guano used in Austria.—The following shows the quantity of guano used in Austria each year, from 1861 to 1869:—1861, 12,819 cwt.; 1862, 13,370 cwt.; 1863, 18,650 cwt.; 1864, 35,264 cwt.; 1865, 45,264 cwt.; 1866 (the year of the war with Prussia), 23,846 cwt.; 1867, 63,446 cwt.; 1868, 67,684 cwt.; 1869, 106,514 cwt. The above figures include the guano used in Hungary.

Lights in the Passenger Car of the Broadway Pneumatic Underground Railway, New York.—The use of the zircon or oxygen lights on this railway has been discontinued, and common gas substituted. The gas is compressed in cylinders, and is made to pass through a soda water bottle containing benzine; this carbon, which the gas takes up in passing through the liquid, greatly increases the brilliancy of the light.

Chemical Intensity of Sunlight.—It is found that the intensity of diffused light of the sky—not that reflected from clouds—is proportional, within certain limits, to that of the sun itself. When the altitude of the sun is less than ten degrees above the horizon, the chemical intensity of its light is practically nothing, while that reflected from the sky reaches a very appreciable quantity. Again, the chemical intensity of the solar light is found steadily and regularly to increase with the sun's altitude until the maximum is reached, when the meridian is crossed. The reason for this obviously is, that as our great luminary pursues his apparent upward course in the heavens, his rays have to penetrate a less extent of the earth's absorbent atmosphere, until, at the zenith, the light has to pierce a layer of minimum thickness of this absorbent envelope. As the sun declines after noon, the same gradual loss of actinic power in its light is observed. It is found that, though the conditions of the atmosphere may vary, this increase and diminution of the intensity of tho solar light is strictly proportional to the altitude of the sun.

Telegraphs in Italy.—According to the report of Signor D'Amico, the Director-general of the Telegraphs in Italy, and published by the Minister of Public Works, tho receipts exceeded the expenditure, in 1868, by 412,892 francs. Although this slight profit is far from satisfactory, it is a decided improvement on that of previous years, as will be seen by the following figures:—

	Expenditure. francs.		Receipts. francs.
1862	3,715,168	..	2,438,763
1863	3,757,619	..	2,814,836
1864	3,924,707	..	3,357,347
1865	3,819,702	..	3,816,787
1866	3,683,729	..	4,018,345
1867	4,006,215	..	4,187,790
1868	4,090,143	..	4,553,035
	26,997,290	..	25,186,903

This shows a loss during the seven years of 1,810,387 francs. The valuo of the telegraphs in Italy is estimated at upwards of eight millions of francs. There are 1,065 offices, of which 542 belong to government, 11 royal, and 512 belong to different companies. The number of instruments is 1,116, and the number of telegrams sent, received, or reproduced was 8,427,442 during the year. Tho service is conducted by 2,110 employés and messengers, and besides this number there aro 75 clerks and 279 messengers employed for tho semaphorical service, making a total of 2,464 employés. The length of tho lines of telegraphs in Italy is 15,976 kils., of which 5,106 kils. aro along lines of railway. The total length of wiro is 47,154 kils.

Phenyl Ether.—When sulphate of diazobenzol is mixed with excess of phenol, nitrogen is evolved, even at the ordinary temperature of the air, while there is obtained, at the same time, a thick, oily fluid, exhibiting an agreeable aromatic smell. When this liquid is treated, first, with excess of caustic soda, and next rectified by distillation with steam, an oil is obtained boiling at from 250° to 255°, which has the same composition as phenyl ether, and becomes solid on cooling, rising again at 28°.

The Composition of Fossil and Recent Bones.—M. Scheurer-Kestner states that he finds in bones, which have been buried for long periods, besides ossein, which is insoluble in water, another organic nitrogenous substance, soluble in water, and into which he supposes ossein to be slowly changed. Running water gradually removes this soluble modified ossein, and consequently the ancient bones found in loose imperious soils contain very little organic matter, while those buried in compact clay may retain a large quantity of it. The rate of decomposition thus varies with the nature of the soil, but in the same soil M. Scheurer-Kestner believes that the relative age of different bones can, to a considerable extent, be determined by their chemical composition.

Electricity and Time.—Dr. Tyndall, in the fourth of his series of lectures at the Royal Institution, on May the 19th, drew attention to the fact that some time is necessary to charge long cables like the Atlantic, and illustrated this important fact by means of Mr. C. E. Varley's artificial cable, which represents, in all electrical respects, a cable 14,000 miles in length, with ten intermediate stations. At each of these a reflecting galvanometer was inserted, the lime-light was used, and ten brilliant little spots on a vertical line showed that all was at rest throughout the line, so far as electric currents were concerned. On connecting a battery at the end, representing the English terminus of this artificial cable, extending between, say England and Australia, about half a second elapsed before the spot representing Gibraltar showed any visible trace of current, a little later Malta, then Suez, Aden, Bombay, Calcutta, Rangoon, Singapore, Java, and lastly Australia showed the electric current. It was twenty-four seconds before Australia sensibly responded to the impulse from England. The idea of infinite speed, so common with regard to electricity, was dispelled by these experiments.

MEETINGS FOR THE ENSUING WEEK.

Mon......Royal Inst., 2. General Monthly Meeting.
Entomological, 7.
Victoria Inst., 8. Mr. James Reddie, "Civilisation—Moral and Material."
London Inst., 4.
R. United Service Inst., 8. Capt. H. Schaw, R.E., "The Amount of Advantage which the New Arms of Precision give to the Defence over the Attack."

Tues ...Ethnological, 8½. Special Meeting (at the Museum of Practical Geology, Jermyn-street). Prof. Huxley, "On the Geographical Distribution of the Chief Modifications of Mankind."
Royal Inst., 3. Prof. Seeley, "Present English History."
Syro-Egyptian, 7½.
British Association of Gas Managers, 12. (At the Society of Arts' House.)

Wed ...British Association of Gas Managers, 12. (At the Society of Arts' House.)
Geological, 8.
Microscopical, 8. 1. Mr. John Bell, "Experiments on Fermentation and Parasitic Fungi." 2. Mr. John W. Stephenson, "A New Form of Binocular Microscope."
R. Literary Fund, 8.
R. Society of Literature, 4½.
Archæological Assoc., 8.

Thur ...Zoological, 8½.
Mathematical, 8.
Royal Inst., 3. Prof. Tyndall, "Electricity."

Fri ......Astronomical, 8.
Royal Inst., 8. Prof. Odling, "The Ammonia Compounds of Platinum."
Quekett Club, 8.
R. United Service Inst., 3. Col. A. a'Court Fisher, "Guncotton applied to Demolitions."

Sat ......R. Botanic, 3¾.
Royal Inst., 3. Prof. Grant, "Comets."

Journal of the Society of Arts.

FRIDAY, JUNE 10, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

THE ALBERT MEDAL.

This medal, which was founded for rewarding "distinguished merit in promoting Arts, Manufactures, and Commerce," has this year been awarded by the Council to M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realization of the Suez Canal."

INDIA COMMITTEE.

On Friday, the 24th instant, a conference will be held on the subject of overland routes between India, Eastern Thibet, Assam, and China. The conference will be opened by Mr. T. T. Cooper.

"JOURNAL" ADVERTISEMENTS.

The Council announce that they have entered into an arrangement with Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, with regard to the advertisements in the *Journal*. All communications on that subject must therefore, after the 24th inst., be addressed to them only.

DRILL REVIEW.

The Review of Schools will take place on June the 21st, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and Her Royal Highness Princess Mary of Teck.

The following schools have signified their intention to be present:—

Royal Caledonian Asylum, Holloway, N.	41
Lambeth Industrial Schools, Norwood	133
Central London District School, Hanwell, W.	263
St. Mary, Islington, Hornsey-road, N.	60
St. Marylebone School, Southall, W.	100
Children's Establishment, Limehouse, E.	125
Welsh Charity School, Ashford, Staines	50
Royal Naval School, Greenwich	800
S. Metropolitan District School, Sutton, Surrey	300
Royal Military Asylum, Chelsea, S.W.	294
British Schools, Brentford	100
Shoreditch Industrial Schools, Brentwood	85
Mile-end Industrial Schools, Bancroft-road	80
St. Olave's School, Tooley-street, S.E.	230
Strand Union School, Millfield House, Edmonton	100
Chichester Training Ship	200
Marine Society's School, 54½, Bishopsgate-st. Within	120
British School, Richmond	40

A programme of the arrangements will be published in the next *Journal*.

It is the intention not only to have a display of military and naval drill, but also of swimming and gymnastics.

After the review, the members of the Society and their friends (including ladies) will partake of a cold collation, during which the schools will sing and their bands play.

Tickets for the collation, price 7s. each, including a pint of light wine, may be had on application at the Society's House, up to the 18th of June, after that day the price will be 10s. 6d. Members proposing to be present are particularly requested to make early application, in order to facilitate the arrangements.

A ticket admitting a member and lady within the circle to witness the review, will be delivered on application for the same at the Society's House.

ANNUAL CONFERENCE.

The Nineteenth Annual Conference between the Council and the Representatives of the Institutions in Union and Local Boards will be held on Wednesday, the 22nd June, at Twelve o'clock noon. The Chairman of the Council will preside.

On this occasion, the Conference will be held in the *Lecture Theatre of the South Kensington Museum*, in order to afford to those present an opportunity of visiting the Horticultural Gardens, the Royal Albert Hall (now in course of construction), and the new buildings now being erected for the International Exhibition of 1871.

The Council will lay before the Conference the Report of the Proceedings of the Union for the past year, and the Results of the Examinations. Suggestions in reference to the Programme of Examinations for 1871 will also be received by the Council.

As the Society of Arts has undertaken, with the aid of a large and influential Committee, to make arrangements for the Educational Section of the International Exhibition to be held in 1871, the Council are desirous of drawing the especial attention of the Institutions in Union, and other local bodies interested in education, to this Exhibition, which it is their desire to render as interesting and valuable as possible. With this view it has decided to invite the Representatives of Institutions and Local Boards to meet some members of the Education Committee on the occasion of this Conference, in order to discuss with them the best modes of bringing local influence to bear in obtaining the most suitable o jects for exhibition in the Education Section, which will include specimens of all the subjects belonging to the following branches into which this class is subdivided:—

(*a*). School Buildings, Fittings, Furniture, &c.
(*b*). Books, Maps, Globes, Instruments, &c.
(*c*). Appliances for Physical Training, including Toys and Games.

(*d*). Specimens and Illustrations of Modes of Teaching Fine Art, Natural History, and Physical Science.

(*e*). Specimens of School Work, serving as Examples of the Results of Teaching.

It may be mentioned that the aim of this Exhibition being to show objects remarkable for excellence, novelty, invention, &c., only those articles will be admitted that receive the approval of the Committee.

The attention of local representatives is particularly drawn to section *e*, which is intended to show the results of teaching, and will include writing, plain and ornamental, drawing and design, modelling in clay, terra-cotta, wax, &c., models of machinery, building construction, &c., needlework, plain and ornamental, lace, knitting, music, &c., and miscellaneous work by pupils in schools for the blind, reformatories, &c. Any information or suggestions that may be offered in reference to this section will be of special value.

The following subjects have also been suggested for discussion at the Conference :—

1. How far it might be possible to make the Institutions rather Elementary Technical Schools than places where only a few miscellanous classes are held ?

2. What further arrangements can Mechanics' Institutions make for promoting the systematic Technical Education of the people in their several localities ?

3. Whether Teachers would not be stimulated in their efforts if those who were most successful in their training of pupils (as tested by the results of the Society of Arts' Examinations) had their services recognised by the Society ?

4. Whether much greater encouragement would not be given to the thorough acquisition of knowledge in the various subjects by the division of them, in all cases where more than one is included in the same Examination paper ; and whether, as the number of subjects in which Examinations are held has been greatly diminished, it would not be advisable to include others in the programme ?

5. What measures can be taken to increase the number of Free Libraries in the United Kingdom ?

6. What arrangements can be made to facilitate visits by members of Institutions in the provinces to the International Exhibition of 1871 ?

At the conclusion of the Conferenee, those present will be invited to visit the Horticultural Gardens and the other objects of interest mentioned above.

The Representatives are also specially invited to witness the Review of Schools, which will take place at the Crystal Palace on the previous day Tuesday, the 21st June.

Secretaries of Institutions and Local Boards are requested to send, *immediately*, the names of the Representatives appointed to attend the Conference; and early notice should be given of any other subjects which Institutions or Local Boards may desire their Representatives to introduce to the notice of the Conference.

Seeretaries of Institutions are requested to forward *at once*, by book post, copies of the last Annual Reports of their Institutions.

ANNUAL INTERNATIONAL EXHIBITIONS.

The Council desire to draw the attention of the members to the following important letter, which they have received from Her Majesty's Commissioners for the Exhibition of 1851 :—

Upper Kensington-gore, London, W., 4th June, 1870.

Sir,—Her Majesty's Commissioners for the Exhibition of 1851 have had under consideration your letter of 8th April, 1870, transmitting resolutions which the Council of the Society of Arts have passed, having for their object the promotion of the success of the International Exhibition of 1871, and the extension of its advantages throughout the United Kingdom, by the circulation of specimens of art and industry; and I am directed to express the thanks of her Majesty's Commissioners for this evidence of the continued attention which the Society pays to the subject of International Exhibitions.

With the view of promoting the circulation to local institutions, throughout the United Kingdom, of objects of art and industry, to be purchased out of the International Exhibition, your Council propose to raise a special fund, and seek to obtain for the subscribers to such fund (being members of the Society of Arts) the privilege of obtaining season tickets at a reduced cost. In this laudable desire of procuring valuable specimens of art and industry for the benefit of the United Kingdom, her Majesty's Commissioners desire me to say they cordially sympathise, and are prepared to assist the views of the Society in carrying into effect the general intention of their resolutions. They have to propose, however, a modification of the means suggested by the Society.

The price of the season ticket for the Exhibition of 1871* will be, as at the Exhibition of 1862, three guineas; and her Majesty's Commissioners are willing to place to a separate account one guinea out of the price of every season ticket sold for three guineas through the agency of the Society of Arts, for the purpose of establishing a fund for the purchase of specimens from the International Exhibition of 1871, calculated to cultivate national taste, and benefit industry.

Subject to the approval of her Majesty's Commissioners, the Society of Arts will be entitled to select objects to be so purchased out of the Exhibitions, to be kept for public benefit on trust for exhibition in local museums, or otherwise.

Trusting that these arrrangements will meet the views of the Society, and enlist its exertions in promoting the success of the Exhibitions,

I have the honour to be, Sir,
Your obedient servant,
Henry Y. D. Scott, Lieut.-Col. R.E., Secretary.

To the Secretary of the Society of Arts.

PRIZES FOR ART-WORKMANSHIP, 1870-71.†

The Council, having in view the International Exhibitions about to take place under the management of the Royal Commissioners for the Exhibition of 1851, think it well to suspend for a time the form hitherto adopted in offering prizes for art-workmanship, believing that the change is likely to be beneficial to the object the Council have at heart, viz., to see the art-workmen of the United Kingdom oceupying a good

* The sale of season tickets in 1862 realised £80,575.

† The Worshipful Company of Salters contribute ten guineas annually to this prize fund. The North London Exhibition Prize consists of the interest of £167 7s. 3d. Consols, invested in the name of the Society of Arts, to be awarded by the Council "for the best specimen of skilful workmanship" at the Society's Exhibition of the works sent in for the prizes named below.

position in the coming International Exhibition in comparison with those of other countries.

With this view, the Council have decided upon offering a series of rewards for special excellence on the part of all concurring in the satisfactory production of works of industry of the highest character. They consider that they can most effectually ensure their object by offering to manufacturers the highest distinctions they have it in their power to confer, and to workmen liberal money premiums.

They desire to obtain, from those who may be willing to compete for the prizes they offer, specimens of art-manufacture, which will have to be sent to the Society's rooms by the 14th January, 1871.

These will be immediately judged upon their merits, and the premiums enumerated below will be awarded. An endeavour will be made to effect arrangements by means of which every object receiving a premium, or selected for the distinction of being exhibited, will be placed in the coming International Exhibition as a contribution on the part of the Society of Arts, showing the results of recent efforts which have been made to improve art-workmanship in this country.

The specimens of manufacture sent in, in competition for the above rewards and premiums, will have affixed to them the name of the designer and of the workmen, in each special branch of industry involved in the execution of the work. Every workman will be eligible to receive money premiums proportionate to his merits, and to the degree in which he may have contributed to the successful results of the whole; whilst the manufacturer may receive the Gold or Silver Medals of the Society.

The Society hope that they may receive objects enabling the judges to award the Society's Gold Medal to manufacturers; and the Society's Silver Medal to manufacturers or designers—accompanied, in the latter case, if the circumstances appear to call for it, with money premiums; and to the art-workmen, money premiums varying from £3 to £20, and to the extent in the whole of £500.

These works may obviously include specimens not only of the taste of the designer, but of the skill of the carver, inlayer, metal worker, chaser, bronzist, engraver, china painter, die sinker, cameo cutter, glass worker, enameller, mosaicist, and other art-workmen, either separately or in any arranged combination.

It is thought better not to define too closely the objects of manufacture likely to result from any such combination; but, by way of illustration of what the Society hopes to receive, may be mentioned the following:—

A cabinet with glazed doors, for the exhibition of articles of *vertu* of the highest character.

A toilette glass, suited for the boudoir of a lady of rank.

Any combination of goldsmiths and silversmiths' work, with elaborate glass fittings, for the centre of a dining-table.

A chamber-organ, piano, or other musical instrument, combining enamels, inlays, marquetrie, and metal work.

A circlet or other personal jewel, executed with enamels, chasing, &c.

A case for a Bible, presentation volume, or any rare book, involving carving, inlaying, marquetrie, and precious metal work.

No object involving combined labour for its production will be eligible for reward, unless accompanied with the names of all those engaged in its production, to the most meritorious of whom—whether their works may be exhibited in the rooms of the Society, or in the International Exhibition—every effort will be made by the Council to give publicity, and attract attention.

Such combinations between the manufacturer, designer, and various workmen, will not preclude the award of premiums to individual workmen producing any object single-handed.

By way of illustration of the class of objects likely to be so produced, and to be highly regarded by the Society, the following may be mentioned:—

A drinking cup.

A centre-piece for flowers in blown or twisted glass, decorated with filigrani, or enamel colours, or by combination with metal work.

A candelabrum in wrought-iron, brass, bronze, or other metal, with inlays, enamelling, damascening, &c.

A flower-box in modelled and painted china or earthenware.

A carved or modelled clock-case.

A carved or modelled chimney-piece.

The Council will far more highly esteem grandeur and beauty of style, invention, or elegant simplicity, than they will richness or minute elaboration.

By order.

P. Le Neve Foster, *Secretary*.

May, 1870.

LIBRARY.

The following work has been presented to the Library by the author:—

Egypt, India, and the Colonies. By W. F. Vesey Fitzgerald.

The following work has been purchased, and added to the library:—

Official Report by Mr. Thurlow, Second Secretary to Her Majesty's Legation at the Hague, on the International Exhibition of Domestic Economy, held at Amsterdam in 1869.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

FINAL EXAMINATION, 1870.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.

PRIZES.

HIS ROYAL HIGHNESS THE PRINCE CONSORT'S PRIZE OF TWENTY-FIVE GUINEAS TO

No. 1328—Edward Turner Sims, jun., aged 22, of the Southampton Athenæum, clerk, who has obtained the following First-class Certificates :—

1867. Arithmetic—First-class Certificate.
 „ Political and Social Economy—First-class Certificate.
 „ Geography—First-class Certificate.
 „ English History—First-class Certificate.
1868. Book-keeping—First-class Certificate.
1869. English Literature—First-class Certificate.
 „ Logic and Mental Science—First-class Certificate.
1870. Metric System—First-class Certificate.

THE COUNCIL PRIZE (FOR FEMALE CANDIDATES) OF TEN GUINEAS

Has not been awarded this year, as no candidate qualified to receive prizes has fulfilled the required conditions.

Arithmetic	1st Prize	£5	To No. 416—William Pollock, 19, Glasgow Mech. Inst., warehouseman
	2nd Prize	3	„ 46—Richard D. Heckels, 16, S.E. Railway Mech. Inst., railway accountant's clerk
	Female Prize.	2	„ 524—Mary H. Barrowby, 20, Halifax W. Men's College (of no occupation)
Metric System	1st Prize	5	„ 279—Thomas Dawe, 19, Devonport Mech. Inst., clerk
	2nd Prize	3	„ 758—William D. Fish, 17, Birkbeck Lit. Inst., clerk
			*No Prize for Females awarded.**
Book-keeping	1st Prize	5	„ 1325—James T. Hamilton, 21, Southampton Ath., clerk
	2nd Prize	3	„ 1329—James F. Mitchell, 20, Southampton Ath. (in the ordnance survey)
			*No Prize for Females awarded.**
Mensuration	1st Prize	5	„ 277—Robert G. Clark, 31, Devonport Mech. Inst., shipwright
	2nd Prize	3	„ 287—Henry E. Wingfield, 20, Devonport Mech. Inst., engineer student
Floriculture	1st Prize	5	„ 1176—George Downton, 22, Richmond Parochial Library, gardener
	2nd Prize	3	„ 701—William Jones, 22, Liverpool Inst., gardener
Fruit and Vegetable Culture	1st Prize	5	„ 1176—George Downton, 22, Richmond Parochial Library, gardener
			No Second Prize awarded.†
Domestic Economy	1st Prize	5	„ 279—Thomas Dawe, 19, Devonport Mech. Inst., clerk
	2nd Prize	3	„ 700—John Armstrong, 20, Liverpool Inst. Local Board, engineer's clerk
			*No Prize for Females awarded.**
Political Economy and Civil Government	1st Prize	5	„ 871—George D. Hooper, 21, City of London College, clerk
	2nd Prize	3	„ 737—Elizabeth Backhouse, 22, Birkbeck Lit. Inst. (of no occupation)
Geography	1st Prize	5	„ 1191—Thomas R. Clarke, 18, Salford W. Men's College, salesman
	2nd Prize	3	„ 574—William Stephenson, 25, Hull Young People's Christian Assoc., assistant to a tobacco manufacturer
			*No Prize for Females awarded.**
English History	1st Prize	5	„ 360—John McAlpine, 19, Glasgow Athenæum, warehouseman
	2nd Prize	3	„ 1032—Henry Vosper, 19, Manchester Mech. Inst., clerk
			*No Prize for Females awarded.**
English Language and Literature	1st Prize	5	„ 739—William Burgoyne, 23, Birkbeck Lit. Inst., clerk
	2nd Prize	3	„ 128—James R. Haslam, 18, Bolton Church Inst., clerk
			*No Prize for Females awarded.**

* No Female Candidate qualified to receive Prizes obtained a First-class Certificate in any of these subjects.
† No other First-class Certificates were given in these subjects, or the Candidates were disqualified for receiving Prizes.

Logic and Mental Science	1st Prize....	£5	To No. 762—William G. Glennie, 23, Birkbeck Lit. Inst., insuranc clerk
	2nd Prize ..	3	„ 1222—William Pollitt, 18, Salford W. Men's College, clerk
Latin	1st Prize....	5	„ 1196—Thomas Evans, 22, Salford W. Men's College, dispenser *No Second Prize awarded.**
French	1st Prize....	5	„ 364—William McOnie, 21, Glasgow Athenæum, clerk
	2nd Prize ..	3	„ 1135—John Waterston, 21, Paisley Artiz. Inst., clerk *No Prize for Females awarded.†*
German			*No Prizes awarded in this subject.‡*
Italian	1st Prize....	5	„ 928—Edward Pickering, 19, Royal Polytechnic Inst., clerk *No Second Prize awarded.** *No Prize for Females awarded.†*
Spanish	1st Prize....	5	„ 363—John R. Cunningham, jun., 21, Glasgow Ath., clerk
	2nd Prize ..	3	„ 843—William J. Bishop, 22, City of London College, foreign correspondent *No Prize for Females awarded.†*
Theory of Music ..	1st Prize....	5	„ 476—William C. Linn, 29, Popular Evening Classes, Andersonian University, Glasgow, warehouseman
	2nd Prize ..	3	„ 746—Richard E. Bartlett, 21, Birkbeck Literary Inst., clerk *No Prize for Females awarded.†*
Elementary Musical Composition (Tonic Sol-fa System)....	..		*No Prizes awarded in this subject, no Candidate having obtained a First-class Certificate.*

The Prizes offered by Mr. T. Twining, a Vice-President of the Society, in Domestic Economy have not been awarded, no other Candidates having obtained First-class Certificates.

The Prizes offered by Mrs. Harry Chester in Political Economy and Civil Government have not been awarded, no other Candidates having obtained First-class Certificates.

The Royal Horticultural Society's Prizes have been awarded as follows :—

Floriculture........	1st Prize	£5	To No. 1176—George Downton, 22, Richmond Parochial Library gardener
	2nd Prize ..	3	„ 701—William Jones, 22, Liverpool Inst., gardener
Fruit and Vegetable Culture	1st Prize	5	„ 1176—George Downton, 22, Richmond Parochial Library, gardener
	2nd Prize ..	3	„ 701—William Jones, 22, Liverpool Inst., gardener

The Prize of £5 offered by the Royal Geographical Society is awarded to—

No. 1191—Thomas R. Clarke, 18, Salford Working Men's College, salesman

The Prizes offered by the Proprietors of the *Gardeners' Chronicle* have not been awarded, no Candidate having fulfilled the required conditions.

Additional Prizes.

The Prizes offered by the Council for Writing from Dictation have been awarded as follows :—

First Prize of £3 to No. 128—James R. Haslam, 18, Bolton Ch. Inst., clerk
Second „ £2 „ 141—Walter Duckworth, 23, Bolton Ch. Inst., clerk
Third „ £1 „ 1328—Edward Turner Sims, jun., 22, Southampton Ath., clerk

The Prizes offered by Mr. Henry Cole, C.B., a Vice-President of the Society, have not been awarded, the conditions of the competition, as laid down in the Programme, having in no case been complied with.

The Prizes offered by the Council for the four best specimens of Handwriting, as shown in any of the papers worked in any subject, have been awarded as follows :—

First Prize of £5 to No. 128—James Riley Haslam, 18, Bolton Ch. Inst., clerk
Second „ £3 „ 935—Francis Henry Hendrie, 20, St. Stephen's, Westminster, Evg. Sch., clerk
Third „ £2 „ 306—Robert Gray Mason Forbes, 22, Watt Inst., Edinburgh, clerk
Fourth „ £1 „ 352—James W. Stewart, 18, Glasgow Athenæum, clerk

* No other First-class Certificates were given in these subjects, or the Candidates were disqualified for receiving Prizes.
† No Female Candidate qualified to receive Prizes obtained a First-class Certificate in any of these subjects.
‡ No Candidate obtaining a First-class Certificate in this subject was eligible to receive a Prize.

VIVA-VOCE EXAMINATION IN MODERN LANGUAGES.

The vivâ-voce examination in Modern Languages, as proposed in the memorandum furnished by Mr. Hyde Clarke, a member of the Council, has been held by only one Local Board, viz., that of the Birkbeck Literary and Scientific Institution, in French, the Examiners reporting the result as follows :—

No. 749—James W. Colvin, 20, clerk, as "very good."
No. 767—Arthur A. Higgins, 17, clerk, as "good."

CERTIFICATES.

The following is an Alphabetical List of the Candidates who have obtained Certificates : —

The numbers following the names give the ages of the Candidates.

(1st) after a subject signifies a First-class Certificate.
(2d) „ „ Second-class „
(3d) „ „ Third-class „

(The occupations stated are either present or proposed.)

835—Abell, Edward G., 21, City of Lon. Coll., clerk—Arith. (2d); Bkpg. (2d)
836—Abrahams, Moses, 18, City of Lond. Coll., clerk French (3d)
634—Acomb, Leonard, 20, Leeds M.I., bank clerk—German (2d); French (3d)
*496—Adamson, Alexander, 25, Pop. Evg. Classes, Anderson Univ., Glasgow, stonemason — Mus. Comp. (3d)
837—Adcock, John H., 22, City of Lond. Coll., teacher, Pol. Econ. &c. (2d)
1360—Agnew, Alexander, 21, Belfast People's Lit. Inst., merchant's assistant—Bkpg. (3d)
1030—Agnew, Hugh, 18, Manchester M.I., short-hand clerk—Arith (2d); Bkpg. (1st)
237—Ainscow, Joseph, 19, Crewe M.I., fitter (appren.) —Arith (2d)
455—Alexander, James, 29, Pop. Evg. Classes, Anders. Univ. Glasgow, boot and shoemaker—Theory of Music (1st)
838—Alexander, William M., 30, City of Lond. Coll., architect and surveyor's assistant—Arith. (3d); Met. Syst. (1st); Bkpg. (2d)
456—Allan, David S., 29, Pop. Evg. Classes, Anderson. Univ., Glasgow, tailor—Theo. of Mus. (1st); Mus. Comp. (3d)
386—Allan, James, 26, Glasgow Inst., printer—Theory of Music (1st)
1324—Allcott, James H., 26, Southampton Ath., customs' officer—Bkpg. (2d); French (3d)
1162—Allen, William T., 20, Portsmouth Local Board, engineer student—Arith. (1st)
272—Allington, James, 18, Devonport M.I., shipwright apprentice—Met. Sys. (1st)
511—Ambler, William E., 19, Halifax M.I., clerk—Bkpg. (3d)
1322—Amos, Robert, 17, Hulme W.M. Inst., junior clerk —Met. Syst. (2d)
311—Anderson, John, 21, Edinburgh Loc. Bd., joiner —Arith (3d)
454—Anderson, William, 21, Glasgow M.I., clerk—Mus. Comp. (3d)
983—Anderton, Thomas, jun., 17, Manchester M.I., tin-plate worker—Arith. (3d)
333—Andrew, Noah, 16, Freetown (Glossop) Loc. Board, warehouse boy—Arith. (2d)
1366—Andrews, James, 23, Belfast People's Lit. Inst., clerk—Bkpg. (3d)
186—Anningson, Thirkell, 18, Burnley Ch. Eng. Inst., chemist's assist.—Eng. Hist. (1st)
1315—Apperley, William H., 17, Hulme W.M. Inst., clerk—Bkpg. (3d)
661—Armitage, Benjamin, 19, Leeds Y.M. Chr. Assoc., book-keeper—Bkpg. (2d)
1124—Armitage, John, 19, Oldham Lyceum, pattern maker—Mensur. (2d)
623—Armstrong, Edward O., 23, Leeds Ch. Inst., clerk —Bkpg. (2d)
700—Armstrong, John, 20, Liverpool Loc. Board, engineer's clerk—Dom. Econ. (1st), with 2nd prize of £3; Pol. Econ. (2d); Geog. (2d)
208—Armstrong, William J., 17, Carlisle M.I., law clerk—Arith. (2d)
1336—Arnold, Frederick J., 16, Southampton Ath., clerk Arith. (2d)
429—Arnott, J., 22, Glasgow M.I.. warehouseman—Eng. Lang., &c. (2d)
1119—Ashton, Alfred, 16, Oldham Lyceum, warehouse-man—Bkpg. (3d)
1182—Ashworth, Charles, 17, Salford W.M. Coll., clerk —Bkpg. (3d)
266—Aspinall, William, 18, Dean Mills Inst., stone-mason—Arith. (3d)
1266—Aston, Edwin, 19, Stourbridge Ch. of Eng. Inst., machine-man—Bkpg. (3d)
251—Ayre, John T., 16, Crewe M.I., fitter—Arith. (3d)

737—Backhouse, Elizabeth, 22, Birkbeck Inst., of no occupation—Pol. Econ. and Civ. Gov. (1st), with 2nd prize of £3
678—Bacon, Arthur S., 16, Leeds Y.M. Chr. Assoc., clerk—Eng. Hist. (2d)
587—Baker, Henry F., 19, Ipswich W.M. Coll., clerk—Bkpg. (2d)
1089—Baker, Orlando, 36, New Swindon M.I., clerk—Theory of Music (2d); Music Comp. (3d)
637—Baldry, Henry O., 18, Leeds M.I., civil engineer —Arith. (1st); Mensur. (3d)
273—Ball, William, 19, Devonport M.I., smith (appr.) Mensur. (2d)
740—Ballard, Elizabeth R., 28, Birkbeck Inst., no occupation stated—Dom. Econ. (3d)
393—Baptie, David, 47, Glasgow Inst., warehouseman Theory of Music (1st)
161—Barker, James, 19, Bradford M.I., clerk—Arith. (1st); Bkpg. (3d)
1374—Barratt, William, 21, Stockport Sunday-school, clerk—Arith. (3d)
738—Barrett, Eugene V., 25, Birkbeck Inst., clerk—Met. System (1st)
1290—Barrett, Jabez C., 26, Weston-super-Mare Local Board, miller—Theory of Music (1st); Mus. Comp. (3d)
592—Barrett, William, 18, Ipswich W.M. Coll., clerk —Bkpg. (3d)
743—Barrett, William J. D., 30, Birkbeck Inst., clerk —Bkpg. (2d)
1239—Barrow, Richard, 25, Salford W.M. Coll., clerk —Arith. (1st)
714—Barrow, William M., 18, Liverpool Inst., clerk —Bkpg. (2d)
524—Barrowby, Mary H., 20, Halifax W.M. Coll., of no occupation—Arith. (1st), with the prize for females of £2
746—Bartlett, Richard E., 21, Birkbeck Inst., clerk—Theory of Music (1st) with 2nd prize of £3

1338—Barton, George, 32, Southampton Ath., schoolmaster—Latin (2d)
326—Bateman, John, 25, Farnham and Aldershot Local Board, bandsman—Arithmetic (3d)
270—Bates, Alfred, 18, Milford Evg. Sch. (Derby), clerk—Arith. (2d); Bkpg. (2d)
1185—Battersby, Robert, 18, Salford W.M. Coll., clerk—Bkpg. (2d)
1309—Baxter, Henry, 34, Hulme W.M. Inst., packer—Bkpg. (3d)
1256—Baxter, James, 20, Stockport M.I., clerk—Arith. (2d); Bkpg. (3d); Eng. Lang., &c. (3d)
459—Baxter, Peter H., 38, Pop. Evg. Classes, Anderson. Univ., Glasgow, jeweller's, &c., assist.—Theory of Music (2d)
274—Bayly, John, 33, Devonport M.I., writer in dockyard—Mensur. (2d); Geog. (2d)
575—Bearpark, Edwin, 26, Hull Y. People's Christian and Lit. Assoc., gardener—Fruit and Veg. Cult. (2d)
590—Beaumont, Arthur W., 16, Ipswich W.M. Coll., clerk—Bkpg. (2d)
972—Beckett, William F., 20, Manchester M.I., clerk—French (3d)
1326—Beer, Henry, 19, Southampton Ath., clerk—Arith. (1st); Eng. Hist. (1st)
1363—Bennett, Edward, 23, Belfast People's Lit. Inst., managing clerk in spinning mill—Bkpg. (2d)
806—Bennett, John, 20, Bromley, St. Mich. Evg. Classes, clerk—Bkpg. (3d)
1186—Bennion, John A., 20, Salford W.M. Coll., engineer—Metric Syst. (1st)
671—Bentley, William, 20, Leeds Y. Men's Chr. Assoc., mech. draughtsman—Arith. (1st); Mensur. (3d)
842—Berry, Walter E., 21, City of Lond. Coll., clerk—French (3d)
684—Beynon, David, 17, Liverpool Inst., apprentice boat-builder—Bkpg. (2d)
814—Bircham, Charles J., 17, Bromley, St. Mich. Evg. Classes, no occupation stated—Bkpg. (3d)
843—Bishop, William J., 22, City of Lond. Coll., foreign correspondent—Mus. Comp. (2d); Pol. Econ., &c. (2d); Spanish (1st), with 2nd prize of £3
627—Blades, Phineas, 19, Leeds M.I., civil service—Mensur. (3d); Geog. (3d); Eng. Hist. (1st)
525—Blagbrough, Luther, 24, Halifax W.M. Coll., warehouseman—Bkpg. (2d)
214—Blaiklock, William, 17, Carlisle M.I., clerk—Arith. (2d)
460—Blair, James, 22, Pop. Evg. Classes, Anderson. Univ., Glasgow, clerk—Mus. Comp. (2d)
322—Blakemore, George, 23, Farnham Y. Men's Assoc., drawing master—Mensur. (3d)
1002—Bland, Thomas, 18, Manchester M.I., clerk—Arith. (1st)
204—Blaylock, Robt., 17, Carlisle M.I., clerk—Arith. (3d)
1187—Blears, John, 21, Salford W.M. Coll., clerk—Arith (1st); Bkpg. (1st)
1350—Bolton, Samuel, 20, Accrington M.I., warehouseman—Arith. (3d)
324—Bond, George, 23, Farnham and Aldershot Loc. Board, soldier—Arith. (2d)
275—Bond, Samuel J., Devonport M.I., engineer stud.—Mensur. (2d)
*677—Booer, William J., 26, Leeds Y. Men's Chr. Assoc., glass stainer and teacher of night class—Theory of Music (3d)
*930—Boon, Edwin J., 24, Roy. Polyt. Inst., teacher—Eng. Hist. (1st); Arith. (2d); Bkpg. (2d)
844—Booth, Isaac J., 24, City of London Coll., clerk—Arith. (1st); Bkpg. (2d)
1046—Booth, James, 16, Manchester M.I., clerk—Arith. (3d); Bkpg. (1st)
1158—Borlase, Kate, 20, Penzance Loc. Board, of no occupation—Theory of Music (1st)
1157—Borlase, Maria, 18, Penzance Local Board, of no occupation—Theory of Music (1st)
745—Bos, Jan, 28, Birkbeck Inst., clerk—German (2d)
173—Bottomley, Alfred W., 19, Bradford M.I., bookkeeper—Eng. Hist. (3d)
741—Bourne, Francis, 18, Birkbeck Inst., printer's apprentice—Geog. (3d)
1189—Bowker, John B., 21, Salford W.M. Coll., warper—Arith. (2d); Bkpg. (2d)
1039—Boyle, John, 24, Manchester M.I., mechanic—Arith. (2d)
*454—Boyle, Robert, 23, Glasgow M.I., clerk—Bkpg. (2d)
742—Bradley, Alfred C., 20, Birkbeck Inst. clerk—Bkpg. (3d)
1020—Bradley, John, 20, Manchester M.I., warehouseman—Arith. (3d)
111—Bradley, Thomas, 22, Bollington Useful Knowl. Soc., cotton piecer—Arith. (1st); Geog. (1st)
88—Bradley, Walter F., 20, Birm. and Midl. Inst., clerk—Latin (2d)
1364—Brady, John, 37, Belfast People's Lit. Inst., clerk Bkpg. (3d)
526—Broadley, Arthur, 19, Halifax W.M. Coll., clerk—Arith. (1st)
210—Broatch, David, 17, Carlisle M.I., of no occupation—Arith. (2d)
937—Brodie, Benjamin C. E., 18, South London W.M. Coll., engineer's labourer—Mensur. (3d)
277—Brook, Sydney R., 19, Devonport M.I., barrister's clerk—Arith. (1st); Bkpg. (2d)
1190—Brooks, Edward, 21, Salford W.M. Coll., clerk—Bkpg. (2d)
927—Brooks, Marion A., 32, Royal Polyt. Inst., governess—German (2d)
979—Broster, George A. B., 19, Manchester M.I., clerk—Arith. (2d); Eng. Hist. (1st)
12—Brown, Alexander, 17, Aberdeen M.I., joiner—Arith. (2d)
1095—Brown, James, 27, New Swindon M.I., clerk—Theory of Music (2d)
1331—Brown, James, 30, Southampton Ath., out-door officer of customs—Arith. (2d)
378—Brown, James, jun., 23, Glasgow Inst., clerk—Arith. (2d); Eng. Lang. and Lit. (3d)
417—Brown, James T., 16, Glasgow M.I., engineer—Arith. (2d)
1316—Brown, Peter, 31, Hulme W.M. Inst., railway clerk—Bkpg. (2d)
1114—Brown, William A., 16, Oldham Lyceum, bookkeeper—Arith. (2d)
845—Brown, William T., 29, City of Lond. Coll., clerk—French (3d)
*215—Browne, Leonard G., 18, Cheltenham W.M. Club, occupation not decided—Arith. (3d); Eng. Hist. (2d)
744—Browning, Alfred J., 20, Birkbeck Inst., clerk—French (3d)
1385—Brownsword, John, 18, Stockport Sunday School, clerk—Arith. (3d)
374—Buchanan, William, 20, Glasgow Inst., clerk—Bkpg. (3d)
430—Buchanan, William, 18, Glasgow M.I., clerk—Eng. Lang. &c. (3d)
747—Buck, Ellen, 27, Birkbeck Inst., no occupation stated—Eng. Lang. &c. (3d)
1320—Bucklish, William J., 16, Hulme W.M. Inst., apprentice—Bkpg. (3d)
979—Bullough, Thomas, 19, Manchester M.I., pattern-card maker—Arith. (3d)
1024—Burgess, Hamlet L., 18, Manchester M.I., clerk—French (3d)
739—Burgoyne, William, 23, Birkbeck Inst., clerk—Dom. Econ. (2d); Eng. Lang., &c. (1st), with 1st prize of £5
847—Burke, Edward, 18, City of Lond. Coll., clerk—Bkpg. (3d); German (3d)

444—Burney, William, 19, Glasgow M.I., pawnbroker's assistant—Theory of Music (3d)
211—Burns, Thomas, 19, Carlisle M.I., pupil teacher—Arith. (1st); Eng. Hist. (2d); Eng. Lang. &c. (3d)
1154—Butler, George, 18, Pembroke Dock M.I., shipwright apprentice—Mensur. (2d)
612—Butler, Henry, 18, Leeds Chr. Inst., railway clerk—Bkpg. (2d)
423—Butter, Robert, 22, Glasgow M.I., engineer—Arith. (1st)
628—Butterfield, John C., 20, Leeds M.I., chemist—Dom. Econ. (3d)

296—Calder, Michael, 22, Edin. Watt Inst., joiner—Arith. (2d)
1362—Camlin, John, 20, Belfast Peop. Lit. Inst., linen-lapper—Eng. Lang., &c. (3d)
304—Campbell, Andrew, 25, Edinburgh Watt Inst., mason—Arith. (2d)
*497—Campbell, Archibald, 28, Pop. Evg. Classes, Anderson. Univ., Glasgow, manuf. chemist—Arith. (1st)
408—Campbell, James, 17, Glasgow M.I., clerk—Arith. (3d); Bkpg. (2d)
848—Campbell, John, 25, City of Lond. Coll., clerk—German (2d)
462—Campbell, Timothy L., 27, Pop. Evg. Classes, Anderson. Univ., Glasgow, bronzer—Theory of Music (1st); Music Comp. (3d)
1305—Carney, John, 27, Hulme Christ Church Inst., maker-up—Arith. (2d); Metric System (3d); Bkpg. (3d)
1005—Carter, Claude, 19, Manchester M.I., engineer—Bkpg. (2d)
1280—Carter, George, 19, Wednesbury (St. John's Church Sch.), carpenter—Eng. Hist. (3d)
1063—Carter, Joseph, 20, Mossley M.I., maker-up—Bkpg. (3d)
752—Carter, Louisa, 30, Birkbeck Inst., hat trimmer—Bkpg. (3d)
1058—Carter, William, 21, Manchester M.I., engineer—French (2d)
1019—Casey, Thomas, 26, Manchester M.I., warehouseman—Arith. (3d)
584—Chadwick, George, 19, Hull Y. People's Chris. and Lit. Inst., clerk—Bkpg. (2d)
1286—Chadwick, Joseph, 17, Wednesbury (St. John's Inst.), screwer—Arith. (3d)
750—Chambers, Harry, 21, Birkbeck Inst., engineer's clerk—Arith. (2d); Bkpg. (2d)
849—Champion, Horace E., 16, City of Lon. Coll., clerk—Arith. (1st); Eng. Hist. (3d)
850—Champion, Walter E., 20, City of Lon. Coll., solicitor's clerk—Arith. (2d)
751—Chatterley, Robert J., 23, Birkbeck Inst., warehouseman—Arith. (3d); Met. Sys. (3d); Eng. Hist. (2d)
153—Cheadle, Alfred S., 15, Bradford M.I., warehouse youth—French (3d)
91—Chevassût, Frederick G., 18, Birm. and Mid. Inst.—pupil teacher—Arith. (2d); Geog. (3d)
464—Christian, Edmund, 31, Pop. Evg. Classes, Anderson. Univ., Glasgow, mechanical engineer—Arith. (3d)
605—Clark, Charles, 21, Keswick M.I., joiner—Arith. (3d)
1250—Clark, Herbert E., 18, Messrs. Chance's Schools, pupil teacher—Arith. (2d); French (3d)
277—Clark, Robert G., 31, Devonport M.I., shipwright—Mensur. (1st); with 1st prize of £5
1276—Clark, Sydney, 19, Walsall (Bradford St. Lit. Assoc.), brushmaker,—Arith. (2d)
1094—Clark, William, 18, New Swindon M.I., clerk—Arith. (2d); Bkpg. (1st)
1191—Clarke, Thomas R., 18, Salford W.M. Coll., salesman—Arith. (1st); Geog. (1st), with 1st prize of £5, and the Roy. Geog. Soc. prize of £5; Eng. His. (1st)
1013—Clarkson, Henry H., 19, Manchester M.I., bookseller's assist.—Eng. Hist. (1st)
851—Clatworthy, Abraham, 23, City of Lon. Coll., clerk—Arith. (2d); French (3d)
559—Clay, John, 16, Hebden-bridge M.I., warehouseman—Arith. (3d); Eng. Lang., &c. (3d)
92—Cleaver, Lousia M., 22, Birm. and Midl. Inst., governess—French (3d)
334—Clegg, Albert, 19, Freetown (Glossop) W. Men's Inst., clerk—Bkpg. (2d)
527—Clegg, Jonah, 20, Halifax W.M. Coll., maker-up—Arith. (2d); Bkpg. (2d)
162—Clough, William H., 24, Bradford M.I., bookseller, &c.—Bkpg (2d); Mensur. (3d)
463—Cochran, John, 33, Pop. Evg. Classes, And. Univ., Glasgow, warehouseman—Theory of Music (1st)
748—Cocking, Alfred E., 19, Birkbeck Inst., clerk—Bkpg. (1st); Geog. (3d); German (3d)
1083—Coe, Samuel, jun., 23, New Mills M.I., cotton spinner—Arith. (2d)
1048—Collier, James, 17, Manchester M.I., salesman—Bkpg. (3d)
581—Collishaw, Edward, 25, Hull Y. People's Chr. and Lit. Inst., clerk—Bkpg. (1st)
288—Colson, Agnes, 25, Dudley M.I., governess—French (3d)
852—Colthrup, Alfred, 22, City of London Coll., clerk—Bkpg. (3d)
618—Columbine, Herbert, 36, Leeds Chr. Inst., certific. master—Eng. Hist. (2d)
749—Colvin, James W., 20, Birkbeck Inst., clerk—German (2d)
329—Colvin, Richard, 25, Farnham and Aldershot Loc. Board, soldier—Arith. (2d)
580—Cook, George, 28, Hull Y. People's Chr. and Lit. Inst., clerk—Bkpg. (2d)
1164—Coomber, Thomas G., 19, Portsmouth Loc. Board, engineer student—Mensur. (2d); Geog. (2d)
1125—Cooper, Benjamin, 16, Oldham Lyceum, warehouse boy—Arith. (3d); Bkpg. (3d)
1192—Cooper, Charles E., 16, Salford W.M. Coll., mill hand—Arith. (3d)
1193—Corcoran, John, 23, Salford W.M. Coll., labourer Arith. (2d)
1312—Corlett, John E., 17, Hulme W.M. Inst., shoeing smith—Bkpg. (3d)
1028—Cornelius, Alexander H., 19, Manchester M.I., book-keeper—Bkpg. (1st)
1194—Cornes, William, 22, Salford W.M. Coll., bookseller's assistant—Arith. (2d)
300—Cowan, George, jun., 20, Edin. Watt Inst., clerk—Arith. (2d)
1074—Cowell, Charles, 21, Newcastle Ch. Inst. clerk—Bkpg. (2d)
528—Cowlishaw, Samuel, 21, Halifax W.M. Inst., schoolmaster—Arith. (1st)
854—Cownley, A. J., 19, City of Lond. Coll., clerk—Metric. Syst. (1st)
755—Cox, James E., 25, Birkbeck Inst., accountant's clerk—Eng. Lang. (1st)
381—Craig, John, 20, Glasgow Inst., clerk—Eng. Lang., &c. (1st); Eng. Hist. (2d); Logic (2d)
361—Craig, Thomas H. A., Glasgow Ath., law apprentice—Logic, &c. (3d)
206—Craig, Thomas J., 16, Carlisle M.I., assistant-teacher—Arith. (3d)
5—Craigmile, Elizabeth, 21, Aberdeen M.I., of no occupation—German (1st)
7—Craigmile, Hannah, 26, Aberdeen M.I., of no occupation—German (2d)
3—Craigmile, Jane, 23, Aberdeen M.I., teacher—German (3d)
715—Craine, Thomas, 20, Liverpool Institute, clerk—Bkpg. (2d)

412—Cranston, Archibald, 16, Glasgow M.I., clerk—Bkpg. (2d)
415—Cranston, George, 16, Glasgow M.I., clerk—Bkpg. (1st)
804—Crick, Edward, 26, Bromley St. Michael's Evg. Classes, clerk—Bkpg. (1st)
1273—Crisp, George Y., 33, Wakefield M.I., mat-maker—Arith. (2d); Bkpg. (2d)
855—Crisp, James B., 25, City of London Coll., clerk—German (2d)
910—Crocker, Charles J., 16, Roy. Polyt. Inst., pupil teacher—Arith. (2d); Geog. (3d); Eng. Hist. (3d)
94—Croghan, William J., 16, Birm. and Midland Inst. chemist—Met. Syst. (2d)
569—Crook, Benjamin, 19, Huddersfield M.I., solicitor's clerk—French (3d)
396—Crookston, George B., 17, Glasgow M.I., grain and commiss. merchant—Bkpg. (2d)
351—Crosby, Robert W., 20, Glasgow Ath., clerk—Eng. Lang. and Lit. (1st)
619—Cross, Thomas, 28, Leeds Chr. Inst., schoolmaster—Arith. (2d); Eng. Hist. (2d); Eng. Lang., &c. (3d)
95—Cross, William J., 17, Birm. and Midl. Inst., gun and pistol-case maker—Latin (2d)
1332—Cruickshank, David, 18, Southampton Ath., pupil teacher—Arith. (2d)
1333—Cruickshank, James C., 23, Southampton Ath., engineer—Arith. (2d)
19—Cruickshank, John F., 19, Aberdeen M.I., assist. teacher—Arith. (1st)
1334—Cruickshank, William, 22, Southampton Ath., engineer—Arith. (2d)
384—Crum, John, 18, Glasgow Inst., stationer—Eng. Lang., &c. (2d)
567—Cryer, Thomas, 20, Holbeach M.I., machine tool fitter—Mensur. (2d)
278—Cuming, Charles H., 21, Devonport M.I., chemist and dentist—Eng. Lang., &c. (2d); Latin (2d)
363—Cunningham, John R., jun., 21, Glasgow Ath., clerk—Met. Sys. (1st); Spanish (1st), with 1st prize of £5.

30—Dale, John, 35, Alderley Edge Educa. Inst., cabinet-maker and science teacher—Theory of Music (1st); El. Mus. Comp. (3d)
404—Dalrymple, John, 16, Glasgow M.I., clerk—Bkpg. (3d)
29—Davie, Francis, 26, Aberdeen M.I., clerk—French (3d)
1178—Davies, David J., 24, Richmond Paroch. Library, schoolmaster—Theory of Music (1st)
1015—Davies, Thomas W., 16, Manchester M.I., clerk—Arith. (2d); Eng. Hist. (1st)
792—Davis, Charles, 17, Birkbeck Inst., woollen warehouseman—French (3d)
1243—Davis, George E., 19, Slough M.I., bookbinder—Met. Sys. (1st)
1177—Davis, Walter, 22, Richmond Paroch. Library, gardener—Flori. (1st); Fruit and Veg. Cult. (2d)
279—Dawe, Thomas, 19, Devonport M.I., clerk—Met. Syst. (1st), with 1st prize of £5; Dom. Econ. (1st), with 1st prize of £5
1153—Dawkins, William B., 17, Pembroke Dock M.I., pupil teacher—Metr. Syst. (1st); Geog. (3d)
991—Dawson, Charles, 18, Manchester M.I., clerk—Bkpg. (2d)
1310—Dawson, William, jun., Hulme (Christ Church Inst.), putter-out—Arith. (2d)
576—Dearman, William, 27, Hull Yng. People's Chr. Inst., clerk—Bkpg. (2d)
182—De Brito, Andre Joaquim, 19, Bristol Trade and Min. Sch., accountant—French (2d)
185—Dickens, William, 18, Bromsgrove Lit. and Mech. Inst., bookseller's assistant—Arith. (1st)
133—Dickinson, Albert, 16, Bolton Ch. Inst., lawyer's clerk—Eng. Lang. and Lit. (3d)
685—Dickson, Humphrey C., 16, Liverpool Inst., clerk—Arith. (1st); Bkpg. (3d); Mensur. (3d); Geog. (3d)
1335—Dixon, John H., 17, Southampton Ath., assistant Ordnance Survey office—Arith. (2d)
1277—Dixon, Joseph, 19, Walsall Ch. Inst., saddler's ironmonger— Arith. (1st); Eng. Hist. (1st)
857—Dobell, Douglas D., 25, City of Lon. Coll., assist. surveyor of taxes—Eng. Hist. (1st); Pol. Econ., &c. (3d)
200—Dobson, Thomas H., 18, Carlisle M.I., railway clerk—Arith. (2d)
1195—Douglas, Anne P., 33, Salford W.M. Coll., schoolmistress—Eng. Lang., &c. (2d)
451—Douglas, David, 23, Glasgow M.I., occupation not stated—Bkpg. (2d)
230—Dowdall, Walter T., 17, Cork Young Men's Society, civil service—Arith. (1st); Geog. (3d)
465—Downie, Thomas, 20, Pop. Evg. Classes, Anderson. Univ. Glasgow, clerk—Bkpg. (2d)
1176—Downton, George, 22, Richmond Paroch. Lib., gardener—Flori. (1st), with 1st prize of £5; and the Roy. Hort. Soc. prize of £5; Fruit and Veg. Cul. (1st), with 1st prize of £5, and the Roy. Hort. Soc. prize of £5
712—Dowson, John, 23, Liverpool Inst., insurance clerk—Arith. (3d); Mensur. (3d)
413—Dreghorn, David, 19, Glasgow M.I., clerk—Bkpg. (1st)
930—Dronfield, John, 27, Roy. Polyt. Inst., schoolmaster—Arith. (3d); French (3d); Geog. (2d); Eng. Hist. (2d)
181—Duckett, Arthur, 16, Bristol Y.M. Chr. Assoc., clerk—Arith. (1st)
141—Duckworth, Walter, 23, Bolton Ch. Inst., clerk—Eng. Hist. (3d); and the second prize of £2 for Writing from Dictation
693—Duncan, Robert, 18, Liverpool Inst.—Arith. (3d); Bkpg. (3d)
427—Dunlop, James, 18, Glasgow M.I., engineer—Mensur. (3d)
340—Dunn, William G., 20, Glasgow Ath., clerk—Bkpg. (3d)

529—Eastwood, Charles, 21, Halifax W.M. Coll., moulder—Bkpg. (3d)
530—Eastwood, Edward, 17, Halifax W.M. Coll., wool sorter—Bkpg. (2d)
1040—Eccles, William C., 16, Manchester M.I., clerk—Arith. (2d)
613—Eddison, Edward H., 18, Leeds Ch. Inst., mechanic—Bkpg. (3d)
39—Eden, James, 19, S. E. Rwy. M.I., engine fitter—Arith. (2d)
1055—Edmondson, William, 24, Manchester M.I., no occupation stated—Arith. (3d); Bkpg. (3d)
759—Edmunds, Alfred W., 19, Birkbeck Inst., clerk—Arith. (1st); Met. Sys. (1st)
711—Edwards, Joseph, 21, Liverpool Inst., clerk—Bkpg. (3d)
1099—Edwards, Joseph J., 21, New Swindon M.I., clerk—Bkpg. (3d)
366—Elder, Ralph H., 20, Glasgow Inst., clerk—French (2d)
45—Elgar, Alfred J., 22, S.E. Rwy. M.I., railway accountant's clerk—Arith. (1st)
35—Elgar, Charles W., 18, S. E. Rwy. M.I., coachmaker—Arith. (2d)
230—Ellis, Alfred, 18, Devonport M.I., accountant—Bkpg (1st)
281—Ellis, Richard J., 25, Devonport M.I., shipwright—Met. Sys. (1st)
858—Elsom, Henry E., 19, City of Lond. Coll., assistant master—Arith. (1st)

124—Entwisle, Ethelbert, 18, Bolton Ch. Inst., millwright—Arith. (2d); Eng. Hist. (3d); French (3d)
228—Evans, Charles, 53, Chelmsford Lit. and Mech. Inst., schoolmaster—French (2d)
859—Evans, Francis B., 22, City of Lon. Coll., clerk—French (2d)
127—Evans, John, 20, Bolton Ch. Inst., junior clerk—Arith. (2d); Bkpg. (3d)
707—Evans, Richard, jun., 16, Liverpool Inst., office boy—Bkpg. (3d)
1196—Evans, Thomas, 22, Salford W.M. Coll., dispenser—Latin (1st), with 1st. prize of £5
4—Ewen, George, 19, Aberdeen M.I., clerk—French (3d)
1150—Eynon, Thomas, 17, Pembroke Dock M.I., shipwright apprentice—Arith. (1st)

703—Fairclough, Clinton, 18, Liverpool Institute, office youth—Bkpg. (3d)
466—Fairlie, James, 30, Pop. Evg. Classes, Anderson. Univ., Glasgow, commission agent—Mus. Comp. (2d)
705—Faragher, John, jun., 17, Liverpool Institute, office youth—Bkpg. (3d)
1197—Farnworth, Joshua H., 16, Salford W.M. Coll., warehouse apprentice—Geog. (2d)
122—Feather, Samuel, 32, Bolton Ch. Inst., clerk—French (3d); German (3d)
757—Feddon, John T., 23, Birkbeck Inst., clerk—Arith. (2d); Bkpg. (3d)
1347—Fenton, Henry, 36, Accrington M.I., cloth-looker—Arith. (2d)
201—Ferguson, John, 16, Carlisle M.I., no occupation stated—Arith. (2d)
467—Ferguson, John, jun., 16, Pop. Evg. Classes, Anderson. Univ., Glasgow, joiner (apprentice)—Geog. (3d); Eng. Hist. (3d)
1198—Ferneley, Thomas M., 18, Salford W.M. Coll., pupil teacher—Arith. (1st); Eng. Hist. (2d)
758—Fish, William D., 17, Birkbeck Inst., clerk—Arith. (2d); Met. Syst. (1st), with 2nd prize of £3
912—Fisher, Henry, 25, Royal Poly. Inst., smith's clerk—Arith. (2d); Pol. Econ., &c. (2d); Geog. (2d); Eng. Hist. (1st)
97—Fisher, James P., 19, Birm. and Midl. Inst., clerk—Latin (3d)
761—Flegg, Robert, 19, Birkbeck Inst., clerk—Arith. (2d); Eng. Hist. (2d)
936—Fleming, Charles S., 17, St. Stephen's (Westmin.) Evg. Sch., pupil-teacher—Arith. (2d); Mensur. (3d)
934—Fleming, George T., 16, St. Stephen's (Westmin.) Evg. Sch., clerk—Arith. (3d)
394—Fleming, William M., 19, Glasgow Inst., clerk—Eng. Lang., &c., (2d)
821—Fletcher, Frank, 21, South Bromley Club, clerk—Arith. (3d)
718—Fletcher, Frederick W., 21, Beauvoir College, jeweller—Theory of Music (2d)
320—Fletcher, George, 22, Farnham and Aldershot Loc. Board, soldier—Arith. (3d)
611—Floyd, William, 19, King's Lynn Ath. solicitor's clerk—Eng. Hist. (2d)
731—Foot, Wrinch J., 23, Beauvoir College, clerk—Theory of Music (1st); Mus. Comp. (3d)
760—Foote, George W., 20, Birkbeck Inst., clerk—Logic, &c. (2d)
306—Forbes, Robert G. M., 22, Edinburgh Watt Inst., clerk—The Council prize of £2 for hand-writing.
196—Ford, Charles, 25, Bury St. Edmonds Local Board, gardener—Floric. (2d)
531—Foster, Frederick, 16, Halifax W.M. Coll., accountant's clerk—Arith. (1st); Bkpg. (1st)
1282—Foster, Thomas, 16, St. John's Inst. (Wednesbury), clerk—Arith. (3d); Eng. Hist. (3d)
192—Foulds, John, 16, Burnley M.I., pupil teacher—Arith. (3d); Geog. (3d)
606—Fox, Frederick, 17, King's Lynn Ath., pupil teacher—Eng. Hist. (2d)
1292—Fox, Richard, 21, Whaleybridge M.I., boat-builder—Arith. (3d)
861—Fox, William S., 25, City of Lond. Coll., clerk—French (3d)
347—Fraser, Hugh C., 17, Glasgow Ath., clerk—Bkpg. (2d)
2—Fraser, James, 21, Aberdeen M.I., grocer—Eng. Lang. and Lit. (2d)
468—Fraser, John, 27, Pop. Evg. Classes, And. Univ., Glasgow, engineer—Arith. (2d)
291—Frazer, Alexander, 19, Edinburgh Watt Inst., mathem. inst. maker—Arith. (3d)
292—Frazer, James H., 17, Edinburgh Sch. of Art, wood engraver—Arith. (3d)
336—Frew, Thomas, 19, Glasgow Ath., clerk—Bkpg. (2d)
916—Frisby, George, 16, Roy. Polyt. Inst., clerk—Eng. Lang., &c.—(2d)
1199—Frost, Joseph, 17, Salford W.M. Coll., hackle and gill maker—Arith. (3d)

385—Galletly, John J., 19, Glasgow Inst., clerk—Bkpg. (3d)
469—Galloway, Henry, 24, Pop. Evg. Classes, And. Univ., Glasgow, pattern-book maker—Theory of Music (2d)
828—Gannaway, Alfred C., 16, South Bromley Club, draughtsman—Arith. (2d)
38—Garaway, Thomas C., S. E. Rwy. M.I., railway accountant's clerk—Bkpg. (2d)
1288—Garbett, John, 17, Wednesbury (St. John's) Inst., pupil teacher—Arith. (3d); Geog. (2d); Theory of Music (3d)
239—Garnett, George, 19, Crewe M.I., turner (appr.)—Arith. (3d)
532—Gaskell, Levi, 20, Halifax W.M. Coll., warp-dresser—Bkpg. (3d)
328—Gates, Cornelius W., 21, Farnham and Aldershot Loc. Board, soldier—Arith. (1st)
301—Gibb, James, 20, Edinburgh Watt Inst., bookseller—French (3d)
981—Gibson, Alexander, 16, Manchester M.I., draughtsman—Arith. (1st); Mensur. (3d)
607—Gibson, William J., 16, King's Lynn Ath. pupil teaeher—Eng. Hist. (2d)
178—Giles, Joseph, 17, Bristol Trade and Min. School, clerk—French (3d)
282—Gill, Edward J., 20, Devonport M.I., clerk—Bkpg. (2d)
863—Gill, Walter, 21, City of London Coll., clerk—Arith. (2d)
290—Gillespie, David, 29, Edinburgh Watt Inst., clerk—Theory of Music (1st)
1018—Gleave, Charles, 16, Manchester M.I., clerk—Bkpg. (1st)
762—Glennie, William G., 23, Birkbeck Inst., insurance clerk—Logic (1st), with 1st prize of £5
1052—Goodwin, Charles, 17, Manchester M.I., clerk—Bkpg. (2d)
1313—Goodwin, William, 23, Hulme W.M. Inst., railway clerk—Bkpg. (2d)
1379—Gosling, George E., 17, Stockport Sunday Sch., clerk—Arith. (3d)
864—Goulding, Fred., 24, City of Lond. Coll., warehouseman—French (3d)
169—Graham, Albert, 17, Bradford M.I., assistant-clerk—Arith. (1st)
195—Grant, John H., 18, Burnley Lit. Inst., teacher—French (3d)
8—Grant, William, 23, Aberdeen M.I., book-keeper—French (3d)
194—Grant, William L., 21, Burnley M.I., clerk—French (3d)

435—Gray, David, 26, Glasgow M.I., clerk—Mus. Comp. (2d)
598—Gray, Frederick H., 19, Keswick M.I., draper appr.—Eng. Hist. (3d)
1106—Greaves, John W., 19, Oldham Lyceum, warehouseman—Bkpg. (3d); Eng. Lang. &c. (2d)
533—Greenwood, Henry E., 23, Halifax W.M. Coll., book-keeper—Bkpg. (2d)
1346—Greenwood, Holmes, 22, Accrington M.I., warehouseman—Metr. Syst. (2d)
54—Greenwood, Wilson, 19, Bacup M.I., mule spinner —Arith. (2d)
1200—Gretton, John J., 22, Salford W.M. Coll. bookkeeper, Bkpg. (2d); Geog. (3d)
388—Grierson, George D., 17, Liverpool Inst., junior clerk—Eng. Hist. (1st); Eng. Lang. (1st); Geog. (2d)
98—Grundy, Harriette, 23, Birm. and Midland Inst., assistant schoolmistress—Arith. (1st); Eng. Hist. (1st); Latin (3d); French (3d)
1314—Grundy, Mark, 36, Hulme W.M. Inst., porter—Bkpg. (2d)

1113—Hadfield, Edward, 18, Oldham Lyceum, warehouseman—Bkpg. (3d)
331—Hadfield, George, 19, Freetown (Glossop) Local Board, clerk—Arith. (2d)
1257—Hadfield, Levi B., 16, Stockport M.I., clerk—Arith. (2d)
99—Hadley, Thomas, 21, Birm. and Midl. Inst., clerk —Met. Syst. (2d)
1122—Hague, Charles, 18, Oldham Lyceum, warehouseman—Arith. (3d)
653—Hall, Richard, 20, Leeds Y. Men's Chr. Asssoc., butcher—Bkpg. (2d)
585—Hall, Thomas N., 19, Hull Y. People's Chr. and Lit. Inst., clerk—Bkpg. (2d)
1108—Hall, William H., 19, Oldham Lyceum, warehouseman—Arith. (1st); Eng. Lang., &c. (3d)
57—Hamer, Ralph T., 18, Bacup M.I., weaver—Arith. (2d)
1325—Hamilton, James T., 21, Southampton Ath., clerk —Bkpg. (1st), with 1st prize of £5.
593—Hammond, Charles, 16, Ipswich W.M. Coll., reporter—French (3d)
866—Hammond, John, 21, City of Lond. Coll., clerk—Arith. (2d); Met. Sys. (2d); Bkpg. (3d)
589—Hancock, Arthur E., 16, Ipswich W.M. Coll., clerk—Eng. Hist. (1st)
995—Hand, William N., 25, Manchester M.I., salesman—French (3d)
793—Harbud, Daniel, 19, Birkbeck Inst., clerk—Arith. (2d)
1301—Hardcastle, Henry, 20, York M.I., clerk in gas works—Mensur. (2d)
1201—Hardman, James, 25, Salford W.M. Coll., bookkeeper—Arith. (2d); Geog. (2d)
1344—Hargreaves, Holden, 18, Irwell Inst., Rawtenstall, warehouseman—Arith. (2d)
1341—Hargreaves, John W., 21, Irwell Inst., Rawtenstall, book-keeper—Arith. (2d)
350—Harley, Joan H., 20, Glasgow Ath., no occupation stated—French (2d)
44—Harris, George E., 18, S.E. Rwy. M.I., railway accountant's clerk—Arith. (1st)
578—Harris, Simon, 29, Hull Y. People's Chr. and Lit. Inst., clerk—Bkpg. (2d)
34—Harrison, William, 19, S.E. Rwy. M.I., turner—Arith. (3d)
668—Hart, William F., 16, Leeds Y. Men's Chr. Assoc., mechanic—Eng. Hist. (3d)
801—Hartley, Joseph J. E., 30, Birkbeck Inst., certificated teacher—French (2d)
644—Hartman, Frederick, 18, Leeds Y.M. Chr. Assoc. clerk—Arith. (2d); Eng. Hist. (2d)
764—Hartt, William E., 21, Birkbeck Inst., warehouseman—Spanish (2d); French (3d); Italian (3d)
100—Harvey, John T., 22, Birm. and Midl. Institute, assistant schoolmaster—French (3d)
346—Harvie, Duncan, 19, Glasgow Athenæum, clerk—French (2d)
128—Haslam, James R., 18, Bolton Chr. Inst. clerk—Arith. (2d); Geog. (2d); Eng. Hist. (1st); Eng. Lang. and Lit. (1st), with 2nd prize of £3; the 1st prize of £3 for writing from dictation; the Council prize of £5 for hand-writing.
470—Hastie, George, 21, Pop. Evg. Classes, Anderson. Univ., Glasgow, teacher—Eng. Hist. (1st)
1283—Hatfield, Charles A., 18, Wednesbury (St. John's) Inst., clerk—Bkpg. (3d)
1136—Hattrick, Alexander, 25, Paisley Artiz. Inst. smith —Theory of Music (2d)
586—Havercroft, George W., 21, Hull Young People's Chr. and Lit. Inst., clerk—Bkpg. (3d)
471—Hay, William W., 30, Pop. Evg. Classes, Anderson. Univ., Glasgow, goldsmith—Theory of Music (2d)
1115—Hayes, Thomas, 19, Oldham Lyceum, mechanic—Arith. (3d)
33—Hayward, William, 27, S.E. Rail. M.I., tailor—Latin (1st)
1202—Heap, Richard, 31, Salford W.M. Coll., clerk—German (3d)
812—Heathcote, Frederick W., 16, Bromley, St. Mich. Evg. Classes, junior clerk—Bkpg. (3d)
46—Heckels, Richard D., 16, S.E. Rail. M.I., railway accountant's clerk—Arith (1st) with second prize of £3
763—Hember, Robert G., 18, Birkbeck Inst., clerk—Logic, &c. (3d)
337—Henderson, John, 19, Glasgow Ath., warehouseman—Eng. Lang. and Lit. (3d)
392—Henderson, John B., 20, Glasgow Inst., draper's assistant—Theory of Music (2d)
935—Hendrie, Francis H., 20, St. Stephen's (Westminster) Evg. Sch., clerk—Latin (2d); French (2d); the Council prize of £3 for handwriting
512—Heyhurst, Phineas, 20, Halifax M.I., cabinetmaker—Arith. (1st); Mensur. (2d)
1170—Heywood, John J., 19, Preston M.I., warehouseman—Mensur. (3d); Eng. Hist. (3d)
1050—Heywood, Joseph, 19, Manchester M.I., warehouseman—Bkpg. (2d)
867—Hibbert, Charles G., 18, City of Lond. Coll., (no occupation stated)—French (3d)
269—Hicking, Philip H., 17, Milford Evg. Sch. (Derby), teacher—Bkpg (1st); Mensur. (2d)
728—Hicks, William J., 32, Beauvoir Coll., pianoforte manufacturer—Mus. Comp. (3d)
1327—Higgs, John C., 29, Southampton Ath., gardener Flor. (2d)
503—Higgs, Samuel, 17, Gloucester Loc. Board, clerk—French (3d)
803—Hill, Arthur, 16, South Bromley Club, clerk—Arith. (2d)
1091—Hill, Edward, 27, New Swindon M.I., fitter—Theory of Music (3d)
1302—Hill, John H., 19, York M.I., book-keeper at gasworks—Mensur. (3d)
420—Hill, Thomas N., 18, Glasgow M.I., measurer and surveyor—Arith. (2d)
583—Hill, William W., 29, Hull Young People's Christian and Lit. Inst., clerk—Bkpg. (2d)
608—Hillam, Arthur A., 16, King's Lynn Ath., pupil teacher—Arith. (2d)
1127—Hilton, William, 22, Oldham Lyc., self-actor minder—Arith. (3d)
535—Hingley, Gideon, 21, Halifax W.M. Coll., schoolmaster—Arith. (3d)

537—Hitchiner, Alfred, 25, Halifax W.M. Coll., warp-dresser—Bkpg. (2d)
313—Hodge, David, 31, Edinburgh Loc. Bd., tutor—Mensur. (3d); Latin (3d); Logic, &c. (3d)
599—Hodgson, Thomas R., 20, Keswick M.I., draper—Pol. Econ., &c. (3d); Geog. (3d)
1097—Hogarth, Thomas O., 19, New Swindon M.I., pattern maker (apprentice)—Arith. (3d)
472—Hogg, Thomas, 26, Pop. Evg. Classes, Anderson. Univ., Glasgow, gardener—Flori. (2d)
1064—Holden, Frederick, 18, Mossley M.I., pupil teacher—Geog. (3d)
538—Holder, Henry W., 19, Halifax W.M. Coll., clerk Eng. Lang., &c. (1st)
1259—Hollingworth, Alfred, 16, Stockport M.I., mechanic—Arith. (2d)
1116—Hollingworth, George H., 17, Oldham Sch. of Sci., book-keeper—Arith. (1st); Mensur. (2d)
170—Holroyd, Samuel, 17, Bradford M.I., clerk—Arith. (2d)
1120—Holt, Henry W., 17, Oldham Lyc., clerk—Arith. (2d)
1203—Holt, Thomas, 17, Salford W.M. Coll., engraver—Arith. (2d)
871—Hooper, George D., 21, City of London Coll., clerk—Pol. Econ. and Civil Gov. (1st), with 1st prize of £5
425—Hope, John, 16, Glasgow M.I., writer—Latin (2d)
1044—Hope, William R., 17, Manchester M.I., clerk—Arith. (1st); Bkpg. (1st)
807—Hornblower, William J., 21, Bromley St. Michael's Evg. Classes, clerk—Bkpg. (1st)
809—Howard, Thomas, 17, Bromley St. Michael's Evg. Class. (operative apprentice)—Arith. (2d)
52—Howarth, John W., 28, Bacup M.I., woollen printer—Theory of Mus. (2d); Mus. Comp. (3d)
686—Howarth, Mark, Liverpool Inst. (apprentice) timber trade—Arith. (3d)
1051—Howarth, Thomas, 20, Manchester M.I., clerk—Arith. (2d); Bkpg. (2d)
263—Howarth, William, 22, Dean Mills Inst., overlooker—Arith. (1st)
1180—Howe, John, 18, Rotherham M.I., clerk—Bkpg. (3d)
207—Howie, Robert, 16, Carlisle M.I., no occupation stated—Arith. (2d)
101—Hughes, Thomas, 18, Birm. and Midl. Inst., jewel-case manufacturer—Eng. Hist. (3d)
1128—Hulme, Stephens, 19, Oldham Lyc., under-carder—Arith. (3d)
254—Humberstone, James T., 19, Crewe M.I., engineer (appr.)—Arith. (2d)
1012—Humphreys, William H., 19, Manchester M.I., warehouseman—Bkpg. (2d)
681—Huther, Alfred, 19, Liverpool Inst., clerk—Bkpg. (2d)

625—Ilderton, John E., 21, Leeds Ch. Inst., solicitor's clerk—Arith. (2d)
518—Illingworth, Thomas, 20, Halifax M.I., mechanic—Arith. (1st); Eng. Hist. (3d)
168—Ingham, John, 22, Bradford M.I., warehouseman Eng. Hist. (2d)
539—Ingham, William H., 17, Halifax W.M. Coll., overlooker—Arith. (3d); Bkpg. (3d)
419—Inglis, Neil, 19, Glasgow M.I., engineer—Arith. (3d)
294—Ingram, George, 23, Edinburgh Watt Inst., clerk—French (3d)
110—Isherwood, Thomas, 20, Blackburn Science Sch., teacher—Arith. (1st); Met. Syst. (1st)

431—Jack, William S., 16, Glasgow M.I., book-keeper—Theory of Music (1st); Mus. Comp. (3d)
985—Jackson, Henry, 27, Manchester M.I., carder—Arith. (2d)
1204—Jackson, John, 17, Salford W.M. Coll., clerk—Arith. (2d)
513—Jackson, Thomas, 18, Halifax M.I., clerk—Arith. (1st); Bkpg. (2d)
517—Jackson, Thomas, 22, Halifax M.I., warehouseman—Bkpg. (2d)
666—Jackson, William, 21, Leeds Young Men's Chr. Assoc., brush-maker—Bkpg. (2d)
768—Jackson, William, 23, Birkbeck Inst., clerk—Bkpg. (1st)
800—Jackson, William, 21, Birkbeck Inst., clerk—Pol. Econ., &c. (2d)
1031—Jackson, William, 18, Manchester M.I., railway clerk—Arith. (3d)
102—James, John M., 19, Birm. and Midl. Inst., pupil teacher—French (3d)
1247—James, Richard Lloyd, 16, Messrs. Chance's schools, pupil teacher—Arith. (3d)
1151—James, Thomas, 17, Pembroke Dock M.I., shipwright apprentice—Arith. (1st)
1152—James, William, 17, Pembroke Dock M.I., pupil teacher—Arith. (1st)
638—Jefferson, John C., 19, Leeds M.I., mechanic—Dom. Econ. (3d)
1159—Jenkin, George E., 18, Penzance Local Board, accountant—Eng. Hist. (3d)
1146—Jenkins, Philip, 16, Pembroke Dock M.I., shipwright apprentice—Arith. (1st)
874—Johnson, Edwin E., 17, City of Lond. Coll., clerk Arith. (1st)
875—Johnson, Jeremiah T., 18, City of Lond. Coll., junior clerk—Arith. (2d)
971—Johnson, John W., 24, Manchester M.I., book-keeper—Geog. (1st); French (2d)
1205—Johnson, Simon, 26, Salford W.M. Coll., clerk—Bkpg. (2d)
314—Johnston, Charles E., 20, Edinburgh Watt Inst., clerk—Geog. (3d); French (3d)
446—Johnston, David, 17, Glasgow M.I., designer—Theo. of Music (2d)
978—Johnston, William, 18, Manchester M.I., book-keeper—Arith. (2d); Eng. Hist. (2d)
973—Johnston, Wilson, 16, Manchester M.I., salesman Arith. (2d)
271—Jones, George S., 20, Derby M.I., clerk—Bkpg. (2d)
713—Jones, Henry, 18, Liverpool Inst., shoemaker—Arith. (2d); Geog. (2d.); Eng. Lang. (2d); Eng. Hist. (1st)
876—Jones, James, 18, City of London Coll., clerk—French (3d)
232—Jones, John H., 18, Cork Y. Men's Soc., draper—Arith. (3d)
1206—Jones, Robert, 21, Salford W.M. Coll., warehouseman—Arith. (3d)
701—Jones, William, 22, Liverpool Inst., gardener—Floric. (1st) with 2d prize of £3, and the Royal Hort. Society's prize of £3; Fruit and Veg. (Cult. (2d) with the R. Hort. Society's prize of £3
1207—Jordan, Thomas, 29, Salford W.M. Coll., clerk—Arith. (2d); Bkpg. (3d)
222—Joyner, Frederick W., 17, Cheltenham W.M. Club, assist. teacher—Arith. (2d); Eng. Hist. (2d); Geog. (3d)

1210—Kay, Andrew, 20, Salford W.M. Coll., clerk—Eng. Hist. (2d)
1209—Kay, David, 22, Salford W.M. Coll., salesman—Eng. Hist. (2d)
1211—Kay, Herbert, 17, Salford W.M. Coll., clerk—Arith. (1st)
1208—Kay, Reuben, 24, Salford W.M. Coll., clerk—Geog. (2d)
1036—Kearsley, Alfred, 18, Manchester M.I., letter-press printer—Arith. (2d)
1358—Keenan, Richard L., 27, Belfast Lit. Inst., gardener

—Geog. (1st); Eng. Hist. (2d); Pol. Econ., &c. (2d)
197—Kemp, Thomas, 23, Bury St. Edmunds Ath., gardener—Floric. (3d); Fruit and Veg. Cult. (3d)
1067—Kenmir, George, 19, Newcastle Excelsior Class, compositor—Eng. Hist. (3d); Eng. Lang., &c. (3d)
938—Kent, H. R., 22, South London W.M. Coll.—Arith. (3d)
473—Kerr, James H., 27, Pop. Evg. Classes, Anderson. Univ., Glasgow, jeweller—Theory of Music (3d)
831—Kidd, George W., 19, South Bromley Club, engineer (apprentice)—Mensur. (3d)
635—Kidney, John, 20, Leeds M.I., clerk—Bkpg. (1st); Mensur. (1st); Latin (2d)
10—Kilgour, George, 23, Aberdeen M.I., no occupation stated—French (2d)
103—Kimpton, Sarah M., 25, Birm. and Midl. Inst., of no occupation—Latin (3d)
789—King, Benjamin G., 22, Birkbeck Inst., tailor—Arith. (1st); Metric Syst. (1st); Bkpg. (2d)
1212—King, Charles, 22, Salford W.M. Coll., warehouseman—Arith. (2d); Bkpg. (3d)
791—Kirk, James, 21, Birkbeck Inst., compositor—Latin (3d)
510—Kitchen, Cooper, 17, Halifax M.I., ironmonger—Mensur. (2d); Eng. Hist. (2d)
507—Knowles, John W., 22, Halifax M.I., pianoforte maker—Eng. Hist. (3d)
379—Kyle, David, 27, Glasgow Inst., gardener—Mensur. (3d)
474—Kyle, James, 30, Pop. Evg. Classes, And. Univ., Glasgow, pattern maker—Theory of Music (3d)

1175—Lacey, George W., 26, Richmond Paroch. Lib., law clerk—Arith. (3d); Eng. Lang., &c. (3d)
827—Lamacraft, Henry, 19, South Bromley Club, cabinet maker—Arith. (3d); Mensur. (3d)
312—Landale, Isabella, 23, Edinburgh Philosoph. Inst., of no occupation—Dom. Ecom. (3d); French (2d)
433—Lands, David, 43, Glasgow M.I., stationer—Theory of Music (3d)
104—Langher, William, 20, Birm. and Midl. Inst., chemist's assist.—Metr. Syst. (3d)
729—Langley, Isaac, 25, Beauvoir Coll., carpenter—Theory of Music (1st)
588—Last, Frederick D., 16, Ipswich W.M. Coll., auctioneer's clerk—Bkpg. (2d)
247—Latham, William B., 17, Crewe M.I., fitter and turner—Arith. (3d); Eng. Hist. (3d); Geog. (3d)
879—Lawson, Henry, 20, City of London Coll., clerk—Geog. (2d)
1079—Lawther, Matthew A., 42, Newcastle M.I., buyer in drapery establishment—Bkpg. (3d.)
1062—Lawton, Fred., 19, Mossley, M.I., minder—Bkpg. (3d)
231—Leahy, Maurice, 20, Cork Cath. Y. Men's Soc., office clerk—Arith. (2d); Geog. (2d)
1134—Lee, Charles H., 18, Paisley Artiz., Inst., clerk—Arith. (2d); Theory of Music (1st)
632—Lee, William, 20, Leeds M.I., engineer—Arith. (2d); Met. Syst. (2d)
994—Lewis, Alfred J., 22, Manchester M.I., clerk—Bkpg. (3d)
683—Lewis, Charles, 20, Liverpool Inst., clerk—Bkpg. (3d)
221—Lewis, William F., 30, Cheltenham W.M. Club, teacher—Geog. (2d); Eng. Hist. (1st); Eng. Lang., &c. (1st)
345—Liddell, George, 26, Glasgow Ath., teacher—French (3d)
166—Lindon, Greenwood, 21, Bradford M.I., clerk—Arith. (1st); Bkpg. (2d); French, (3d)
476—Linn, William C., 29, Pop. Evg. Classes, And. Univ., Glasgow, warehouseman—Theory of Music (1st), with 1st prize of £5; Mus. Com. (2d)
1001—Livesey, James, 17, Manchester M.I., clerk—Arith. (2d)
708—Lloyd, Edward, 16, Liverpool Inst., office-boy—Bkpg. (3d)
418—Lockie, John, 17, Glasgow M.I., engineer—Arith. (2d)
405—Logie, William, 20, Glasgow M.I., shopkeeper—Bkpg. (2d)
262—Lomax, James, 20, Dean Mills Inst., grocer's assist.—Arith. (2d)
642—London, Thomas, 28, Leed's Y. Men's Christian Assoc., schoolmaster—Eng. Lang., &c., (2d); Geog. (1st)
770—Longley, Francis E., 17, Birkbeck Inst., clerk—Arith. (1st)
203—Lord, Alfred, 16, Carlisle M.I., law clerk—Arith. (1st)
107—Lovesy, John J., 17, Birm. and Midl. Inst., pupil teacher—Arith., (3d); Geog. (3d)
106—Lovett, William J., 17, Birm. and Midl. Inst., rose-engine-turner—Metr. Syst. (2d)
999—Lowe, Thomas, 18, Manchester M.I., clerk—Arith. (1st)
*802—Lowrie, Augustus F., 24, Birkbeck Inst., clerk—Bkpg. (3d)
771—Lowrie, Harry E., 20, Birkbeck Inst., clerk—Bkpg. (1st)
1213—Lucas, John E., 16, Salford W.M. Coll., warehouseman—Arith. (2d)
516—Lumb, Dixon, 19, Halifax M.I., card-maker—Eng. Hist. (3d)
1214—Lyon, James, 29, Salford W.M. Coll., merc. clerk—Bkpg. (3d)

348—Macfarlane, David, 27, Glasgow Ath., cashier and book-keeper—French (3d)
1139—Macfarlane, Peter, 24, Paisley Artiz. Inst., brass finisher—Theo. of Music (2d)
398—MacIntosh, Robert, 18, Glasgow M.I., pupil teacher—Arith. (2d); Bkpg. (3d)
717—MacKenzie, Alexander, 39, Beauvoir Coll., clerk—Theo. of Music (2d)
108—Mackenzie, John A., 21, Birm. and Midl. Inst., jeweller—Met. Syst. (3d)
1078—Mackie, John, 21, Newcastle M.I., railway clerk—Bkpg. (2d)
880—Macintosh, James A., 21, City of Lond. Coll., teacher—Mensur. (2d)
308—MacLennan, Donald, 22, Edinburgh Watt Inst., normal student—Arith. (3d)
434—Macpherson, Thomas, 27, Glasgow M.I., clerk—Theo. of Music (1st)
6—MacTaggart, Annie, 22, Aberdeen M.I., governess—German (3d)
776—Madden, Ronald G., 22, Birkbeck Inst.—French (3d)
881—Maignen, Prosper A., 19, City of Lond. Coll., clerk—Bkpg. (2d); Eng. Lang., &c. (3d)
509—Mallinson, James E., 18, Halifax M.I., clerk—Arith. (2d)
1244—Manlove, Richard J., 16, Slough M.I., chemist—Met. Syst. (2d)
236—Mann, Henry, 17, Crewe M.I., fitter—Eng. Hist. (3d)
482—Manuel, James, 16, Pop. Evg. Classes, And. Univ., Glasgow, pupil teacher—Arith. (3d)
319—Marchant, Edward T., 23, Farnham and Aldershot Loc. Bd., soldier—Arith. (2d)
157—Marchbank, Marshall, 16, Bradford M.I., manufacturer's apprentice—Arith. (2d)
109—Marlow, Frederick G., 19, Birm. and Midl. Inst., pupil teacher—Arith. (2d)
26—Marr, Alexander, 25, Aberdeen M.I., clerk—Mensur. (2d)
483—Marshall, James N., 21, Pop. Evg. Classes, And. Univ., Glasgow, warehouseman—Theo. of Music (3d)

409—Marshall, William, 19, Glasgow M.I., clerk—Bkpg. (2d)
773—Marston, Emma L., 33, Birkbeck Inst., governess—Arith. (2d); Eng. Hist. (2d); Eng. Lang., &c. (2d)
253—Matson, George, 18, Crewe M.I., fitter (apprentice)—Eng. Hist. (2d)
573—Martin, John, 22, Hull Young People's Christn. Asso., clerk—Bkpg. (2d)
1294—Martin, Margaret E., 17, Whaleybridge M.I., (no occupation)—German (2d); French (3d)
400—Mason, James, 17, Glasgow M.I., warehouseman—Bkpg. (2d)
965—Massey, George, 17, Manchester M.I., junior clerk—Arith. (3d)
591—Massingham, Henry, 18, Ipswich W.M. Coll., clerk—Bkpg. (1st)
1323—Massy, Charles, 22, Southampton Ath., engineer's clerk—Geog. (2d); French (3d)
882—Masters, John, 16, City of Lond. Coll., artificial limb-maker—Geog. (2d)
883—Mavity, Frederick W., 16, City of Lond. Coll., junior clerk—Arith. (2d)
436—McAlister, Robert, 22, Glasgow M.I., and also 477—Pop. Evg. Classes, And. Univ., Glasgow, baker—Theory of Music (1st); Mus. Comp. (3d)
360—M'Alpine, John, 19, Glasgow Ath., warehouseman—Eng. Hist. (1st), with 1st prize of £5; Geog. (1st)
1251—McArdle, John, 23, St. Martin's Sch. of Art. Stamford, gardener—Floric. (1st); Fruit and Veg. Cult. (2d)
233—McCarthy, Edward, 16, Cork Y. Men's Soc. merchant—Arith. (1st)
1367—McChesney, Joseph, 31, Belfast People's Lit. Inst., no occupation stated—Bkpg. (2d)
478—McClure, Robert, 19, Pop. Evg. Classes, And. Univ., Glasgow, bookseller—Geog. (3d)
354—McCrae, John, 16, Glasgow Ath., clerk—Bkpg. (2d)
884—M'Crea, Henry M., 23, City of Lond. Coll., clerk—Bkpg. (2d); Pol. Ecom., &c. (2d); Geog. (1st)
250—McCrindle, Alexander, 20, Crewe M.I., fitter (appr.)—Arith. (3d); Mensur. (3d)
690—McCully, John, 17, Liverpool Inst., glass stainer—Arith. (2d); French (3d)
976—McDermott, Thomas, 27, Manchester M.I., clerk in cotton mill—Bkpg. (2d); French (3d)
479—McDougall, William H., 19, Pop. Evg. Classes, And. Univ., Glasgow, book-keeper—Bkpg. (3d)
426—McFarlane, James W., 21, Glasgow M.I., mchan. draughtsman—Mensur. (2d)
342—McHaffie, John A., 16, Glasgow Ath., warehouseman—Arith. (2d); Bkpg. (1st)
1361—McIlroy, James M., 18, Belfast People's Lit. Inst., in the linen business—Bkpg. (3d)
283—McIlroy, William, 16, Devonport M.I., clerk—Arith. (2d)
399—McKechnie, Niel, 18, Glasgow M.I., pupil teacher—Arith. (2d); Bkpg. (2d)
1076—McKendrick, William, 21, Newcastle-on-Tyne M.I., clerk—Theory of Music (1st); Mus. Comp. (2d)
16—McKenzie, Andrew, 23, Aberdeen M.I., watchmaker—Eng. Lang. and Lit. (3d)
1132—McKinnon, John, 24, Paisley Artiz. Inst., certificated master—French (3d)
14—McLean, George, 27, Aberdeen M.I., mercantile clerk—Eng. Lang. and Lit. (3d)
732—McNaught, William G., 21, Beauvoir Coll., clerk Music Comp. (2d)
364—McOnie, William, 21, Glasgow Ath., clerk—French (1st), with 1st prize of £5
372—McSkimming, William, 18, Glasgow Inst., clerk—Arith. (2d)
424—Meikle, William, 18, Glasgow M.I., clerk—Spanish (1st); Arith. (3d)
1011—Mellor, William H., 17, Manchester M.I., clerk—Bkpg. (3d)
1281—Merrick, Mary, 19, St. John's Inst. (Wednesbury), pupil teacher—Arith. (3d); Eng. Hist. (3d)
484—Merrylees, Agnes G., 17, Pop. Evg. Classes, And. Univ., Glasgow, no occupation—Theory of Mus. (2d)
485—Merrylees, Jane McA., 18, Pop. Evg. Classes, And. Univ., Glasgow, no occupation—Theory of Music (3d)
486—Merrylees, Mrs. Rachael, 36, Pop. Evg. Classes, And. Univ., Glasgow, no occupation—Theory of Music (1st)
165—Midgley, Samuel, 20, Bradford M.I., music teacher—Arith. (2d)
487—Millar, Alexander H., 22, Pop. Evg. Classes, And. Univ., Glasgow, upholsterer—Theory of Music (1st); Music Comp. (2d)
648—Miller, John H., 17, Leeds Y.M. Chr. Assoc., draper—Eng. Hist. (2d)
265—Miller, Joseph, 17, Dean Mills Inst., warehouse boy—Arith. (2d)
402—Miller, Robert, 20, Glasgow M.I., clerk—Bkpg. (1st)
777—Miller, William W, 19, Birkbeck Inst., clerk—Arith. (2d)
1035—Mills, Frank, 16, Manchester M.I., warehouseman Bkpg. (3d)
673—Mills, James, 24, Leeds Y.M. Chr. Assoc., teacher—Arith. (3d); Geog. (3d)
1319—Mills, James, 21, Hulme W.M. Inst., gardener—Bkpg. (3d)
1017—Mills, Thomas G., 19, Manchester M.I., mechan. draughtsman—Eng. Lang. &c. (2d)
223—Mills, William, 19, Cheltenham W.M. Club, pupil teacher—Arith. (3d); Eng. Hist. (3d)
13—Milne, Robert, 20, Aberdeen M.I., labourer—Eng. Lang. and Lit. (3d)
1130—Minshull, William H., 20, Oldham Lyc., draughtsman—Arith. (3d)
1253—Mitchell, Henry, 18, St. Martin's School of Art, Stamford, finishing department in terra cotta works—Arith. (2d); Mensur. (3d)
1329—Mitchell, James F., 20, Southampton Ath. on the Ordnance Survey—Bkpg. (1st) with 2nd prize of £3
775—Mitchell, Thomas E. 19, Birkbeck Inst., pressmaker—Arith. (1st)
774—Moar, William, 22, Birkbeck Inst., clerk—Bkpg. (3d)
1166—Moncrieff, Henry A., 20, Portsmouth Loc. Board, stationer's clerk—Arith. (1st); Geog. (2d); Eng. Hist. (2d)
885—Monday, Alfred, 20, City of London Coll., clerk—French (3d)
1112—Moore, Octavius, 19, Oldham Lyceum, mechanic—Arith. (3d); Eng. Hist. (2d)
1147—Morgans, Henry John, 16, Pembroke Dock M.I., shipwright apprentice—Arith. (3d)
886—Morice, Beaumont, 20, City of Lond. Coll., clerk—Pol. Econ., &c. (2d)
1025—Morris, William H., 19, Manchester M.I., clerk—Bkpg. (1st); German (2d)
541—Morton, Sid, 18, Halifax W.M. Coll., warehouseman—Bkpg. (3d)
887—Mountjoy, R. A., 27, City of London Coll., clerk—Arith. (2d); Geog. (2d)
428—Munro, James, 17, Glasgow M.I., clerk—Eng. Lang., &c. (3d)
1138—Muro, James, 22, Paisley Artiz. Inst., house painter—Theory of Music (1st)
450—Murray, John M., 19, Glasgow, M.I., pattern designer—Theory of Music (1st)
215—Murray, William, 22, Carlisle M.I., of no occupation—Arith. (2d)

1262—Nattrass, James C., 17, Stockton M.I., clerk—Mensur. (3d)
159—Needham, James, 27, Bradford M.I., schoolmaster—French (3d)
40—Needham, James J., 19, S.E. Rail. M.I., engine-fitter—Arith. (1st)
490—Neilson, David, 22, Pop. Evg. Classes, Anderson. Univ., Glasgow, weigher—Arith. (1st)
974—Nelson, George, 21, Manchester M.I., warehouseman—French (2d)
779—Nevill, James F., 17, Birkbeck Inst., clerk—Arith. (1st); Met. Syst. (2d)
1267—Newcombe, Frederick, 22, Stourbridge Ch. of Eng. Inst., ironmonger's assistant—Bkpg. (3d)
1241—Newlyn, George, 26, Slough M.I., gardener—Met. Syst. (3d)
620—Newton, George, 19, Leeds Ch. Inst., mechanic—Bkpg. (2d)
778—Newton, Richard B., 16, Birkbeck Inst., temp. assist. in Geolog. Museum—Eng. Hist. (3d)
226—Niblett, Charles, 19, Cheltenham W.M. Club, soda-water maker—Arith. (3d); Eng. Hist. (2d); Eng. Lang. &c. (2d); Geog. (3d)
1217—Nichols, William, 18, Salford W.M. Coll., clerk—Geog. (3d)
299—Nisbet, John, 19, Edinburgh Watt Inst., piano tuner—Arith. (3d)
1218—Noar, Herbert, 18, Salford W.M. Coll., clerk—Arith. (1st); Bkpg. (2d)
923—Norris, James, 21, Royal Poly. Inst., clerk—Arith. (2d); French (3d)
834—North, Clifford T., 19, South Bromley Club, writer, &c.—Arith. (3d)
1271*-North, Tom H., 16, Wakefield M.I., clerk—Bkpg. (2d)
888—Norton, William H., 23, City of Lond. Coll., Civil Service—Arith. (1st); Geog. (2d)
825—Notman, James, 18. South Bromley Club, engineer—Mensur. (3d)
970—Nunn, William W., 22, Manchester M.I., clerk French (3d)
1219—Nuttall, Edward B., 20, Salford W.M. Coll., clerk—Arith. (2d); Spanish (2d)
913—Nye, Henry S., 19, Roy. Poly. Inst., occupation not stated—French (3d)

725—O'Brien, Edward, 26, Beauvoir Coll., law stationer—Theo. of Music (1st); Mus. Comp. (3d)
229—O'Callaghan, Patrick, 22, Cork Cath. Y. Men's Soc., rate collector—Arith. (1st)
1107—Oddie, Matthew, 18, Oldham Lyceum, warehouseman—Bkpg. (3d)
565—Oldfield, George, 20, Holbeck M.I., machine tool fitter—Arith. (1st)

891—Page, Edmund, 16, City of London Coll., architect's junior assist.—Arith. (2d)
*679—Page, John W., 26, Leeds Y.M. Chris. Assoc., post-office clerk—Arith. (1st)
560—Parker, John, 17, Hebden-bridge M.I., factory operative—Arith. (3d); Eng. Lang., &c. (3d)
892—Parker, John J., 21, City of London Coll., clerk—Bkpg. (2d); Eng. Lang. &c. (2d)
822—Parkes, Henry G., 17, South Bromley Club, clerk—Arith. (3d)
1041—Parkes, Robert, 19, Manchester M.I., engraver—Bkpg. (2d)
975—Parkes, Walter, 21, Manchester M.I., solicitor's clerk—Bkpg. (1st)
1065—Parkin, William, 18, Mossley M.I., minder—Bkpg. (3d)
1054—Parkins, Sidney, 17, Manchester M.I., artist—Bkpg. (2d)
1043—Partington, Ralph, 19, Manchester M.I., clerk—Bkpg. (2d)
327—Patterson, Henry, 25, Farnham and Aldershot Loc. Bd., corporal—Eng. Hist. (1st); Eng. Lang., &c. (2d); Geog. (2d)
130—Pennington, Robert T., 25, Bolton Church Inst., warehouseman—Bkpg. (2d)
919—Percival, Arthur J. 21, Roy. Polyt. Inst., railway clerk—Bkpg. (3d)
917—Percival, Lloyd H., 17, Roy. Poly. Inst., clerk—Bkpg. (3d)
1221—Percival, Thomas, 20, Salford W.M. Coll., packing clerk—Bkpg. (1st)
1000—Pettitt, Frederick M., 18, Manchester M.I., clerk—French (3d)
1339—Petty, John, 24, Southampton Ath., Custom's officer—Arith. (3d)
1148—Phillips, Levi, 16, Pembroke Dock M.I., shipwright (apprentice)—Arith. (1st)
27—Pickard, Nathaniel L., 21, Aberdeen M.I., stonecutter—Eng. Lang. and Lit. (3d)
928—Pickering, Edward, 19, Royal Polyt. Inst., clerk—Ital. (1st), with 1st. prize of £5; Eng. Lang., &c. (2d); German (3d); Spanish (3d)
1342—Pickup, Henry, 17, Irwell Inst., Rawtenstall, minder—Arith. (2d)
893—Pike, Evan V., 19, City of London Coll., book-keeper—Metric Syst. (2d)
1270—Pilkington, Joseph, 17, Tottington Lit. Inst., book-keeper—Arith. (2d)
1317—Pilkington, Samuel H., 18, Hulme W.M. Inst., warehouseman—Bkpg. (3d)
1269—Pilkington, Thomas, 20, Tottington Lit. Inst., weaver—Arith. (3d)
64—Pilling, Edmund J., 17, Bacup M.I., turner and fitter—Arith. (2d)
1045—Pilling, Thomas, 17, Manchester M.I., clerk—Arith. (3d); Bkpg. (2d)
55—Pilling, William, 19, Bacup M.I., weaver—Arith. (2d)
990—Pimlott, Henry, 22, Manchester M.I., clerk—Bkpg. (2d)
1137—Pinkerton, William, 21, Paisley Artiz. Inst., house painter—Theory of Music (1st)
894—Pollard, Henry T., 22, City of Lond. Coll., clerk—Bkpg. (2d)
735—Pollard, Kate, 24, Birkbeck Inst., governess—German (1st)
1006—Pollard, William, 16, Manchester M.I., clerk—Bkpg. (2d)
332—Pollitt, Samuel, 20, Freetown W.M. Inst. (Glossop), clerk—Bkpg. (2d)
1222—Pollitt, William, 18, Salford W.M. Coll., clerk—Bkpg. (1st); Logic, &c. (1st) with 2nd prize of £3; Latin (2d); Pol. Econ., &c. (3d)
416—Pollock, William, 19, Glasgow M.I., warehouseman—Arith. (1st) with 1st prize of £5
964—Porter, Alexander, 17, Manchester M.I., salesman—Pol. Econ., &c. (3d)
1075—Porteus, Joseph, 26, Newcastle-on-Tyne Ch. Inst., tailor—Mus. Comp. (3d)
443—Pottie, James, 22, Glasgow M.I., stationer and newsagent—Theory of Music (1st); Mus. Comp. (3d)
1271—Preston, James. 21, Tottington Lit. Inst., book-keeper—Arith. (2d); Metric Syst. (2d); Bkpg. (3d)
1348—Preston, Richard, 20, Accrington M.I., dyer—Arith. (2d)
1381—Prestwich, David, 17, Stockport Sunday School, factory operative—Arith. (2d)
72—Pretty, Charles, 20, Birm. and Midl. Inst., chemist—Met. Syst. (3d)
895—Price, William, 24, City of Lond. Coll., clerk—Italian (2d); Polit. Econ., &c. (3d)
73—Pritchard, George, 30, Birm. and Midl. Inst., clerk—Arith. (3d); Bkpg. (3d)
1237—Probert, Frederick, 21, Salford W.M. Coll., clerk—Arith. (1st)

1023—Prophet, William S., 18, Manchester M.I., clerk —French (3d)
*498—Provan, Andrew, jun., 20, Pop. Evg. Classes, And. Univ., Glasgow, clerk—Theo. of Music (2d)
542—Proven, John, 22, Halifax W.M. Coll., mechanic —Bkpg. (3d)
183—Pryer, William S., 36, Bristol Y.M. Chr. Assoc., schoolmaster—French (3d)

674—Raby, John, 16, Leeds Y.M. Chr. Assoc., pupil teacher—Arith. (3d)
74—Radclyffe, Frederick C. P., 18, Birm. and Midl. Inst., chemist—Met. Syst. (2d)
341—Ramsay, Robert, 18, Glasgow Ath., clerk—French (3d)
445—Rankin, William, 28, Glasgow M.I., mason—Theo. of Music (1st)
805—Read, Thomas J., 16, Bromley St. Michael's Evg. Classes, auctioneer's clerk—Bkpg. (3d)
1179—Read, William, 21, Richmond Paroch. Library, gardener—Floric.' (1st); Fruit and Veget. Cult. (3d)
1014—Redfearn, Abraham, 16, Manchester M.I., warehouse boy—Arith. (1st)
561—Redman, James, 18, Hebden-bridge M.I., factory operative—Eng. Lang., &c. (3d)
318—Reed, Thomas, 29, Farnham and Aldershot Loc. Bd., clerk in ordnance survey—Arith. (1st); Eng. Hist. (1st)
1255—Reedman, Benjamin, 17, St. Martin's Sch. of Art, Stamford, carpenter—Arith. (3d); Mensur. (3d)
931—Rees, Turner J., 21, St. Stephen's (Westm.) Evg. Sch., assistant master—Bkpg. (3d)
921—Reeves, William, 27, Royal Polyt. Inst., schoolmaster—Arith. (3d)
491—Reid, Robert, 32, Pop. Evg. Classes, And. Univ., Glasgow, boot and shoe maker—Theo. of Music (2d)
335—Reid, William J. D., 16, Glasgow Ath., clerk—Eng. Lang. and Lit. (3d)
1169—Rendell, James R., 19, Avenham Inst., Preston, clerk—Theo. of Music (1st); Mus. Comp. (3d)
238—Rennell, Francis, 21, Crewe M.I., turner—Arith. (3d)
1308—Rhind, Edwin, 19, Hulme (Christ Church Inst.), salesman—Arith. (2d)
190—Rhodes, James F., 18, Burnley M.I., railway clerk —Bkpg. (3d)
252—Richards, Jeremiah, 27, Crewe M.I., fitter—Arith. (2d)
897—Richardson, John E., 23, City of London Coll., clerk—Metr. Syst. (1st); Bkpg. (2d)
816—Richman, Harry, 16, South Broml y Club, pupil teacher—Arith. (1st); Mensur. (3d)
614—Ridge, Alfred, 16, Leeds Ch. Inst., pupil teacher —Arith. (2d); Eng. Hist. (2d).
726—Ridge, Thomas H., 28, Beauvoir Coll., solicitor's clerk—Theory of Music (1st)
1131—Rigg, James, 26, Paisley Artiz. Inst., clerk in print works—Theory of Music (2d); Mus. Comp. (2d)
1059—Riley, James H., 23, Manchester M.I., warehouseman—Bkpg. (3d)
1226—Riley, Thomas, 33, Salford W.M. Coll., clerk and townsman—German (2d)
909—Riorden, George J., 19, Roy. Polyt. Inst., engraver—Eng. Hist. (2d); French (3d)
797—Robbins, James L., 16, Birkbeck Inst., jun. clerk Geog. (2d); Eng. Hist. (2d); Eng. Lang, &c. (3d)
617—Roberts, Joseph, 21, Leeds Ch. Inst., clerk—Bkpg. (3d)
220—Roberts, Reuben, 16, Cheltenham W. Men's Club, clerk—Arith. (1st)
781—Roberts, Robert A., 17, Birkbeck Inst., clerk—Arith. (1st); Metr. Syst. (1st)
989—Roberts, Walter, 20, Manchester M.I., clerk—Bkpg. (2d)
543—Roberts, William, 16, Halifax W.M. Coll., clerk —Bkpg. (2d)
719—Robertshaw, Frank L., 27, Beauvoir Coll., agent —Theory of Music (1st); Musical Comp. (3d)
441—Robertson, John, 27, Glasgow M.I., designer—Theory of Music (2d)
1264—Robinson, Joseph, 19, Stourbridge Ch. of Eng. Inst., clerk—Arith. (1st); Latin (2d)
1265—Robinson, Zachariah, 17, Stourbridge Ch. of Eng. Inst., teacher—Latin (1st)
710—Robison, John, 17, Liverpool Inst., clerk—Bkpg. (3d)
452—Roddie, William S., 24, Glasgow M.I., engraver, Theory of Music (1st)
224—Rogers, Edward H., 18, Cheltenham W.M. Club, portmanteau maker—Eng. Hist. (3d)
898—Rogers, William, 29, City of Lond. Coll., clerk—French (3d)
780—Rogulski, Edward, 25, Birkbeck Inst., warehouseman—Arith. (1st); German (2d)
1228—Roles, John, 19, Salford W.M. Coll., warehouseman—Arith. (1st); Bkpg. (2d)
899—Rose, John H., 22, City of Lond. Coll., clerk—Arith. (1st); Spanish (1st); Eng. Lang., &c. (2d)
1047—Rosenberg, Harry, 18, Manchester M.I., clerk—Bkpg. (2d)
1156—Ross, Caroline H., 17, Penzance Loc. Board, no occupation stated—Theory of Music (2d)
493—Ross, David, 27, Pop. Evg. Classes, And. Univ., Glasgow, schoolmaster—Logic, &c. (1st)
494—Ross, James, 20, Pop. Evg. Classes, And. Univ., Glasgow, teacher—Arith. (1st)
1229—Rothwell, John, 20, Salford W.M. Coll., junior clerk—Bkpg. (2d)
1230—Rowlands, William, 18, Salford W.M. Coll., packer—Arith. (3d)
1167—Rowse, Joseph W., 23, Portsmouth Loc. Board, draughtsman—Arith. (2d); Met. Sys. (1st); Dom. Econ. (2d)
914—Rubinstein, Joseph S., Roy. Polyt. Inst., clerk—Arith. (2d); Eng. Hist. (3d)
367—Runcie, Adam, 24, Glasgow Inst., commercial traveller—Theory of Music (1st)
514—Rushworth, Ratcliffe, 22, Halifax M.I., timekeeper—Arith. (3d); Bkpg. (3d); Eng. Lang., &c. (2d)
342—Russell, Robert, 19, Glasgow Ath., clerk—French (2d)
900—Ryan, Andrew J., 24, City of Lond. Coll., clerk —French (3d)
577—Rymer, Walter, 27, Hull Young People's Chr. and Lit. Inst., clerk—Bkpg. (2d)

544—Sagar, Joe, 17, Halifax W.M. Coll., clerk—Bkpg., (2d)
783—Salter, William, 25, Birkbeck Inst., engraver—Metr. Syst. (1st)
901—Samuel, Marcus, junr., 16, City of Lond. Coll., clerk—Eng. Hist. (2d)
177—Scammell, Edward T., 24, Bristol Y.M. Chr. Assoc., theological student—Arith. (1st); Eng. Hist. (1st); French (3d)
677—Scholefield, Walter, 16, Leeds Y.M. Chr. Assoc., clerk—Arith. (1st); Eng. Hist. (3d)
198—Scott, William, 18, Carlisle M.I., assist. teacher—Mensur. (3d)
496—Scouller, John, 24, Pop. Evg. Classes, And. Univ., Glasgow, clerk—Theory of Music (1st); Mus. Comp. (3d)
1260—Seal, James, 17, Stockport M.I., cloth warehouseman—Arith. (3d)
1298—Seller, John C., 20, York M.I., railway clerk—Arith. (1st); Eng. Hist. (2d)
664—Sharp, William C., 18, Leeds Y.M. Chr. Assoc., clerk—Arith. (2d)

349—Shaw, Archibald, 20, Glasgow Ath., clerk.—French (3d)
545—Shaw, Enos, 21, Halifax W.M. Coll., warehouseman—Arith. (3d)
1061—Shaw, John, 18, Mossley M.I., warehouseman—Bkpg. (3d)
1129—Shaw, John W., 22, Oldham Lyceum, self-actor piecer—Bkpg. (3d)
988—Shaw, William J., 19, Manchester M.I., clerk—Bkpg. (1st)
646—Sheard, John, 21, Leeds Y.M. Chr. Assoc., copying-clerk—Arith. (3d); Bkpg. (2d)
397—Shedden, John, 19, Glasgow M.I., clerk—Bkpg. (3d)
112—Shenton, Joseph T., 16, Bollington Useful Knowl. Soc., office-boy—Arith. (2d)
695—Shepherd, John, 20, Liverpool Loc. Bd., smith—Mus. Comp. (3d)
649—Shoesmith, George, 20, Leeds Young Men's Christian Asso. currier—Bkpg. (2d)
696—Shore, William J., 17, Liverpool Inst., assistant ship and commiss. agent—Arith. (2d); Geog. (1st); Eng. Hist. (1st); Eng. Lang. &c. (1st)
1239*-Shorrocks, Walter, jun., 20, Salford W.M. Coll., clerk—Bkpg. (2d)
969—Sidebotham, G. H., 18, Manchester M.I., clerk—Spanish (3d)
75—Sidley, William H., 24, Birm. and Mid. Inst., clerk—Arith. (1st)
167—Silverwood, Leonard, 21, Bradford M.I., clerk—Metric. System (2d)
42—Silverwood, Thomas A., 17, S.E. Railway M.I., turner—Arith. (2d)
20—Sim, John, 17, Aberdeen M.I., writer—French (2d)
172—Sim, William H. C., 18, Bradford M.I., clerk—French (3d)
1328—Sims, Edward T., jun., 22, Southampton Ath., clerk—Metric Sys. (1st); Latin (2d); and the 3rd Prize of £1 for Writing from Dictation; also the Prince Consort's Prize of Twenty-five Guineas.
310—Sinclair, Allan, 28, Edinburgh Watt Inst., clerk and serjeant Edin. Co. Constabulary—Geog. (2d); Eng. Hist. (3d)
21—Singer, William, 22, Aberdeen M.I., clerk—Eng. Lang. and Lit. (2d)
1330—Skeats, Frank G., 24, Southampton Ath., clerk—Eng. Hist. (1st); Eng. Lang., &c. (2d)
36—Skelton, Frederick J., 20, S.E. Rail. M.I., engine smith—Arith. (1st)
902—Skilton, Charles H., 27, City of Lond. Coll., clerk—Arith. (2d); Bkpg. (1st); French (2d)
209—Slater, Joseph, 16, Carlisle M.I., of no occupation—Arith. (2d)
303—Slight, John, 25, Edinburgh Watt Inst., clerk—Bkpg. (3d)
307—Smellie, Alexander, 28, Edinburgh Watt Inst., shipping clerk—French (3d)
56—Smith, Edwin, 16, Bacup M.I., rope, &c., maker—Arith. (3d)
76—Smith, George, 19, Birm. and Midl. Inst., teacher—Met. Syst. (2d)
1004—Smith, John R., 16, Manchester M.I., jun. clerk—Bkpg. (3d)
802—Smith, Martha, 24, Birkbeck Inst., no occupation stated—Arith. (2d); Bkpg. (3d)
219—Smith, Robert, 26, Cheltenham W.M. Club, gardener—Arith. (3d); Eng. Lang., &c. (3d); Geog. (2d); Eng. Hist. (2d)
547—Smith, Thomas, 19, Halifax W.M. Coll., manuf. chemist—Bkpg. (1st)
289—Smith, Walter, 19, Dudley M.I., solicitor's clerk—Bkpg. (3d)
41—Smithwhite, William, 16, S.E. Rail. M.I., engine fitter—Arith. (1st)
255—Soulsby, Mary Ann, 17, Crewe M.I., pupil teacher—Arith. (3d); Eng. Hist. (2d)
782—Sowdon, William J., 21, Birkbeck Inst., wholesale druggist's clerk—Met. Syst. (2d)
77—Spencer, John, 24, Birm. and Midl. Inst., cashier Met. Syst. (1st)
1246—Stanier, William H., 21, St. Peter's Inst., Wolverhampton, railway clerk—Pol. Econ., &c. (2d)
548—Stansfield, William, 19, Halifax W.M. Coll., wool sorter—Bkpg. (1st)
339—Stark, Thomas, 18, Glasgow Ath., clerk—Logic, &c. (3d)
636—Stead, John, 23, Leeds M.I., linen manufacturer Spanish (1st)
1232—Steele, Thomas, 24, Salford W.M. Coll., merc. clerk—Arith. (1st); Bkpg. (1st)
155—Stephenson, Albert, 20, Bradford M.I., clerk—Arith. (2d)
574—Stephenson, William, 25, Hull Young People's Chr. Assoc., assistant to a tobacco manufacturer—Mensur. (2d); Geog. (1st) with 2nd prize of £3; Eng. Hist. (1st)
495—Stevenson, John, jun., 21, Pop. Evg. Classes, Anderson. Univ., Glasgow, mechanical engineer Met. Syst. (1st)
316—Stewart, Francis, 26, Farnham Young Men's Assoc., clerk—Arith. (2d); Mensur. (3d)
1160—Stewart, Henry, 16, Penzance Loc. Bd., clerk—Arith. (1st)
352—Stewart, James W., 18, Glasgow Ath., clerk—Arith. (2d); French (3d); the Council prize of £1 for handwriting.
78—Stickley, William, 28, Birm. and Midl. Inst., clerk—Arith. (2d)
79—Stokes, John S., 22, Birm. and Midl. Inst., teacher—Met. Syst. (1st)
1321—Stott, Thomas, 20, Hulme W.M. Inst., tea dealer's assistant—Logic, &c. (2d); Eng. Lang., &c. (2d)
903—Stubbs, John, 38, City of London Coll., teacher in charity school—French (3d)
616—Sugden, M. W., 26, Leeds Ch. Inst., mechanic—Bkpg. (3d)
609—Suggett, Samuel, 17, King's Lynn Ath., clerk—Bkpg. (2d)
65—Sutcliff, John, jun., 17, Bacup M.I., draughtsman—Arith. (1st); Met. Syst. (2d); Dom. Econ. (2d)
670—Sutcliffe, James, 17, Leeds Y.M. Chr. Assoc. occupation not decided—Arith. (2d)
622—Sutton, Edward, 16, Leeds Ch. Inst., clerk—Arith. (1st); Bkpg. (2d)
815—Swain, Thomas, 18, South Bromley Club, engineer apprentice—Arith. (2d)
1082—Swann, William, 17, New Mills W.M. Inst. bookkeeper—Bkpg. (3d)
723—Swindale, William, 33, Beauvoir Coll., stationer—Mus. Comp. (3d)
572—Sykes, Charles C., 16, Huddersfield M.I., clerk—French (3d)
566—Sykes, Joseph, 19, Holbeck M.I., factory hand—Arith. (2d); Bkpg. (3d)
1037—Sykes, William E., 18, Manchester M.I., apprentice—German (3d)

18—Tait, James, 28, Aberdeen M.I., clerk—German (2d)
1248—Talbot, Arthur, 18, Messrs. Chance's schools, pupil teacher—Arith. (2d)
931—Tapp, George W., 21, St. Stephen's (Westm.) Evg. School, clerk—Bkpg. (3d)
80—Taylor, Aulton, 19, Birm. and Midl. Inst., clerk—Eng. Hist. (2d)
179—Taylor, Charles G., 17, Bristol Y.M. Chr. Assoc., ironmonger's assistant—French (3d)
1303—Taylor, James, 29, Stockport Sunday School, warehouseman—Arith. (3d)
582—Taylor, Percy, 20, Hull Y. People's Chr. and Lit. Inst., clerk—Bkpg. (1st)
993—Taylor, Robert, 20, Manchester M.I., warehouseman—Bkpg. (2d)

1066—Taylor, Sidney, 19, Mossley M.I., cotton-piecer —Bkpg. (3d)
401—Taylor, Thomas, 22, Glasgow M.I., clerk—Bkpg. (1st)
1123—Taylor, William, 17, Oldham Lyceum, warehouseman—Mensur. (2d)
722—Teather, Herbert W., 18, Beauvoir Coll., teacher Mus. Comp. (2d)
395—Templeton, Alexander, 17, Glasgow M.I., clerk—Arith. (3d); Bkpg. (1st)
406—Templeton, John, 23, Glasgow M.I., no occupation stated—Bkpg. (2d)
1300—Tenniswood, Walter, 16, York M.I., boot and shoe maker—Theo. of Music (3d)
819—Terrell, James, 17, South Bromley Club, clerk—Arith. (2d)
1307—Tetlow, Walter F., 18, Hulme (Christ Church Inst.), warehouseman—Arith. (3d)
1149—Thomas, Alfred, 17, Pembroke Dock M.I., shipwright apprentice—Arith. (2d)
202—Thomlinson, John H., 18, Carlisle M.I., no occupation stated—French (3d)
375—Thompson, Richard, 19, Glasgow Inst., junior clerk—Bkpg. (3d)
382—Thomson, James, 28, Glasgow Inst., warehouseman—Eng. Lang., &c. (3d)
391—Thomson, William, 19, Glasgow Inst., clerk—Theory of Music (2d)
267—Thornley, Joseph, 20, Dean Mills Inst., cotton spinner—Arith. (2d)
997—Thorp, Henry, 18, Manchester M.I., clerk—French (3d)
667—Tiffany, John B., 26, Leeds Y.M. Christian Assoc., tobacco manufac., Eng. Lang., &c. (3d)
610—Tilson, Edward, 26, King's Lynn Ath., clerk—Arith. (3d)
568—Tinker, Alfred, 25, Huddersfield M.I., warehouseman—French (3d)
81—Tinley, Charles, 19. Birm. and Mid. Inst., clerk —Arith. (1st)
1238—Tongue, Alfred, 17, Salford W.M. Coll., entering clerk—Arith. (2d)
721—Torring, John J., 20, Beauvoir Coll., wood engraver—Mus. Comp. (3d)
497—Tosh, James W., 20, Pop. Evg. Classes, Anderson. Univ., Glasgow, clerk—Geog. (2d); Theory of Music (2d); French (3d)
284—Treleaven, Joseph T., 25, Devonport M.I., shipwright—Eng. Hist. (1st); Pol. Econ., &c. (2d)
925—Troake, Edwin, 23, Roy. Polyt. Inst., messenger (India Office)—Eng. Hist. (2d); Eng. Lang., &c., (3d)
602—Turner, Isaac, 18, Keswick M.I., draper (appr.) —Eng. Hist. (2d)
1233—Turner, William, 22, Salford W.M. Coll., clerk—Eng. Hist. (3d)
694—Turton, Fletcher T., 17, Liverpool Inst., surveyor —Eng. Hist. (1st.); Mensur. (3d)

982—Urquhart, Alexander H., 17, Manchester M.I., clerk—Eng. Hist. (3d)

1299—Volans, William, 28, York M.I., solicitor's clerk —Arith. (3d); Bkpg. (3d)
264—Vose, James, 17, Dean Mills Inst., pupil teacher—Arith. (2d)
1032—Vosper, Henry, 19, Manchester M.I., clerk—Eng. Hist. (1st) with 2nd prize of £3; Polit. Econ. &c. (2d)

968—Wade, Charles H., 17, Manchester M.I., no occupation stated—Arith. (2d); Dom. Econ. (2d); Geog. (3d)
787—Waddington, William H., 16, Birkbeck Inst., junior clerk—Metr. Syst. (2d)
285—Walke, Andrew J., 18, Devonport M.I., engineer student—Metric Syst. (1st)
17—Walker, William P. S., 28, Aberdeen M.I., clerk —Logic, &c. (2d)
199—Wallace, John, 19, Carlisle M.I., clerk—Bkpg. (2d)
1034—Wallis, George, 20, Manchester M.I., hosier, &c. French (3d)
734—Want, George W., 23, Beauvoir Coll., cabinet maker—Theory of Music (1st)
1010—Warburton, Alfred, 20, Manchester M.I., clerk—Bkpg. (2d)
268—Wardle, David T., 22, Dean Mills Inst., mechanic —Arith. (2d)
639—Wardle, James W., 20, Leeds M.I., engineer—Arith. (2d); Mensur. (2d)
1009—Wardle, John, 18, Manchester M.I., clerk—Bkpg. (1st); French (3d)
908—Warner, Alfred E., 26, Roy. Polyt. Inst., seal engraver—Mensur. (2d); Eng. Hist. (1st)
330—Warr, Thomas, 30, Faversham Inst., bookseller, &c.—Mus. Comp. (3d)
824—Waterson, Francis J., 18, South Bromley Club, pilot—Mensur. (3d)
1135—Waterston, John, 21, Paisley Artiz. Inst., clerk—French (1st), with 2nd prize of £3
82—Watson, Charles J., 22, Birm. and Midl. Inst., grocer—Met. Sys. (1st)
187—Watson, James, 19, Burnley M.I., clerk—Arith. (1st)
811—Watson, James H., 16, Bromley St. Michael's Evg. Classes, jun. clerk—Bkpg. (3d)
905—Way, Thomas H., 24, City of Lond. Coll., teacher —Arith. (1st); Geog. (1st); Bkpg. (2d); French (3d)
788—Weatherley, George, 16, Birkbeck Inst., clerk—Arith. (1st)
980—Weinich, Valentine, 26, Manchester M.I., glass engraver—Bkpg. (2d)
403—Weir, Joseph, 20, Glasgow M.I., clerk—Bkpg. (2d)
675—Westgarth, Joseph, 25, Leeds Y.M. Chr. Assoc., teacher—Arith. (1st)
242—Whellens, James, 20, Crewe M.I., fitter—Arith. (3d)
50—Whitaker, John, 18, Bacup M.I., clerk—Arith. (1st); Mensur. (3d)
84—Whitehouse, Joseph, 18, Birm. and Midl. Inst., apprentice—German (3d)
652—Whiteley, Benjamin, 20, Leeds Y.M. Chr. Assoc., clerk—Bkpg. (2d)
1008—Whitfield, Charles H., 18, Manchester M.I., clerk —Arith. (1st); Bkpg. (2d)
521—Whitley, Phineas, 18, Halifax M.I., teacher of music—Theo. of Music (2d)
60—Whittles, Henry, 21, Bacup M.I., teacher—Arith. (1st); Geog. (2d); Mensur. (3d); Eng. Hist. (3d)
1042—Wilcock, James, 23, Manchester M.I., boiler maker—Bkpg. (1st)
709—Wilcock, Roger, 18, Liverpool Inst., office youth —Bkpg. (3d)
550—Wilcock, Thomas, 23, Halifax W.M. Coll., sawyer —Eng. Lang., &c. (3d)
1108—Wilcock, Thomas, 21, Manchester M.I., boiler maker—Bkpg. (3d)
205—Wild, William, 17, Carlisle M.I., engineer's clerk —Arith. (1st)
1249—Wilkins, Frederick, 16, Messrs. Chance's Schools, pupil teacher—Arith. (3rd)
785—Wilkinson, Jeannette G., 26, Birkbeck Inst., upholsteress—Eng. Hist. (2d); Eng. Lang., &c., (3d)
626—Wilkinson, John H., 18, Leeds Ch. Inst., insurance clerk—Arith. (3d); Eng. Hist. (3d)
163—Wilkinson, Joseph, 19, Bradford M.I., bookkeeper—French (3d)
1100—Willan, George, 16, Newton Heath, All Saints (No. 2) School, clerk—Arith. (2d)
1145—Williams, Herbert, 18, Patricroft M.I., mechanic —Arith. (3d)

1337—Williams, Henry, 21, Southampton Ath., clerk—Arith. (1st)
243—Williams, John, 26, Crewe M.I., turner—Arith. (2d)
830—Williams, Lewis M., 23, South Bromley Club, clerk—Arith. (2d)
9—Wilson, George, 19, Aberdeen M.I., clerk—French (3d)
338—Wilson, James, 21, Glasgow Ath., clerk—French (2d)
1070—Wilson, John, 34, Newcastle Excelsior Class, joiner—Eng. Lang. &c. (3d)
1080—Wilson, John J., 19, Newcastle M.I., clerk—Arith. (2d); Bkpg. (3d)
1365—Wilson, Matthew, 27, Belfast People's Lit. Inst., clerk—Bkpg. (3d)
365—Wilson, William, 18, Glasgow Ath., warehouseman—Eng. Lang. and Lit. (1st)
818—Wilson, William J., 19, South Bromley Club, clerk—Arith. (2d)
11—Winchester, Julia A., 23, Aberdeen M.I., of no occupation—German (1st)
1181—Wing, William, 16, Rotherham M.I., accountant's clerk—Bkpg. (3d)
287—Wingfield, Henry E., 20, Devonport M.I., engineer student—Arith. (1st); Mensur. (1st), with 2nd prize
823—Wintle, Arthur G., 17, South Bromley Club, pupil teacher—Mensur. (3d)
25—Wiseman, Robert, 19, Aberdeen M.I., pupil teacher Arith. (1st)
1303—Wolfenden, Henry, 20, Hulme W.M. Inst., clerk—Bkpg. (2d)
1235—Wolstenholme, John B., 20, Salford W.M. Coll., porter—Eng. Hist. (2d)
298—Wood, Alexander, 21, Edinburgh Watt Inst., clerk—Arith. (2d); Bkpg. (3d)
579—Wood, Arthur, 20, Hull Y. People's Lit. Inst., clerk—Bkpg. (1st)
1384—Wood, John, 19, Stockport Sunday School, book-keeper—Arith. (2d)
85—Woodcroft, George F., 17, Birm. and Midl. Inst., apprentice—Met. Syst. (1st)
1022—Woods, Aaron, 20, Manchester M.I., warehouseman—Bkpg. (2d)
1021—Woods, Henry, 19, Manchester M.I., clerk—Arith. (2d)
1060—Woods, John, 17, Manchester M.I., stock-book keeper—Bkpg. (2d)
410—Woodside, Robert, 18, Glasgow M.I., joiner's clerk—Bkpg. (3d)
43—Woodworth, William R., S.E. Rwy. M.I., railway accountant's clerk—Bkpg. (1st)
1254—Woolston, Robert, 18, St. Martin's School of Art, Stamford. bookbinder—Arith. (2d)
86—Wootton, Bertha M., 16, Birm. and Midl. Inst., no occupation — Eng. Hist. (3d); French (3d)
906—Worley, George, 26, City of London Coll., bank clerk—Spanish (2d)
986—Worswick, Frederick H., 19, Manchester M.I., warehouseman—Geog. (3d); Eng. Hist. (3d)
1236—Wright, William, 22, Salford W.M. Coll., book-keeper—Bkpg. (3d)
1026—Wrigley, James, 18, Manchester M.I., clerk—Bkpg. (2d)
1016—Wrigley, Seth, 16, Manchester M.I., clerk—Arith. (3d); Bkpg. (2d)
411—Wyld, J. P., 21, Glasgow M.I., marine engineer—Bkpg. (1st)
373—Wylie, Thomas M., 18, Glasgow Inst., clerk—Bkpg. (2d)
353—Wylie, William C., 16, Glasgow Ath., clerk—Bkpg. (3d)

*801—Young, Sidney W., 24, Birkbeck Inst., no occupation stated—Arith. (3d); Bkpg. (1st)
447—Young, William, 22, Glasgow M.I., law clerk—Theory of Music (2d)
1368—Young, William, 25, Belfast People's Lit. Inst., muslin printer—Bkpg. (3d)

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

CORRESPONDENCE.

THE METRIC SYSTEM.

Sir,—I cannot see what Dr. Leone Levi's letter has to do with what I said. Mr. Hendriks had stated that all enlightened men of all nations had adopted the metric system. To this I demurred, on behalf of those enlightened men who are not prepared to adopt the metric system and reject other standards.

Professor Levi states at great length what we all know, that Lagrange, &c., were concerned in establishing the metric system, and that it has since been adopted in various countries. Nobody denies this. There are, however, enlightened men, men of science, in this country and in the United States, who are not prepared to adopt the metric system and displace their own standards. One enlightened man opposed to the metric system, according to Professor Levi, was Napoleon the Great.—I am, &c.,

Hyde Clarke.

MEETINGS.

By permission of the Council, the British Association of Gas Managers held their annual meeting in the rooms of the Society, on Tuesday and Wednesday, June 7th and 8th.

NEW PUBLICATIONS.

Messrs. Cassell and Co. have recently published the following works:—

The Uses of Plants. By E. A. Davidson. Foolscap 8vo., cloth, 1s.
The Guide to the Indian Civil Service. By A. E. Ewald, F.S.A. Extra Foolscap 8vo., cloth, 4s. 6d.
Bacon's Guide to America and the Colonies. By G. W. Bacon, F.R.G.S. Cloth, 2s. 6d.
Cassell's Popular Guide. Vol. V. Cloth, 6s.
Cassell's Household Guide. Vol. I. Cloth, 6s.

They also announce the following works:—

Our First Grammar. By E. A. Davidson. Foolscap 8vo., 1s.
Drawing for Carpenters and Joiners. By E. A. Davidson. Cloth, 3s. 6d.

GENERAL NOTES.

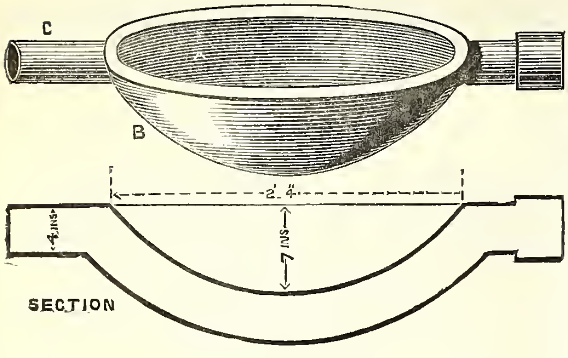
Navigation School in Japan.—This school is to be established, and Japanese officers, trained under the Europeans, are to be the teachers. The nobility are eagerly seeking nominations for their children as cadets.

The Arctic Expedition.—It is understood that the House of Representatives at Washington, United States, have appropriated 100,000 dols. in aid of the Arctic expedition; and that in reference to the French Arctic expedition, the needful money has been raised.

Petroleum for Railway Engines.—Two engines on the Strasbourg Railway have been fitted with M. Deville's furnaces for burning petroleum, and are employed in the goods traffic. The consumption of oil in the engines drawing heavy trains is stated to have been from 3½ to 5 kilogrammes for every kilometre traversed, or (say) from 8 lb. to 12 lb. for every two-thirds of a mile. The oil is said to have been very completely burned, and there is no smoke, and consequently no waste. Another advantage claimed is, that as there is no sulphur in the oils, the atmosphere of the tunnels would be free from sulphurous acid.

Volcanic Movements in Guayaquil.—It is reported that a peculiar volcanic movement has taken place between Point Pasado and Point Venado. In a space of two leagues, the surface of the earth undulated slowly, and great chasms and deep circular excavations were opened. A new lagoon was formed, and between the shore and the sea there appeared a large sized hill. During all this fearful commotion, the hills along the coast were observed to be in a state of unrest, and large land-slides took place, carrying with them rocks and trees. This agitation continued for four days, the undulation being from east to west.

Hot-water Tea-pan and Drying Apparatus.—The great expense of charcoal has long caused it to appear desirable to devise a means of finally drying teas, which will be at once more economical, manageable, and cleanly, and yet less dangerous and prejudicial to the quality of the tea. The tea-pan here represented is the ordinary tea-pan (A) with a double casing (B), and



connexions (C) for joining the one to the other. By casting a connexion into the bottom of the pan it may be made to act as a boiler for a small apparatus, by which means there would be the greatest possible economy of heating material. For large establishments, however, auxiliary boilers had best be used, to insure a more certain and rapid circulation. These boilers may either be independent of, or act in conjunction with, the tea-pans, as may be thought most desirable; it is quite practicable to connect the pan with the pipes by other connexions than those represented above, and to render them suitable for fixing under special circumstances. The pans should, if possible, be set over furnaces, however, as it may sometimes be necessary to increase the heating surface, in the event of a sudden demand upon the apparatus, such as the bringing in of large quantities of wet, green leaves, &c. It may perhaps be necessary to remark here, for the information of the non-practical reader, that the hot-water system may be modified to suit almost any circumstances, and may be applied to a building of any size; it may either be applied to a temporary building or a substantial one, as well to a building with wattle sides as to a well-finished brick and tile structure. It is quite practicable to use pipes which will take to pieces at will for removal, or to use such as will remain permanently fixed in their position. It is only necessary to know the required amount of pipe, and the maximum degree of heat desirable, and then to supply the requisite boiler surface is a simple arithmetical question. The maximum heat required in the manufacture of tea is 200° Fahr., an amount which may be always safely maintained on the surface of the tea-pan when the green leaves are undergoing their so-called "first roasting;" these green and succulent leaves, under the ordinary pressure of the atmosphere, have, like water, a limit to their capacity for heat. Water cannot be heated to more than 212°, nor can the green leaves of tea be heated to more than 160°, so long as active evaporation is taking place. The purpose of roasting the green leaves of tea on a heated iron vessel is to evaporate the acrid juices, and at the same time to render the leaves sufficiently pliable for the rolling process; but so objectionable has the primitive tea-pan, heated by a wood fire, proved to many managers, that they have preferred to trust to sun-heat rather than risk their leaves on a vessel which is often dangerously overheated in the hands of natives, who cannot be expected to understand regulating fires for the preservation of volatile oils, &c. The object of the inventor (Mr. McPherson) is not so much to supersede the ordinary tea-pan, however, as to utilise it as a boiler for the drying-pipes, which drying-pipes are to supersede charcoal fires. These drying-pipes will be laid in a parallel course round the inside of the tea-house, and immediately above them will be placed wire-bottomed sieves containing the teas to be dried. It is important to explain here that tea is, to all intents and purposes, manufactured before it receives this final drying—that is, it has been roasted to evaporate the acrid juices, and to render the leaves sufficiently pliable to receive the twist and curl; it has also been fermented to convert a portion of its sugar into acid, but, to retain a proper amount of this sugar, heat is sometimes applied in the so-called "second roasting," after which it is exposed to the sun and air, to still further evaporate the juices, so that, when the teas are placed over the charcoal fires, more than three-fourths of the moisture has been dispelled. It will readily be understood what great danger there is of these comparatively dry leaves being burnt over open charcoal fires, and also the great attention required to prevent the particles falling through the sieves on to the fire, and thus creating a smoke, to the great injury of the aroma and flavour. Indeed, this so frequently happens, that a certain class of teas are often depreciated in value from 4d. to 6d. per lb. from these causes alone. It is scarcely necessary to point out the great danger from fire, and the anxiety caused to a manager where these open fires are used in buildings with wooden sides and thatched roofs. In connection with this subject, it is highly important to understand that too great a degree of heat will destroy the aromatic and volatile oil to which tea owes so much of its taste and nearly all its aroma. It is not one of the least recommendations of the hot-water system to know that, while the boiling-point of water will not entirely destroy the volatile oil, 140° Fahr. is sufficient to resinise and develop in the highest degree this peculiar and all-important principle. The surface heat of a range of pipes of any length may, if desirable, be maintained at 180° throughout; and, that this heat may be utilised in the greatest possible degree, it is proposed to construct ranges of shelves above the pipes, on which to spread the green and wet leaves during the prevalence of the monsoon rains, and thus to wither them independently of the sun. A complete apparatus for an estate of 200 acres might be put on board ship for £200, and making the liberal allowance of 50 per cent. for freight, cost of erection, and repairs for twenty years, the cost on the plantation would be, say, £300. Against this cost must be set the price of charcoal, which, for an estate of 200 acres yielding 3 maunds, or 240 lbs., of tea per acre, will cost quite 1s. 4d. per maund of tea, or 4s. per acre, or, say, £800 for twenty years.

Tin in California.—Large quantities of tin ore have been discovered to exist in California, yielding 13·37 per cent. of tin, and almost twice as much as the usual working ore of the tin mines of Cornwall. The black mineral in the ore is tourmaline (it contains boracic acid), and the brownish red is the capilterite. The property is said to consist of 50,000 acres of mining lands, which have been opened at twenty points, all producing the ore.

Detection of Logwood in Wine by Neutral Acetate of Copper.—Lapeyrère has discovered that the hematine contained in logwood yields a sky-blue colour with salts of copper. Thus, if strips of good filtering paper, Swedish being preferred, are placed in an aqueous solution of neutral acetate of copper, and then dried, they can be used for testing wine. When a strip has been dipped into the wine and removed again, the adhering drop must be made to run backwards and forwards over the paper, which is then quickly but carefully dried. If the wine be free from logwood, the colour exhibited after the strip is dried will be grey, or rose-red greyish, but if logwood is present, the tinge will be distinctly sky-blue.

Halfpenny Card Postage.—The Marquis of Hartington, in reply to a question by Dr. Playfair, in the House of Commons, said he was happy to be able to inform his hon. friend that the government had decided, in connection with the reduced postage on newspapers and printed matter, to adopt halfpenny postage cards, one side of which would contain the address, and the other any communication that might be desired, whether in writing or print. He believed that the issue of such cards would afford great accommodation to the public, while, on account of their uniform size, light weight, and small bulk, they would be extremely convenient to the Post-office. He did not believe that those communications would materially interfere with the revenue derived from the ordinary letter postage.

To Render Wood Difficultly Combustible, and Preserve it when Underground.—In the *Annales du Génie Civil*, of April last, Dr. Reinsch gives the following directions for this purpose:—The wood, unplaned, is to be placed for 24 hours in a liquid composed of one part of concentrated silicate of potassa and three of pure water. After being removed and dried for several days, the wood is again to be soaked in this liquid, and after being again dried, painted over with a mixture of one part of cement and four parts of the above liquid. When the first coat of this paint is dry, the painting is to be repeated twice. This paint mixture should only be made up in small quantities, as it rapidly becomes dry and hard. Wood thus treated becomes uninflammable, and does not decay underground.—*Chemical News.*

Preventing Incrustation in Boilers.—Mr. C. Forster, of Augsburg, Bavaria, proposes for this purpose the placing of a vessel above the boiler, to be connected with it by two pipes, thus:—To the top of the boiler he bolts a standard, through which are two small pipes. To the upper end of this standard a cock or valve is secured, having two passages through it, to open or close the passages from the boiler through the standard to a closed vessel, which vessel he bolts on to the upper side of the cock or valve. This closed vessel, which is secured to the boiler by the standard and valve chamber, has two pipes in it extending upwards from the passages in the valve chamber, to about its centre or a little higher. The passages or pipes at the lower end of the standard are connected to two similar pipes, projecting downwards into the boiler, reaching below the low-water level. In this manner there is a continuous passage from the boiler to the closed vessel above, as described by means of two distinct pipes and passages, each pipe being open at both ends, but capable of being closed by the valve between the boiler and closed vessel above.

Dr. Oerche's Prizes.—On April 22nd, 1873, the Académie des Sciences will make its first award of these prizes. They are worth, one 20,000 francs, and the other 5,000 francs, and are for the discovery of some easy and accurate method of distinguishing apparent from real death.

The Origin of Man.—These beings Dr. F. G. Bergmann, from his own consciousness, has projected to be "Anthropeskes." They lived in Central Africa; they developed out of apes, and a certain number of them, finding themselves in favourable circumstances, developed into men, black men, and became the parents of the families whence the brown, copper, yellow, and white races branched off. Dr. Bergmann looks to the science of the future to do him justice upon this subject, and also in reference to some equally original ideas on language.

Statistics of the Russian Railways.—The first railroad from St. Petersburg to Isarskoé-Selo, a distance of about eighteen miles, was opened in the year 1838. Nine lines of railway, measuring together 1,325 miles, were opened to traffic in 1868. On the 1st of July, 1869, the lines available for traffic measured over 4,300 miles, more than four-fifths having been laid during the previous ten years. By the end of the present year (1870) it is believed that more than 2,144 miles will have been added, to be increased by 2,650 miles in the two or three following years. On the 1st of January, 1874, it may be expected that the surface of the Russian Empire will be covered by a network of more than 9,000 miles of railroads. The cost of the line from St. Petersburg to Moscow, a distance of 403 miles, is reckoned at £19,159,000 sterling, or £47,542 per mile. About £100,000,000 sterling have been, or will be spent in the 7,500 miles of lines either built or now building. Of the 4,356 miles of railroad worked on the 1st of January, 1869, only 14 per cent. were furnished with a double line of rails, and only three lines out of twenty-six, the Nicholas, the Riga-Dunaburgh, and the St. Petersburg-Peterhof, possessed a double line throughout. The government has the power of insisting upon a second line upon all railways, the gross receipts of which have reached £2,150 per mile. The guage of all railways is 5 ft. (French measure) with the exception of the Isarskoé-Selo line, which has a guage of 6 ft. On the Polish lines, on the left bank of the Vistula, the guage is 4 ft. 8 in. The traffic returns for three months, from January 1st to April 1st, taken upon a length of 4,266 miles, shows the number of passengers travelled, 1,742,295; weight of goods conveyed, 1,569,697 tons; gross receipts, £1,703,571 sterling, in 1868. Passengers, 2,196,376; goods, 2,277,617 tons; receipts, £2,447,062 sterling in 1869. The average receipts of twenty-two Russian lines were £2,056 per mile, in 1868. The St. Petersburg and Moscow line averaged 63,084 frs. per kilometer in 1864; 87,451 frs. per kilometer in 1865; and 96,240 frs. per kilometer in 1868. The French line, the Lyons and Mediterranean, averaged receipts of 82,034 frs. per kilometer in 1868. The capital of the railway debt in 1867 amounted to £11,676,000 sterling. On the 1st of January, 1868, this stood at £12,092,114; further increased in the course of the year to £12,690,237. This is exclusive of the debt of the "Grande Société," which owes to the State upwards of £13,000,000 sterling. The yearly liability of the government upon guarantees to railway companies for interest and sinking funds, on 1st January, 1869, amounted to £3,683,877 sterling. During the summers of 1867 and and 1868, upwards of 100,000 men were taken from other employments for the construction of the railroads. The Orel-Vikbst, which was built in a few months, employed at one time 25,000 men. The proportion of persons killed upon the Russian railways is stated to be 1 out of 273,000; as against 1 out of 570,000 on the French; 1 out of 730,000 on the English and Austrian; 1 out of 1,000,000 on the Belgian; and 1 out of more than 4,900,000 on the Prussian lines.

Coffee and Cinchona in Jamaica.—Mr. Robert Thomson says that, as the coffee plantations were gradually extended, and the primæval forests disappeared, the rain-producing agents were removed, and a comparatively dry, hilly climate obtained. Coffee has thus produced its own climate, and the same history may be predicted of cinchona.

Cordova International Exhibition, 1870-71.—An exhibition of works of art, manufactures, produce, &c., will take place at Cordova, from 15th October, 1870, to 15th January, 1871, under the management of a board of directors appointed by decree of the national government, dated December 9th, 1868. In addition to the contributions of native exhibitors, the following manufactures are specially invited from foreign countries:—Machinery applicable to the manufacture of cloth, woollen fabrics, &c., flax industry, paper, sugar, liquors, &c.; threshing and reaping machines, steam ploughs, harrows, and all other implements and machinery for agricultural purposes; machinery for mining, artesian wells, brick and tile making, sawing, &c.; cast-iron articles for use and ornament; models of architecture; wood work, water supply, drainage of land, &c. Goods for exhibition will be admitted duty free, and must be forwarded to Rosario, whence the carriage per rail, and all expenses *en route* to Cordova, will be defrayed by the national government, exhibitors being only charged with carriage on the return of goods, should they remain unsold. No charge will be made for space; and exhibitors of machinery will be entitled to a remuneration of £8 towards the expenses of every engineer or workman employed by them in the building for the purpose of showing how to work their machinery. The number of hands required must be stated at time of making application for space. The necessary fuel and water for steam power will be provided free of cost to exhibitors, as also the shafting to which the bands and pullies are to be attached. Steam engines must bear labels indicating the pressure at which they are to be worked, and will be tested with a pressure double of that indicated. Special regulations as to setting in motion, extinction of fires, working pressure, safety bars, &c., will be strictly enforced. Agricultural implements and machinery will be publicly tested in a field prepared for the purpose; the highest awards will be given to those which are most perfect and suitable to the requirements of the country. The trials will be made under official supervision, shortly after the opening of the exhibition, and cards announcing the awards will be affixed to the various successful exhibits. Exhibitors will be required to furnish full particulars as to prices of goods and cost of freight to Rosario, also of motive power and consumption of fuel of steam engines, &c., and will be held bound to execute orders at the prices given. Goods shown may be insured at the expense of exhibitors. 220 prizes out of a total of 1,008 will be allotted amongst the classes open to foreign exhibitors. These awards will comprise 15 gold medals, 30 silver medals, 75 bronze medals, and 100 "honorable mentions." Foreign manufacturers will likewise be entitled to compete for the grand prize (gold medal and 300 dollars = £60) upon fulfilling any one of the following conditions:—1. Exhibiting a collection of objects excelling in their kind, although each taken separately may not do so. 2. Obtaining more than eight prizes in the different sections comprised in one class, or more than three gold medals, &c., in one class, or a gold medal and several honorable mentions in one class. 3. Exhibiting a machine or other article of extraordinary merit and utility. Goods for exhibition will have to be despatched in time to reach Cordova not later than the 15th September. Applications for space or for further information, with particulars of the articles proposed for exhibition, should be addressed immediately to Messrs J. M. Johnson and Sons, 3, Castle-street, Holborn, London.

Amorphous Silica.—A series of experiments, by Dr. Lippert, has proved that amorphous silica is always hygroscopic after ignition; the degrees of hygroscopicity differs greatly, according to the heat at which the silica has been ignited, so that feebly-ignited silica is far more hygroscopic than when strongly ignited. When silica has been only feebly ignited, its avidity for the absorption of water, even after the lapse of a few minutes, is so great as to cause, if not taken into account, serious faults in the weighing and quantitative estimation of that substance. Crystalline silica, even when feebly ignited, is not at all hygroscopic.

Coca.—The *Erythroxylon coca* is a shrub about six feet high, with bright green leaves and white blossoms. The latter are succeeded by small scarlet berries; the former are described as shaped similarly to the leaf of the cherry tree. In the tables accompanying Von Bibra's work, some specimens are shown in nature print *(Naturselbstdruck)*. They appear to be considerably smaller than cherry leaves, although in shape not unlike them. The coca is raised for the seed, in garden beds, called almazigas. It requires humidity; therefore, maize is sown between the *matas*, or young shoots, to screen them from the too great influence of the sun. When the leaves are ripe, that is to say, when on being bent they crack or break off, the gathering commences, and they are stripped from the branches, a task usually performed by women. The plant thus rendered leafless is soon again overgrown with verdant foliage. The colour of the leaves when dried is a pale green. The drying demands great care and attention, for if they imbibe damp they become dark, and then a lower price is obtained than when they are green. Coca is not believed to improve by keeping; the inhabitants find it unpalatable at a year old. Von Bibra estimates the yield of one acre (German) at 800 lbs. of dried leaves; and he calculates that 30,000,000 lbs. are annually produced. The Indians masticate the coca generally in combination with some alkaline substance, which they carry in a small flask gourd, called the *ishcupuru*; a pouch called the *huallqui*, or the *chuspa*, contains a supply of coca leaves. Unslacked lime pulverised is usually taken with the herb. In Cerro de Pasco, and in places still further south, the Indians use, instead of this, a preparation of the pungent ashes of the quinine. This preparation is called "llucta," or "llipta." The flavour of coca is said to be rather pleasant It is slightly bitter, aromatic, and similar to the worst kind of green tea. When mixed with the ashes of the musa root, as in some of the Montana regions, it is somewhat piquant, and more pleasant to European palates than it is without that addition.—*Food Journal.*

MEETINGS FOR THE ENSUING WEEK.

MON......R. Geographical, 8½. 1. Mr. T. T. Cooper, "Travels in Western China and Eastern Thibet." 2. Dr. J. Anderson, "On the Sources of the Irrawady."
British Architects, 8.
London Inst., 4.
Social Science Assoc., 8. Mr. Thos. Hare, "On the Constitution of Municipalities and Local Governing Bodies for London and other Towns and Districts."
Society of Engineers, 7½. 1. Adjourned discussion on Mr. W. Lloyd Wise's paper on "The Patent Laws;" and (time permitting) 2. Mr. Michael Sefi, "On the Theory of Screw Propulsion."

TUES ...Medical and Chirurgical, 8½.
Photographic, 8.
Anthropological, 8.

WED ...E. India Assoc., 3½. Dr. Goldstücker, "On the Shortcomings of the Present Administration of Hindu Law."
Meteorological, 7. Annual Meeting.

THUR ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8.
Zoological, 4.
Chemical, 8.
Numismatic, 7. Annual Meeting.

FRI ......Philological, 8¼.
Social Science Assoc., 8. Miss Rye, "On Emigration of Pauper Children." Chair to be taken by the Right Hon. the Earl of Shaftesbury, K.G.

Journal of the Society of Arts.

FRIDAY, JUNE 17, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

INDIA COMMITTEE.

On Friday, the 24th instant, a conference will be held on the subject of overland routes between India, Eastern Thibet, Assam, and China. The conference will be opened by Mr. T. T. Cooper.

DRILL REVIEW.

The Review of Schools will take place on June the 21st, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and Her Royal Highness Princess Mary of Teck.

The following schools have signified their intention to be present:—

Royal Caledonian Asylum, Holloway, N.	41
Lambeth Industrial Schools, Norwood	133
Central London District School, Hanwell, W.	263
St. Mary, Islington, Hornsey-road, N.	60
St. Marylebone School, Southall, W.	100
Children's Establishment, Limehouse, E.	125
Royal Naval School, Greenwich	800
S. Metropolitan District School, Sutton, Surrey	300
Royal Military Asylum, Chelsea, S.W.	294
British Schools, Brentford	100
Shoreditch Industrial Schools, Brentwood	85
Mile-end Industrial Schools, Bancroft-road	80
St. Olave's School, Tooley-street, S.E.	230
Strand Union School, Millfield House, Edmonton	100
Homeless Boys of London, viz, *Chichester* Training Ship and Refuge Farm School	200
Marine Society's Training Ship *Warspite*	150
British School, Richmond	40
Newport Market Refuge and Industrial School	50

Eleven schools will compete in swimming, in three divisions of 16 each, according to ages, and six prizes will be awarded.

There will also be a competition in gymnastics, and two prizes given.

A competition in drill among the schools will take place, and a prize banner will be awarded to that school which shall acquit itself the best.

The following is the programme of the arrangements:—

1. The schools, on arriving at the Crystal Palace, will march to the Balloon and Archery Ground, at the north end of the Grand Terrace.

2. They will form there, on any convenient part of the ground, and stand easy. Their drill instructors are to remain with them, and wait for further orders. Whenever possible, the large schools should form in quarter distance column, right in front.

3. For the review, the schools will be formed in line on the Grand Terrace, facing the Crystal Palace. Line will commence to be formed at one o'clock precisely. The schools must therefore be on the Balloon Ground ready to move off before that time.

4. A sergeant-major of the Guards will be in charge of the parade, and direct all the movements. He will receive instructions from the Committee as to the position of the several schools in line, which must, to some extent, depend on circumstances.

5. The line will receive H.S.H. the Prince of Teck at open order—double distance, the band of the Royal Military Asylum playing the National Anthem (see paragraph 17). No other band will play at this time. Immediately the Royal Military Asylum band ceases playing, the boys will give three cheers for the Queen.

6. The bugle will sound one G, as a signal for the ranks to be closed.

7. At the second bugle sound—which will be two G's—the line will break into open column, right in front, by each company wheeling to its right.

8. The next movement will be to form quarter distance column on the centre. On the bugle sounding the "Close," the right wing will face to the right-about, and close to quarter distance on the centre. The left will advance, and also close to quarter distance on the centre.

9. The march past in quick time will commence on the bugle sounding the "Advance."

10. Each school will move off in succession from the right, at wheeling distance.

11. The drill instructor of each school (who is requested to come in uniform when he has one) will march in front of the centre of his leading company, and salute as he passes the reviewing officer.

12. Each school will be provided with a banner on the ground, which will be carried by one of the boys at the head of the school. When the school is in line, the banner will be in front of the centre of the school.

13. After marching past—as soon as the Grand Terrace is sufficiently clear—the schools will proceed, in quarter distance column, down the centre steps and along the central avenue, to the cricket ground, where they will be massed in quarter distance column.

14. The schools may then fall out for ten minutes, returning to the places marked by their banners.

15. When the bugle sounds the "Assembly," the columns will be re-formed, and the detachments for the several competitions will be called out. Competitions will then take place in drill, swimming, diving, gymnastics, &c.

16. The bugle will sound the "Assembly," when the boys will fall in on the Cricket Ground. They will then get their provisions. Afterwards the schools can move off independently.

BANDS.

17. On forming line to receive H.S.H. the Prince of Teck, as each school is deployed, its band will move to the central square of gravel in front of the saluting point. The bands will, while there, be placed under the directions of the Bandmaster of the Royal Military Asylum.

18. The band of each school will play it past the saluting point, and also each succeeding school which has no band.

19. As soon as a band ceases playing, it will move to the rear, to the central steps, and await the arrival of its school.

20. In marching to the Cricket Ground, each band will commence playing as it passes the Central Fountain, and not till then.

Should the weather be such as to prevent the Review taking place out of doors, it will be held within the building, and the necessary special orders for this purpose will be given on the spot.

After the review, the members of the Society and their friends (including ladies) will partake of a cold collation, during which the schools will sing and their bands play.

Tickets for the collation, price 7s. each, including a pint of light wine, may be had on application at the Society's House, until to-morrow, the 18th of June, after that day the price will be 10s. 6d. Members proposing to be present are

particularly requested to make early application, in order to facilitate the arrangements.

A ticket, admitting a member and lady within the circle to witness the review, will be delivered on application for the same at the Society's House.

ANNUAL CONFERENCE.

The Nineteenth Annual Conference between the Council and the Representatives of the Institutions in Union and Local Boards will be held on Wednesday, the 22nd June, at Twelve o'clock noon. The Chairman of the Council will preside.

On this occasion, the Conference will be held in the *Lecture Theatre of the South Kensington Museum*, in order to afford to those present an opportunity of visiting the Horticultural Gardens, the Royal Albert Hall (now in course of construction), and the new buildings now being erected for the International Exhibition of 1871.

The Council will lay before the Conference the Report of the Proceedings of the Union for the past year, and the Results of the Examinations. Suggestions in reference to the Programme of Examinations for 1871 will also be received by the Council.

As the Society of Arts has undertaken, with the aid of a large and influential Committee, to make arrangements for the Educational Section of the International Exhibition to be held in 1871, the Council are desirous of drawing the especial attention of the Institutions in Union, and other local bodies interested in education, to this Exhibition, which it is their desire to render as interesting and valuable as possible. With this view it has decided to invite the Representatives of Institutions and Local Boards to meet some members of the Education Committee on the occasion of this Conference, in order to discuss with them the best modes of bringing local influence to bear in obtaining the most suitable objects for exhibition in the Education Section, which will include specimens of all the subjects belonging to the following branches into which this class is subdivided:—

(*a*). School Buildings, Fittings, Furniture, &c.
(*b*). Books, Maps, Globes, Instruments, &c.
(*c*). Appliances for Physical Training, including Toys and Games.
(*d*). Specimens and Illustrations of Modes of Teaching Fine Art, Natural History, and Physical Science.
(*e*). Specimens of School Work, serving as Examples of the Results of Teaching.

It may be mentioned that the aim of this Exhibition being to show objects remarkable for excellence, novelty, invention, &c., only those articles will be admitted that receive the approval of the Committee.

The attention of local representatives is particularly drawn to section *e*, which is intended to show the results of teaching, and will include writing, plain and ornamental, drawing and design, modelling in clay, terra-cotta, wax, &c., models of machinery, building construction, &c., needlework, plain and ornamental, lace, knitting, music, &c., and miscellaneous work by pupils in schools for the blind, reformatories, &c. Any information or suggestions that may be offered in reference to this section will be of special value.

The following subjects have also been suggested for discussion at the Conference:—

1. How far it might be possible to make the Institutions rather Elementary Technical Schools than places where only a few miscellanous classes are held?

2. What further arrangements can Mechanics' Institutions make for promoting the systematic Technical Education of the people in their several localities?

3. Whether Teachers would not be stimulated in their efforts if those who were most successful in their training of pupils (as tested by the results of the Society of Arts' Examinations) had their services recognised by the Society?

4. Whether much greater encouragement would not be given to the thorough acquisition of knowledge in the various subjects by the division of them, in all cases where more than one is included in the same Examination paper; and whether, as the number of subjects in which Examinations are held has been greatly diminished, it would not be advisable to include others in the programme?

5. What measures can be taken to increase the number of Free Libraries in the United Kingdom?

6. What arrangements can be made to facilitate visits by members of Institutions in the provinces to the International Exhibition of 1871?

At the conclusion of the Conference, those present will be invited to visit the Horticultural Gardens and the other objects of interest mentioned above.

The Representatives are also specially invited to witness the Review of Schools, which will take place at the Crystal Palace on the previous day Tuesday, the 21st June.

Secretaries of Institutions and Local Boards are requested to send, *immediately*, the names of the Representatives appointed to attend the Conference; and early notice should be given of any other subjects which Institutions or Local Boards may desire their Representatives to introduce to the notice of the Conference.

Secretaries of Institutions are requested to forward *at once*, by book post, copies of the last Annual Reports of their Institutions.

ELEMENTARY EDUCATION BILL.

The Council have had under their consideration the Bill for establishing a national system of elementary education, now before Parliament.

1. The Council have seen with thankfulness the introduction of a Bill, intended to place elementary education within the reach of every child, making her Majesty's Government responsible that such education shall be provided.

2. Local inquiries, directed by the Council, have led to the suggestion of some amendments, which are designed

to bring about a speedy, certain, and economical attainment of the great end we have in view. The inquiries show the low quality of the primary education in many instances now given, and the state of utter ignorance, vice, and physical deterioration in which large masses of the population are being reared. These melancholy facts are corroborated by the reports of her Majesty's Inspectors of schools, showing the deplorable condition in which children are being reared in such seats of arts, manufactures, and commerce as Manchester, Liverpool, Leeds, and Birmingham. These facts justify the expression of a confident opinion on their part, that if a Bill were passed only enacting that sound elementary education and training ought to be given to every child in the country, and that an Education Department should be constituted and empowered to make complete inquiries throughout the country, as to the educational conditions of each locality, and the means required for improving them, a step would have been made which would be an epoch in our history.

3. The Council, however, regret to observe on all sides, that the due consideration of the essential conditions of education are set aside, and the deplorable defects of widely prevalent methods of religious and moral teaching in the existing schools are overlooked, and that even the extensive absence of any religious or moral teaching whatsoever amongst the lower classes is disregarded for conflicts on questions of denominational dogmas. The Council were apprehensive that, in the midst of these conflicts, consideration of the subject will be obstructed, and the measure in chief be lost in the struggle for the maintenance of rights and privileges assumed to be menaced.

4. The Council feared from experience of the existing local authorities, to whom it is proposed to confide new educational functions, there are just grounds to apprehend that, unless some stringent control or settled principles be adopted, neither the quality of the education nor the religious freedom of conscience will be secured. Experience in the administration of the Poor-law has shown this to be the case.

5. Parties of all denominations refused to act properly until compelled by orders from the Poor-law Board, and threats of legal proceedings to enforce them. By the stat. 31 and 32 Victoria cap. 122, sec. 18, it may be considered that the duty of protecting minorities in the freedom of religious teaching has been fully recognised.

6. The Council submitted that experience warrants the apprehensions they entertain, and the same are expressed by the Rev. Mr. Pryce, one of Her Majesty's Inspectors of Schools, in his recently published report to the Privy Council, in which he refers to dissenting majorities in school boards in Wales; and also to the statement of an Essex farmer,* speaking of local dissensions that will be engendered in the rural district by the provisions of the Bill as it now stands.

7. The Council are of opinion it is expedient that the local majorities should be relieved of the duty of making arrangements for the religious instruction, and that it should be charged as a duty upon the Department of Education, with full power and responsibilities for the protection of the religious freedom of minorities in the teaching of their children. Experience in the formation of poor-law unions and local unions under the Public Health Act justifies the conclusion that, by the intervention of a departmental officer responsible for the exercise of a judicial impartiality, and for acting independently of any local party, concessions may be got, and agreements between parties to school unions, which it were hopeless to expect from each other.

8. The Council fear that the rough and seemingly ready initiation of a change of system affecting four or five millions of children by local authorities, already generally over-occupied by the administration of relief to upwards of a million of paupers, will be found to be really dilatory, not only from the dissensions which it generates, but from the want of skill in school organisation, occasioning the retention and extension of common methods of schooling, which occupy six and seven years of time with instruction which may be better imparted in four years or in three, and in three hours' daily schooling instead of five and six. Early competent initiation is, moreover, needed to remove local misapprehensions, and guide well intended local efforts.

9. The Council have had the advantage of much administrative experience amongst its members, in considering how the initiation of the requisite change may, in their view, be most speedily, efficiently, and economically accomplished, and have agreed to outline resolutions thereon, which are given below.

Lord Henry G. Lennox, the Chairman of the Council, has been requested by the Council to bring before the Prime Minister, for his consideration, the following proposed amendments to the Bill:—

1. *Direct Departmental Initiation of Local Inquiries.*—After the passing of this Act, the Education Department shall direct inquiries to be made, as and when they shall see fit, in manner hereafter provided, or in such other modes as they may consider appropriate, into the efficiency of the education given in any district; as to the non-attendance of any children at school; and as to the defects of their mental, moral, religious, and physical training; and as to the conditions of their employment, and whether injurious or not; and as to the means of ensuring to every child efficient primary education, and proper physical training, and bodily protection against overwork.

2. *Standard of Efficiency in Primary Education.*—The standard of the efficiency of the primary elementary secular education, to be ensured for all children, shall be that which is attained by the eleventh year in the best of the district half-time schools for pauper children under the direction of the Poor-law Board—viz., reading with intelligence, writing a fair hand from dictation, arithmetic (including vulgar and decimal fractions), elementary free-hand drawing, vocal music, and military drill. And the standards of efficiency for secondary and art and science instruction shall be, as may be prescribed by the Education Department, according to the requirements of each district.

3. *Powers of Direct Inquiry.*—The Education Department may order returns to be made, and may authorise any inspector to enter and examine any schools, or any places where children and young persons are employed, and examine any children, and order any returns to be made for the purposes of any inquiry under this Act.

4. *Departmental Powers for Consolidating the Application of Local Educational Means.*—The Education Department shall direct, and from time to time revise, the expenditure of all moneys granted in aid of secondary or of science and art instruction, as well as of primary instruction, and may, by rule and order, determine the conditions of the continuance of such aid, and also

* War in the vestry, bitter and continuous, will result from the powers of controlling the compulsory and religious provisions of the Bill. The peace of villages will be disturbed, and friendly relations will be interrupted and perhaps destroyed. Labourers will bitterly resent the imposition of compulsion by their masters, who will often compose the majority of the education boards, and masters will shrink from inflicting the really slight hardship upon their men, who, as they know, are able to earn but too little already. Then, if the labourers have a vote in the election of the education boards, they will undoubtedly vote for those men who are against compulsion, and we shall still have thousands of children growing up in shameful ignorance, as under the present system. In short, I firmly believe that the bill in its present shape will be far more of a curse than a blessing; but that by settling the religious difficulty, insisting on compulsion up to the age of ten (twelve is too long for farm labourers to keep their children at school), and by rating people in proportion to their means, and not in proportion to their present burdens, it would become a really great and useful measure, and an incalculable blessing to the country.

regulate the application of any educational endowments, and of any local rates in connection with voluntary contributions and payments by school fees, and regulate the constitution of any local school boards, their powers and duties, and the qualifications, payments, appointment and dismissal of school teachers and local officers, and also to make rules and regulations for the better application of the "Factories and Workshops Regulation Act," and also in relation to the "Industrial Schools and the District Schools Act."

5. *Powers to make Arrangements for the Instruction of Children of different Religious Denominations.*—The Education Department may direct inquiries to be made, for the organisation and regulation of school teaching, as to the numbers of children of parents of different religious denominations, and as to any arrangements that may be made for the religious instruction of such children according to the tenets of their parents, and may, by rule and order, provide for the due enforcement of such arrangements.

6. *Right of Parents to Complain as to the Religious Teaching of their Children.*—If, within such district, parents of any religious denomination feel aggrieved in respect to the sufficiency or insufficiency of the arrangements for the appropriate religious instruction of their children, or as to the mode in which such arrangements are executed, they may prefer a complaint thereof to the school inspector for the district, by whom they shall be heard, and who shall take order for remedy thereof.

Parents' Right of Appeal to the Education Department.—If the parents are dissatisfied with any decision on their case by such inspector, they may appeal, by memorial, to the Department of Education, which may, if it shall think fit, allow the complaints to be heard thereon.

SCHEDULE.

Method of Local Inquiry, and of the Initiation and Constitution of Special Local School Boards, for the Execution of this Act.

1. *Heads of Local Inquiry.*—For the purpose of this Act, the Education Department shall send to any district a person conversant with the most efficient methods of secular elementary teaching and the training of children, who shall examine the arrangements, and the results in total cost and efficiency of the secular elementary teaching and training in such schools as there may be in such district; and the amount of school accommodation within it, or that may be available near it.

2. *Powers of Inquiry.* — For this purpose, such inspector may enter any school, and examine the scholars, and the method of teaching therein, and examine the school books and accounts of attendances and of non-attendances, and the school reports, if any, and ascertain the time and the annual and total cost of imparting given amounts of teaching, and require copies or abstracts and returns to be made by the teacher or the teachers, for the inquiry, and examine them, and take notes of any information he may deem requisite for the purpose of this inquiry.

3. *Sanitary Conditions to be Inquired into.*—He shall inquire into and ascertain the extent of the non-attendance of scholars at such schools from sickness, as well as from other causes; and from medical officers or medical practitioners he shall inquire as to any sickness or disease, permanent disability or mortality, likely to be caused or aggravated by the conditions of any school —its defective ventilation and warming, the excessive crowding of the children, or the state of filth in which they are brought together, or from the excessive duration of the sedentary constraint in which they are kept.

4. *Means of Physical Training.*—He shall inquire as to the extent of the bodily exercise given in such schools by means of gymnastics, or military or naval training, the means of exercise and play-grounds available for the scholars out of school; and as to the use made of them.

5. He shall ascertain, as nearly as may be, the numbers of children within the school ages who are in the streets during the school hours, and the total numbers of those who do not attend any school, and shall examine as to the causes why they are not at school.

6. *Qualifications of Children required for Service.*—He shall make inquiries of the employers of the labour of children within the district, as to the qualifications in the training and education of children needed by them for their service, and as to the extent to which such qualifications are imparted in the existing schools of the district.

7. *Labour of Children to be inquired into.*—He shall inquire as to the nature and character of the labour in which children are engaged in such district, and whether it is of the same number of hours as that of adult labourers, and therefore excessive; and as to the extent to which protection against over-work, by measures on the principles of the Factories' Regulations Acts, is needed for children within the districts.

8. *Juvenile Delinquency to be inquired into.*—He shall inquire from the employers of labour, from the police, and from any other sources, the extent of vice or crime, or of any juvenile delinquencies that may have occurred within the district.

9. *Report to be prepared.*—Having ascertained the state of the elementary education and training of the children of such district, its sufficiency or insufficiency in quality and extent for the education and training of all children from the fourth to the fourteenth year within such district, and the need of any regulations to prevent the bodily injury of children from over-work, as well as mental and moral injury through exclusion from education by reason of over-work, and what remedial measures are needed thereon. he shall prepare a report to the Education Department, setting forth such measures, and the evidence in justification thereof.

10. In such report he shall submit a scheme for the constitution of a local school board for the supervision of the administration of the school funds, and of the measures required for the training and education of the children to be provided for in such district.

11. *Constitution of Local School Boards.*—Such school board shall be constituted on the principle of a proportionate representation of the chief sources of contribution to the school funds, whether existing voluntary contributions, or endowments, or local rates, or grants from the consolidated fund; the representation of the ratepaying contribution being by direct election by ratepayers, according to the mode of election in use for poor-law guardians; the representation of schools supported by voluntary contribution, or by private endowments for any united schools, to be by members appointed from the school managers of such schools respectively; the representation in respect of the contribution from the consolidated fund being by persons resident within or near the school district, appointed by the Education Department, on the report of the inspector, on inquiry within the district.

12. Such report shall be printed and circulated within the proposed school district, accompanied by a notification that any suggestions or objections may, within one fortnight, be sent to the reporter, by him, if required, to be transmitted, with any observations thereon, to the Education Department.

13. The Education Department may, if it shall think fit, order any further inquiry.

14. If it shall be finally satisfied with the expediency of the measures recommended, it may, within not less than one fortnight after the circulation in the locality of the examining officer's report, direct the constitution of the school board, and the execution of the measures therein recommended.

15. Any new appointments of head teachers, or of assistant teachers, shall be made by the method of

open competition, regard being had to qualifications by practice in teaching and training, and to general character.

16. That the school board should have the power, and be required, to provide play-grounds in all school board schools, and to make grants only to such schools as are provided with play-grounds.

RAILWAY REFORM.

The Council have appointed a committee to consider the means of promoting improved administrative economical and structural arrangements on railways.

LIBRARY.

The following works have been presented to the Library:—

The First Annual Report of the American Museum of Natural History. January, 1870.

Discorse Agrario di Antonio M. Lombardi.

A Pamphlet on Artificial Alizarin. By W. H. Perkin, F.R.S. Presented by the author.

The Patent Laws. By W. Lloyd Wise. Presented by the author.

Tarasp and its Mineral Waters. By the Rev. N. B. Whitby.

Hogg's Secret Code for Letters or Telegrams.

Wool and Woollen Manufactures of Great Britain: a Historical Sketch of their Rise, Progress, and Present Position. By Samuel, Brothers.

SUBSCRIPTIONS.

The Lady-day subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

A meeting of the Committee on Educational Works and Appliances was held on Wednesday, the 15th inst., at the Council-room of the Royal Horticultural Society, Kensington, at 11 o'clock, Sir William Bodkin in the chair. There were present—The Rev. Charles Mackenzie, Colonel Harness, C.B., R.E., Major-General Eardley-Wilmot, Charles Brooke, F.R.S., Professor Ansted, Rev. R. Whittington, Captain Donnelly, R.E., Hon. and Rev. F. Byng, Rev. John Curwen, C. W. Franks, F. Pitman, Colonel Strange, F.R.S., John Bell, Professor Hughes, F.R.G.S., Otto Goldschmidt, Dr. Armitage, T. Moore, F.L.S., Rev. J. G. C. Fussell, Henry Cole, C.B., Lieut.-Col. Scott, R.E., Alfred Bourne, G. C. T. Bartley, C. W. Merrifield, F.R.S., H. A. Bowler, W. Matchwick, F.L.S., T. Chesman, R. Redgrave, R.A., Hyde Clarke, Rev. J. H. Edgar, M.A., J. A. Franklin, Eyre Crowe, Rev. J. Johnson, B.A., H. Sandham, T. Dixon Galpin Henry Jeffery, Rev. J. S. Brewer, M.A., Professor W. H. Flower, Rev. Muirhead Mitchell, James T. Ware, Rev. J. F. Twisden, M.A., Dr. Davis, W. McLeod, Rev. Arthur Rigg, Rev. W. J. Unwin, LL.D., P. Le Neve Foster, Secretary of the Society of Arts, and C. Critchett, Secretary of the Committee.

The Secretary to the Committee (Mr. C. Critchett) read the minutes of the last meeting, which were confirmed.

Mr. Cole, C.B., said he believed the committee were already acquainted with the sections into which it was proposed to divide the educational works and appliances, the classification adopted being in the main based upon that employed in the Educational Exhibition of 1854, held in St. Martin's Hall, which was considered highly successful. The Commissioners had prepared a list of the various trades which seemed to be of such a character as ought to be represented in the exhibition, and, although there might be one or two trades mentioned in the list which appeared slightly ambiguous, such as pink-saucer makers, and so on, he did not think any real difficulty would arise, some of the trades connected with education and with the fine arts verging very nearly upon one another. There were two main objects to be kept in view by the committee, one being a complete representation of the objects themselves used in education, and the second, the results obtained by the use of these objects; and it was arranged, in order to facilitate business, to subdivide the committee into sections, according to the trades mentioned, the matters to be exhibited being very numerous. The members of the present general committee were nominated by the Council of the Society of Arts, and it was now found, as might have been expected, that there were some names which it would be desirable to include, but which had been omitted, and, therefore, it was now proposed to add them to the committee. It was also proposed to ask various gentlemen, who had more or less manifested a desire to take an active part in connection with the forthcoming exhibition, to act as secretaries of the sub-committees. For example, in section 4—"Specimens and illustrations of the modes of teaching fine art, natural history, and physical science"—the subjects included were very numerous, and the teaching of fine art was a very different thing from teaching chemistry or natural history; and the artists engaged in producing objects to be employed in teaching drawing were not those engaged in producing diagrams and specimens of natural history. Physical science, again, was different from either, and, therefore, in this case it was proposed to ask two or three gentlemen, more or less, to act as secretaries in each sub-division, and to give them a personal responsibility, whilst, at the same time, they would call in the aid of the whole sectional committee, more or less, to act when required. A list of the names of gentlemen who were willing to act in each subdivision had been prepared, but if any others were willing to render aid in this way, they would be glad of their assistance. In the first section—"School buildings, fittings, and furniture"—after consulting high authorities, it was represented to them that Mr. Laurie, the late inspector of schools, and who had also held a high position in Ceylon, was willing to act in that department, and with him would be associated Mr. King, Keeper of the Educational Collections at South Kensington. In section 2—"Books, maps, globes, instruments, &c."—the Rev. Muirhead Mitchell, who had taken a most active part in the organisation of the Exhibition of 1854, was willing to give his services, and with him would be associated the Rev. W. H. Brookfield. In section 3—"Appliances for physical training, including toys and games"—Professor Huxley had intimated that he would give them the benefit of his experience, and Mr. Nunn, one of the surgeons at the Middlesex Hospital, who was now engaged in preparing some physiological diagrams, for the purpose of showing some facts connected with natural science, would assist him. With regard to the toys and games, a gentleman who had taken considerable interest in this subject, having written a report on it for the last Paris Exhibition, Mr. Bartley, had volunteered his services. Next came section 4—"Specimens and illustrations of the modes of teaching fine art, natural history, and physical science," to which should be added music. Professor Huxley, Dr. Frankland, Professor Guthrie, Captain Donnelly, and Mr. Iselin, the Inspector for Science, had consented to act, and it was proposed to ask Dr. Michael Foster to join them. It was thought that these gentlemen amongst them would have so much

knowledge of producers in their respective branches that a creditable exhibition would be the result. As respected art, Mr. Redgrave, the Inspector-General, had agreed to act as secretary, and he would be assisted by Mr. Bowler. With respect to music, Mr. Hullah had promised his services; and Mr. Alan Cole, having some knowledge of this art, would aid him. In the last section—"Specimens of school work"—out of which he hoped they would get some very active competition, not only in singing, music, and drawing, but also in writing, if that art was not quite extinct, the names which had occurred as being likely to afford assistance were Mr. Edwin Chadwick, the Rev. Arthur Rigg (late principal of the Chester Training College), Professor Ansted, Capt. Donnelly, Mr. J. G. Fitch (Inspector of Schools), Mr. Chesman, and, as art was also included, Mr. Bowler. He begged leave to move that the following gentlemen be requested to act as secretaries of the several sectional committees or sub-committees, with power to summon them when necessary:—

Secretaries of Sections.

A.—School Buildings, Fittings, Furniture, &c.

J. S. Laurie.	A. C. King.

B.—Books, Maps, Globes, Instruments, &c.

Rev. Muirhead Mitchell.	Rev. W. H. Brookfield.
J. G. Fitch.	Hyde Clarke.

C.—Appliances for Physical Training, including Toys and Games.

Prof. Huxley, F.R.S.	Physical Training.
J. W. Nunn	
G. C. T. Bartley	Toys and Games.

D.—Specimens and Illustrations of Modes of Teaching Fine Art, Music, Natural History, and Physical Science:—

R. Redgrave, R.A.	Fine Art.
H. A. Bowler	
John Hullah	Music.
Alan S. Cole	
Prof. Huxley, F.R.S.	Natural History and Physical Science.
" Frankland, F.R.S...	
" Guthrie, Ph.D.	
Dr. Michael Foster	
Lieut.-Col. Alex. Strange F.R.S.................	
Capt. Donnelly, R.E.	
Rev. A. Rigg............	
J. F. Iselin..............	

E.—Specimens of School Work, serving as Examples of the Results of Teaching.

Edwin Chadwick, C.B.	J. G. Fitch.
Prof. Ansted, F.R.S.	T. Chesman.
Rev. A. Rigg.	H. A. Bowler.
Captain Donnelly, R.E.	W. G. Larkins.

The motion having been seconded by **Col. Harness**, it was suggested that in the section of books, maps, &c., there were only two clergymen, and it would be desirable to add a layman, the name of Mr. J. G. Fitch being mentioned.

Dr. Davis wished to ask if the secretaries would have plenary powers in their own divisions, or whether they would be bound to call their committees together and act with them?

Mr. Cole said the sub-committees would be called together, but the secretaries should not shrink from taking some responsibility themselves. He should say that, if they were to wait in every case for a formal meeting of the committee, and a report, and a confirmation of minutes, the business would not get on very quickly. Still, it was their business to summon the members of the committee, and to get all the assistance they could from them.

The Chairman wished to ask if it was intended that these sections should remain as they were, or whether it was proposed further to subdivide them.

Mr. Cole thought that must really be left to the committees themselves. If a committee thought that the work would be more advantageously done by further dividing the subjects it might do so.

The Rev. John Curwen asked whether these secretaries and sub-committees would have the power of rejecting articles—in fact, whether they would be judges, or whether some other persons would be chosen for this duty.

Mr. Cole said the time was hardly come for considering that question. No doubt the time would arise when, if the applications were more numerous than the space could accommodate, a selection would have to be made and some articles rejected, but that might be left for further consideration. No doubt the Council of the Society of Arts, in appointing the judges, would be guided by the recommendations of the sub-committees.

Professor Ansted thought the Commissioners for the exhibition, rather than the Society of Arts, should appoint the judges.

Mr. Cole said that, in the educational section, the Council of the Society of Arts would act very much in the same way as foreign commissioners would act with respect to foreign goods; in fact, the Society of Arts and the Committee then assembled were responsible for making an effective exhibition in this section.

Mr. Fitch's name having been added to section B, the resolution was put, and carried unanimously.

Mr. Cole said the next resolution was that each sectional committee should have power to add to its number, and to divide itself into sub-committees, though the latter part had been already virtually agreed to.

Professor Ansted suggested that the sub-committees should have power to appoint additional secretaries.

The resolution was then passed in the following form, on the motion of **Mr. Hyde Clarke**, seconded by **General Eardley-Wilmot**:—"That, subject to the sanction of the Council of the Society of Arts, each sectional committee have power to add to its numbers, to divide into sub-committees, and to appoint additional secretaries if required."

Colonel Strange moved "That the following gentlemen be added to the committee:—J. S. Laurie, Professor Sterndale Bennett, Jules Benedict, Dr. Michael Foster, W. G. Larkins, T. Chesman, A. S. Cole."

Mr. Charles Brooke said he had much pleasure in seconding the motion.

The motion was put and carried unanimously.

The proceedings having concluded with a vote of thanks to the Chairman, moved by **Mr. Charles Brooke, F.R.S.**, and seconded by the **Rev. Charles Mackenzie**, the committee proceeded, under the guidance of **Lieut.-Col. Scott, R.E.**, to inspect the galleries in the Albert Hall of Arts and Sciences, which are intended for the educational portion of the Exhibition.

THE BELGIAN COMMISSION.

Extrait du "Moniteur Belge" du 10 *Juin*, 1870.—"Hier, à 2 heures, a eu lieu dans la Salle de l'Académie, une réunion de la Commission de l'Exposition Internationale de Londres en 1871, sous la présidence d'honneur de S.A.R. Mgr. le Comte de Flandre."

ALTERATIONS OF FINE ART RULES.

Her Majesty's Commissioners invite attention to the following alterations which, in accordance with the recommendations of the Fine Arts Committees, have been made in the general regulations for exhibiting examples of fine art.

Rule 2, which is as follows:—

"2. No artist can be allowed to exhibit more than two

works of each kind, one of which at least must not, except under special conditions, have been previously exhibited in London, but he may send works of as many different kinds as he pleases; thus the same artist may send for admission two oil paintings, two water-colour paintings, two paintings on enamel, porcelain, etc., also two sculptures in marble, two in wood, etc.,"

will be suspended in the first exhibition; artists will consequently be at liberty to submit any number of their works, whether previously exhibited or not.

Rules 4 and 5 have been altered and incorporated,

"4. The works of deceased artists are not admissible, except as copies or reproductions (Class 7),"

"5. All works of art, except reproductions of ancient and mediæval works, must have been executed since 1862,"

and now read as follows:—

"4. All works of art, except reproductions of ancient and mediæval works, must have been executed by living artists, or by artists deceased within five years,"

consequently the restriction as to the date of execution has been removed.

In Rule 10, now 9, the words "or series of drawings relating to one subject" have been inserted.

The Rule now stands thus:—

"9. Each picture, drawing, or series of drawings relating to one subject, must be in a separate frame, except very small miniatures, or sculptured gems, any number of which may be placed in a frame not exceeding a foot square."

Rule 15, now 14, has been altered by the insertion of "The price, if for sale; unless the exhibitor objects," and "The date of execution," and now reads thus:—

"14. To every work, when exhibited, will be attached a label, prepared by Her Majesty's Commissioners, which will contain the following particulars:—

1. The subject.
2. The artist's name.
3. His address.
4. The price, if for sale; unless the exhibitor objects.
5. The date of execution.
6. Any explanations.

A copy of the rules as revised may be had, and Her Majesty's Commissioners request the destruction of unrevised copies.

THE EDUCATION BILL.

On Saturday, the 4th instant, Mr. Forster met deputations of his constituents at Bradford, especially representing the views of the League, to discuss the Education Bill. The principal objections brought forward are stated in a memorial read to Mr. Forster, which says:—"We object to the length of time which it is proposed shall elapse before the Bill is to take effect; we think that immediate action should follow the passing of the measure and its receiving Royal assent. We object to the mode of electing the local school boards by town councils or select vestries. We think that, as the schools are to be supported, at least in part, by local rates, the boards should be elected by the ratepayers, each ratepayer voting by ballot, and with but one vote for each member of such board. We object to the uncertainty introduced by the permissive nature of the compulsion recognised by the Bill. We desire the principle of compulsion to be laid down by the authority of Parliament, and not left to the accidents of local caprice or prejudices. We object that the Bill, while it provides for the levying of rates in aid of education, does not also provide that the education should be free to all, but makes it needful for the very poor practically to declare themselves paupers before they can obtain for their children the educational benefits which the State provides. The clauses, however, to which we most object, and against which we most protest, are those referring to religious teaching in the proposed schools. We had hoped that the Government's policy with regard to the Irish Church, so emphatically endorsed by your constituents as well as by the nation at large, would have been taken as a guide in framing those clauses, and that special pains would have been taken to apply no money, whether from national or local resources, to the direct or indirect advancement of any religious sect or party. We are sure that to leave the question of denominational teaching to the decision of school boards is to provide causes of serious contention and of grave scandal, all the more hurtful to national morality that these will be aroused and repeated yearly in the sacred name of religion."

These objections having been urged with considerable force by members of the deputations, Mr. Forster replied at length. He asserted that there would be immediate action on the part of the Bill, and explained the nature of it. He defended the election of school boards by the town councils, who would, he thought, do their duty efficiently, and in whom he had great confidence, but still he thought this was not a matter of vital importance. With regard to the second question, Mr. Forster announced that he was now convinced that we must rely for the future very much on the principle of direct compulsion. But although he had changed in this matter, he did not believe that it was yet the opinion of the majority of the country, and he thought it doubtful whether the proposal would meet with the acceptance of the House or of the country when carried; and he felt that this was eminently a matter in which those who advocate compulsion must take care not to go before the feelings of the country. He went on to say:—"What has actuated the government in bringing forward the measure as it stands was this, that believing the principle had a great deal of truth and force in it, we do enable districts to carry it out in the belief that those districts which carry it out would do this so well that the principle would obtain much greater favour before the public, and it would be possible, after having tried this experiment, to apply it to the whole country; whereas, if we were wrong in the matter, we could acknowledge our mistake, and try to do without direct compulsion. I have very little doubt, if the Bill passes as it stands, Manchester would put the compulsory principle in force, and I believe that if Manchester would take it in hand, it would work so well as to tempt other places to follow the example, and also give the government power, by the support of public opinion, to apply it over the whole country." In reference to the third question, that of free schools, Mr. Forster said his chief argument in favour of the government proposal was, that the parents generally throughout the country are able to bear part of the cost, and that he thought it would be a very bad thing if the government of the country were to relieve parents of all direct pecuniary responsibility in the education of their children. Besides, if the parents did not contribute at all to the cost of their children's education, the additional charge upon the Exchequer would be enormous. With regard to the last objection, bearing upon the religious question, Mr. Forster said:—"On this question I really cannot do more than just explain the principles upon which the Bill was brought forward. The first of these principles was, that the State, meaning by the State the Imperial Government, should not in any way interfere in religious education. That is carried out in this Bill as it was in those Bills that Mr. Bruce and I brought forward in 1867 and 1868, and if anything it is more carried out in this Bill, because here we have at once done what we only contemplated carrying out in the previous Bills—we have abolished the religious inspection of Church schools, and consequently no money of the State can be paid for finding out whether any religious teaching be given or not. But while we think it right to carry out this principle, we would not prevent any parents who wished it from having religious teaching given to their children by the same schoolmaster and in the same school as the other teaching is given." With respect to

the proposal to leave to the school boards the power of determining the kind of religious instruction to be given in rate-aided schools, he added that the objections raised on this point "deserve the best attention, and the government are prepared most closely to consider them in committee."

The *Times*, commenting on Mr. Forster's explanations, says in reference to the objections raised by the Nonconformists:—"These objections may be expressed in a single phrase—'Church rates over again.' It is vain to ignore the influence of this prejudice, or to disguise the fact that, as the Bill now stands, there are sufficient grounds, not, indeed, to justify such a cry, but to render it dangerous. The Bill proposes to leave to school boards complete liberty to decide whether any or what religious instruction shall be given in the schools under their charge, and it protects the consciences of parents by giving them the right to withdraw their children from the religious instruction. It was objected that, under this system, all parishioners might be required to pay rates for training children in the strictest ecclesiastical or Nonconformist dogmatism. It is perfectly true the Churchman or Dissenter could withdraw his own child. But, in precisely the same way, the Dissenter was not compelled to go to church, and yet he agitated successfully against being compelled to pay rates for the advantage of those who did attend. There are, no doubt, great differences between the two cases. The church-rate was contributed for religious purposes alone; the main purpose of the school-rate is to promote objects equally desired by Churchmen and by Dissenters. Still, these are differences of degree, and, if the point be pressed, it cannot be denied that the principle conceded in church-rates would be infringed by the proposed arrangement. . . . . How has Mr. Forster hitherto met this difficulty. He simply substitutes another conscience clause, rendered more effective by the application of a time-table. But it is evident this merely renders it more difficult for the Dissenter to be compelled to go to church. It does not relieve him from the obnoxious burden of supporting Church teaching. It is beside the real difficulty."

A very influential meeting of the Roman Catholic laity was held, by the special invitation of the Duke of Norfolk (who presided), at Norfolk-house, on the 13th instant, at which the leading Catholic peers and gentry were present. Lord Howard of Glossop proposed a resolution to the effect that the future of primary education in this country is such as to cause the greatest anxiety to all friends of religious instruction. This was seconded by Mr. Weld Blundell, who advocated the continuance of the denominational system. A committee was afterwards appointed to aid the Catholic clergy in their educational efforts.

On the evening of the same day, a large meeting, called to give the Nonconformist community an opportunity of expressing opinions on the Government Bill, was held in St. James's Hall. Mr. W. M'Arthur, M.P., presided. The first resolution passed was to the effect that, while cordially recognising the value of the amendments proposed by Mr. Forster to be introduced into the Bill, they feel "compelled to express their conviction that, so long as under its provisions any classes may be required to pay rates for the teaching of religious tenets from which they dissent, the Bill cannot have the approval of Nonconformists." The second resolution, which its mover regarded as only a concession, was:—"That considering that a number of denominational schools have been called into existence under the minutes of the Privy Council, this meeting does not urge the withdrawal of the grants they at present receive, but deprecates any extension of the denominational system of education at the cost of the State, and heartily approves of the application of the time-table conscience clause to those schools, and of the abolition of all inquiries on the part of the government inspector into the religious teaching given in them." This was passed, but not with unanimity. The third resolution was:—"That in relation to schools established or aided by local school boards out of the rates, this meeting believes that the difficulties of the case may be met by prohibiting the use therein of any religious catechisms or formularies, or the teaching of anything in opposition to or in support of the tenets of any sect—this prohibition not to apply to the use of the Holy Scriptures; but such use, wherever adopted, to be under the regulation of the time-table conscience clause, so that the attendance of any child at such Bible lessons shall not be compulsory." This was seconded by Mr. Spurgeon, who declared himself entirely opposed to local boards as school authorities, such bodies always becoming mere "bumbledom." He was also entirely opposed to a school without the Bible.

A special meeting of the deputies of the three denominations of Nonconformists was held on the following day, at the City Terminus Hotel, to consider the amendments to the Bill, and the present position of the question. Mr. Charles Reed, M.P., presided. The principal resolution, which, however, was only passed by a small majority, urged the objections, first, that the Bill will still leave the religious teaching in new schools to be determined by local boards; and secondly, that it will perpetuate and extend denominational management and teaching, and will compel ratepayers to support the teaching of contradictory religious beliefs; "that they are further of opinion that while, as a matter of equity, existing schools partially supported by Parliamentary grants alone may, subject to an effective conscience clause, continue to maintain their present religious character, the only principle which Nonconformists can consistently sanction in regard to schools supported to any extent by local rates is, that all religious teaching given to the children of such schools should be supplied by voluntary effort."

Meetings of Nonconformists have also been held in Manchester, Liverpool, Romsey, Stafford, Cambridge, and other places, at which similar views were generally expressed.

On Tuesday night last, a crowded meeting, convened by the Working Men's Educational Committee, was held in Exeter Hall, to consider the provisions of the Bill. The chair was taken by the Rev. C. H. Spurgeon. The first resolution, proposed by Mr. Cremer, carpenter, and seconded by Mr. Guile, iron-founder, was—"That this meeting, knowing from sad experience the want of proper educational provision for the people, regrets that the Government Bill, even in its amended form, does not supply that want; and this meeting records its deliberate conviction, founded on such experience, that the educational wants of the country cannot be supplied, except by the establishment in every parish or district of free schools, at which attendance shall be compulsory, and the teaching entirely free from anything of a sectarian character. But while this meeting strongly protests against the reading or teaching of any creed, catechism, religious dogma, or formulary of any kind, in any national schools, it has no wish to prevent the reading of the Bible at such schools, provided that it be left to the parents or guardians of each child to decide whether they shall attend the class for Bible reading or not." An amendment was moved to the effect "That it is needful to enact that no catechism, or creed, or Bible reading, or teaching, or clerical influence shall be allowed in any national school supported by national rates," but this received hardly any support, and the original resolution was carried. The other resolutions were to the effect that school boards be established in every district immediately after the passing of the Bill, and that it be "imperative on such school boards to enforce the attendance at the national schools of every child who is not elsewhere receiving a satisfactory education."

At the annual meeting of the National Society for Promoting the Education of the Poor in the Principles of the Church, held on Wednesday, at Willis's Rooms,

the Archbishop of York in the chair, the speakers, if not unanimous on all points, appeared thoroughly impressed with the gravity of the crisis, and the resolutions were carried without a single dissentient. There was entire concord as to the acceptance by the society of the conscience clause contained in Mr. Forster's Bill on the second reading. This position was again and again affirmed by every speaker, unless Lord Redesdale is to be excepted, and there was at least equal unanimity in uncompromising opposition to the modifications in it that have since been adopted.

On the same afternoon, a general conference on the subject of the present aspect of the education question was held in another room at the same establishment, the council and delegates from branches of the League meeting to consider the "critical position now reached in the education debate." The chair was occupied by Mr. George Dixon, M.P., who also presided at a great meeting held in the evening in Exeter Hall, which was completely filled. Among those present were the Hon. Auberon Herbert, M.P., Mr. W. Morrison, M.P., Mr. H. Winterbotham, M.P., Mr. W. Shaen, Dr. Rutherford, and Mr. Fawcett, M.P. The first resolution, proposed by the Hon. A. Herbert, was in favour of "the general and immediate establishment of elected school boards, compulsory attendance of children at schools, free admission, and undenominational teaching in all schools maintained or aided by local rates;" and the second condemned the amendments proposed to be introduced by the government in the Bill as "wholly insufficient to meet the requirements of the country, as expressed in public meetings and petitions," and urged "that unless further amendments are introduced, it would be desirable to postpone further legislation until a future Session."

MEAT PRESERVING.

By John Blackbourn.

A great waste of meat has been for some time going on in Australia, and the demand for a greater supply in England has been the means of establishing meat-preserving companies, so that now, instead of thousands of sheep being boiled down for their fat alone, the meat is sent here. The Melbourne Meat Preserving Company, whose works I visited in January last, cannot keep pace with the demand. The Victoria Meat Preserving Company send the meat home in tallow, but the Melbourne Meat Preserving Company exhaust the air from tin cases. Their works are situated at Foot's Cray, about four miles from Melbourne. It is at present the largest establishment of its kind in Victoria. The company manufacture everything on the spot, even their tins and packing-cases. Besides cattle, they kill six hundred sheep every twenty-four hours; once the number reached one thousand. The meat is separated from the bones, which go to make excellent soups. Look in at the slaughter-house; the pens at the back are full of sheep waiting to be killed. About twenty men are killing and skinning as fast as they can, everything being done by piece-work. The heads are severed, the tongues preserved, and the carcases are carried to a block, where a man with an axe separates the legs; these are put into a truck and carried to the preserving-house, the rest is chopped up and sent to the boiling-house, where upwards of seventy tons of tallow per week are turned out. There is no waste; everything save the blood is used, and that is run into the river. The company are endeavouring to buy a piece of ground adjoining the works, so as to use the blood for manure, but the owner will not come to terms. Here, adjoining the slaughter-house, is a large pig-yard, where upwards of three hundred of these animals are fed. They are very profitable. When I made the remark that I should be sorry to eat the pork, the reply was, "Oh, they do for Chinamen."

The company have an abundant supply of water from the Jan Jean; they have also a large vegetable garden. Tramways and machinery extend all over the ground. Above one hundred hands are employed. The company is about to build a number of cottages for the men; at present there is a lodging-house on the ground. Although a large extent of ground is covered, not a horse is required, the works being situated by the side of the Salt Water River. The company's tug and barges load and unload at a wharf alongside. Mr. Purchase is the engineer and architect to the company; he met me on the ground, and explained very fully; he has some very clever contrivances for working the trams and hoists.

The preserved meats are used largely in Victoria, and are valued much when other meat would not keep, as well as on board ship. We had it in the ship I returned home by (*Loch Ness*), and it was very much liked. Meat is cheap. At the Eastern Market I have seen three good legs of mutton offered for one shilling, and, although numbers were standing round, no one would buy; half a sheep will fetch one shilling and sixpence.

CORRESPONDENCE.

THE SUEZ CANAL.

Sir, — The arguments and views of Professor Haughton, as expressed in his paper read at a meeting of the Royal Geological Society, and reported in your *Journal* (p. 647), on the subject of the "Probable Geological Effects of the Permanent Opening of the Suez and Darien Canals," are neither convincing or conclusive. The opening of the Suez Canal is no interference with nature, more than any other of the operations upon the surface of this globe which have been carried out for some thousand years. The Suez Canal does not form a communication between two great oceans, but merely unites two inland seas, whose only connections with the ocean are through the Gut of Gibraltar and the Straits of Babelmandel. The professor's idea that the isthmus or barrier has been built up by the meeting or conflict of strong currents is contradicted by the fact of the existence of rock at the Suez end of the canal, which will be kept clear and even enlarged by those same strong currents whenever rocky impediments shall be completely removed.

A prejudice has existed in all times against the cutting, on account of the flat shores and shoal water at both ends, so that all attempts, from the time of Sesostris downwards, to form a water passage, have been to cut a canal from the Nile, at or near Cairo, to Suez or Kolzoum, which, of course, could never be kept open from the total absence of current, though some remains of such works are still discoverable. The object of Professor Haughton seems to be that of confirming that prejudice, but when a free current shall be established, and the entrances protected into deep water by means of rock barriers on one or both sides, all difficulties to the entrance of the largest ships will entirely disappear.

I see it stated that the Nile sand percolates into the cutting through the breakwater already laid down; but, in the first place, I doubt the fact; and, in the next, such percolation is readily prevented by throwing down rubble on that side, where it cannot be carried into the channel. That the strong currents alluded to by the professor will take place there is not the slightest doubt, because high water in the two inland seas depends upon the prevalence of southerly or westerly winds, which never take place at the same period of time, neither is there any doubt that, when completed, the Suez Canal will be a perfect success.

With regard to the isthmus of Darien, the cutting, though much shorter, is impracticable, on account of the mountain ridge that forms the backbone of *terra firma* at that part, and the cutting, if attempted, must be made

much higher up, and nearer to Mexico. But if once formed and freed from rock, the canal would ultimately become wide straits like the Gut of Gibraltar, where no shoals or sandbanks are ever formed, and where the current is always inwards, to supply the waste by evaporation of the Mediterranean, a loss which all the rivers flowing into it cannot replace.—I am, &c.,

Henry W. Reveley.

Reading.

SPELLING REFORM AND WEIGHTS AND MEASURES.

Sir,—A passage in the *Panama Herald* has recalled to my mind the observations I made at our meetings on the necessity of co-operation between all branches of our nation on any national institution. The *Herald* observes, in reference to the revision of the Bible, that this should not be undertaken without the co-operation of American representatives, for although when the translation was made the nation was one and undivided, it now consists of two great bodies in England and the United States. This is a reason why, with regard to spelling reform, as it is called, I recommended that no action should be taken without an invitation to those interested in the United States and our great colonies.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W., 11th June, 1870.

PRESERVATION OF MEAT.

Sir,—The accompanying certificate refers to some meat preserved by the stearino process. This meat, upwards of 1 cwt., was prepared in the beginning of February last, and was not packed till the end of that month. After filling two cases, there was some over. One piece was sent to the Society of Arts' house, and was there cooked and tasted, and I do not think you will find that any peculiarity of flavour is recorded. The remaining pieces were sent to Mr. Weatherdon, 77, Chancery-lane, who states that they were eaten and relished; this was at the end of March, the time when the cases sent to Buenos Ayres were due. It seems important to me to make this distinction, that the meat was not injured by the preservative, but by the packing. Both cases were filled with meat from the same animal, preserved at the same time, and by the same process. The pieces of meat were put into the cases indiscriminately. In one case bran, previously dried and mixed with salt, was used; in the other, lumps of lime. Each piece of beef was wrapped in several papers, to prevent contact with the salt or lime. The two cases were then put into a larger one, and, unfortunately as I think, had to be sent to Falmouth. The motion of the train may have been unfavourable; the hard pieces of quick-lime, it appears, turned to "flour of some sort." In the other case, the salt, used to preserve the bran, can hardly be supposed to have penetrated the papers and salted the meat; it might have been tasted and mistaken in part for the preservative. I dwell on the materials used for packing viands, as hitherto considerable difficulty has been experienced—even fruit, eggs, &c., have been found to taste of the packing,—and although beef may be brought from the River Plate in 30 days, that is half the time this meat was kept in the cases, still it is very important that some material be used that cannot impart flavour or otherwise injure the meat.

We now hope to be able to bring meat over from Buenos Ayres, &c., and think it right that the public should know every step of the procedure, or be assured that the preservatives are simple, clean, and harmless. The process alluded to as "stearino" is little more than causing the fatty acids to be absorbed by meat; the preservative is bland, and probably acts mechanically, though its introduction is brought about by chemical means.

The account of this experiment may be interesting to the readers of the Society's *Journal*. Previous to another attempt, I shall be happy to hear any suggestion respecting the packing of meat in foreign countries.—I am, &c.,

W. Estor.

14, Vicars-road, Haverstock-hill, N.W.

"I certify that, at the request of Senor Don Federico Terrero, I was present at the rooms of the Rural Society of Buenos Ayres, at the opening of a case of preserved meat shipped in England, by the steamer *City of Brussels*, on the 1st March, 1870, by Senor Don Mariano Terrero, and that the result of my personal inspection was as follows:—

"The case contained two boxes, one with beef packed in bran, and covered with paper, the condition of which was good. The colour was rather dark, and the general appearance, smell, and taste, that of meat dried by smoke and some salting mixture.

"The other case contained beef packed in flour of some sort; portions of this were putrified, and the general condition bad.

"Frank Parish, H.B.M.'s Consul.

"British Consulate, Buenos Ayres,
"29th April, 1870."

MEETINGS.

The East India Association, by permission of the Council, held a meeting in the Great Room of the Society, on Wednesday, June 15th, at half-past 3 o'clock p.m., when a paper was read by **Iltudus T. Prichard**, Esq., entitled "Indian Finance." **W. S. Fitzwilliam**, Esq., presided.

EXHIBITIONS.

Industrial Exhibition in India.—In the province of Guzerat, Bombay, an exhibition devoted mainly to cotton in all its states, from the raw product to the most highly-finished manufactures of the loom and the needle, has just closed. It was situated at the town of Broach, celebrated for the excellence of its cotton wares, and its creation and successful conduct were due largely to the exertions of an Englishman, Mr. Greaves. Pecuniarily, no profit arose from the exhibition; but the receipts balanced the expenditure, and nothing is owing to anybody concerned except a heavy debt of gratitude to the gentleman named. Fifty-one medals have been forwarded to Broach for presentation to the exhibitors.

Russian Industrial Exhibition.—This Exhibition was formally opened at St. Petersburg on the 27th ult., and proves that Russia has also greatly advanced in metallurgy during the last few years. The time is past when Russia used to export her best iron to have it worked in Sweden, in Germany, in England. She exhibits rails, locomotives of immense proportions, ship armour of a prodigious thickness, rifled steel guns on a most improved system, &c. The internal arrangement is somewhat similar to that of the Paris Universal Exhibition of 1867. It begins with the approaches of the building, the principal entrance of which is through the Fontaka Quai. As those approaches are somewhat small, two bridges have been temporarily thrown over the Lebiagy Canal, and connect the Champ de Mars with the Summer Garden; another bridge connects that garden with the building. A large flight of steps leads to the Exhibition. The Imperial saloon is on the left of the principal entrance; the telegraphic office on the right. The visitor passes through a turnstile, and is at once dazzled by an immense number of small glazed kiosques, resplendent with precious stones, and gold and silver plate. Yonder appears the oasis of the Exhibition, a most delicious garden growing in open air, and encased in the centre of the large central court.

If he turns to the left, around the small garden leading to the Imperial saloon, he finds a complete collection of precious metals and Russian coins. A little further there are rails of Poutikof, disposed very much like the arms which ornaments the guards' room at Hampton Court. Also on the left there is the court of agricultural implements, which leads to a gallery surrounding an immense space below, in which a large number of steam machines are at full work. In the gallery are exhibited the collections of the Imperial navy, of the Technological School, and of the Russian Steam Navigation Company of the Black Sea. Beyond that gallery is the exhibition of the War Department, as complete as the one of Woolwich, beginning with a Lilliputian revolver, and ending with a model of the monster cannon now in course of construction at the Votinsky Works; it is fitted with a powerful machine to lift and introduce a huge ball into the muzzle of that frightful war contrivance. From thence extends a long gallery, running along the whole back part of the Exhibition; in that gallery are collected specimens of all the kinds of coal found in Russia. Then there are splendid town and travelling carriages, lines of railway carriages having powerful locomotives in front, and several specimens of field hospital waggons with all their accessories.

GENERAL NOTES.

Woodbury Type.—The patent for printing photographs by a permanent process, known as the Woodbury type, has been purchased by Mr. Vincent Brooks, of Gate-street, Lincoln-inn-fields, on behalf of a new company.

The Warwick Violin at South Kensington.—One of the most perfect specimens of the electrotypist's art yet executed has been lately placed among the collection of South Kensington. In the same case with a huge wine fountain, with its concomitant cistern, stands what to the majority of visitors will no doubt appear to be a carved wooden violin. Close inspection reveals the fact that the material is metal, the wooden appearance being effected by brown varnish, but leaves unabated our wonder at the skill—and let us add the daring—which could venture to subject such delicate wood carvings to the process of moulding. The original object, which may be seen thoroughly uninjured in another part of the court, belongs to the Earl of Warwick, and has long been known for its singularity of form and richness of decoration. It has been figured and described in Sir John Hawkins's "History of Music." The descriptive label attached to the two objects assigns to the original the date of 1330-40, with additions made in 1579. Despite the minuteness of this statement, and admitting that the foliage with which the sides are covered much resembles the Gothic spandrels of the fourteenth century, we have great doubts whether, at that early period, such delicate carving had been applied to musical instruments, and can trace no evidence whatever of subsequent additions to the original design. The decorations all adapt themselves with accuracy to the irregular outlines of the form, and the combined evidence of the shields of Queen Elizabeth and of Leicester on the silver-gilt plate of the neck, the *habitat* of Kenilworth Castle, and the date which we presume to exist somewhere, all induce us to consider this unusual variety of the *genus* fiddle to be a work of the sixteenth century. The metallic copy, which has been duly stringed, has, we are informed, a better tone than its prototype; but, as Sir John Hawkins speaks very unfavourably of the latter, the praise is not excessive, and the claims of both instruments to admiration will rest on their unquestioned beauty rather than on any problematical musical usefulness. This electrotype is the work of the well-known artist-worker Giovanni Franchi.

The Boarding out of Pauper Children, England.—From the reports of the various Poor-law Inspectors, in reply to a certain circular of the Poor-law Board, it appears that this system has been already adopted by the following Unions, viz.:—Altrincham, Bath, Berwick-upon-Tweed, Caistor, Chorlton, Christchurch (South Hants), Colchester, Dartford, East Preston, Eton, Eversham, Garstang, Highworth and Swindon, Horncastle, Leominster, Ludlow, Macclesfield, Merthyr-Tydvil, Ringwood, Swansea, and Warminster; and the Guardians of the following Unions, viz., Carlisle, Pottersbury, Warwick, and St. Ives, have since determined to adopt the system.

Education in Ireland.—The thirty-sixth report of the Commissioners of National Education in Ireland, just issued, shows that at the close of 1868 there were 6,586 schools in operation, which had on their rolls for the year ended 967,563 children, with an average daily attendance for the same period of 354,853. At the close of the year 1869, the number of schools in operation was 6,707. The total number of children on the rolls within the year was 991,335, and the average daily attendance of children for the year was 358,560. There has been, therefore, an increase of 23,772 on the rolls, and of 3,707 in the average daily attendance. During the last year an increase has been made of 121 schools, and schools are in course of building which will afford accommodation to 14,000 more children. The total expenditure for the year was £415,864.

The Halfpenny Postage.—The bill for further regulation of duties of postage, and for other purposes relating to the Post-office, has just been published. For the purposes of the Act, the Channel Islands and the Isle of Man are to be deemed parts of the United Kingdom. The Act will come into force on the 1st of October. Allowance will be made for stamps to those who at that time may be in possession of them. Any publication coming within the following description shall, for the purposes of the Act, be deemed a newspaper (that is to say) any publication consisting wholly or in great part of political or other news, or of articles relating thereto, or to other current topics, with or without advertisements, subject to these conditions:—That it shall be published in the United Kingdom; that it shall be published in numbers at intervals of not more than seven days; that it be printed on a sheet or sheets unstitched; that it have the title and date of publication printed at the top of every page. The proprietor or printer of any newspaper may register it at the General Post-office in London, at such time in each year, and in such form, and with such particulars as the Postmaster-General from time to time directs, paying on each registration such fee, not exceeding five shillings, as the Postmaster-General, with the approval of the Treasury, from time to time directs. On and after the 1st of October, 1870, registered newspapers, book packets, pattern or sample packets, and post cards may be sent by post in the United Kingdom, at the following rates of postage:—On a registered newspaper, not exceeding, with any supplement, and with any cover, six ounces in weight, one halfpenny. On a book packet, or pattern or sample packets, if not exceeding two ounces in weight, one halfpenny; if exceeding two ounces in weight, for every additional two ounces, or fractional part of two ounces, one halfpenny. On a post card, one halfpenny. The Treasury may, from time to time, by Treasury warrant, allow any newspapers and periodical publications, British, colonial, and foreign, to be sent between the United Kingdom and places out of the United Kingdom, whether through the United Kingdom, whether through the United Kingdom or not, at such rates of postage not exceeding twopence for each newspaper or publication, irrespectively of any colonial or foreign postage, and on such conditions as they think fit, and according to Post-office regulations to be from time to time made in that behalf.

Rhea Grass Fibre.—Upwards of one hundred varieties of machines for the preparation of rhea grass fibre are being sent (according to a telegram from Calcutta) for the government prize competition.

Suspension Bridge.—In 1805, Mr. J. Raffield exhibited at the Royal Academy "a design for a suspended bridge over the Danube, at Vienna, with a double passage for carriages, and a promenade."

Telegraphic Communication.—It is understood that application has been made for letters patent for constructing a cylindrical iron kerb for reception, repairing, and maintaining telegraph wires, to be of the same external form and size as the stone kerb now in use. Should this, in the opinion of practical men, be available, it must be a means of extending telegraphic communication, and prove of great public utility and economy, by preventing the constant necessity of taking up the roadways and pavements.

Lighting-up Beacons and Buoys by Electricity.—Mr. Fleeming Jenkin has discovered and patented a new method of lighting the beacons and buoys on the sea-coast by electricity, giving a bright, permanent, and unmistakable light to guide the mariner and preserve him from treacherous rocks and shoals. The light is produced by a rapid succession of sparks, due to successive charges and discharges of a condenser situated upon the beacon or buoy. This is charged directly with a voltaic battery, without the intervention of an induction coil. The communication is made by means of submarine wires, running from the shore to the beacon or buoy, and can be operated thoroughly by parties on shore. The invention is considered in all respects practicable; and it is certainly to be hoped that it is so, and we hope to see it adopted on the dangerous parts of our coast, as one of the means of rendering less the dangers of the seas.

The New Vine Disease in France.—This disease is exciting considerable attention, on account of the alarm it has created. A couple of reports lately published by the Société des Agriculteurs contain some interesting, but confessedly incomplete particulars of this new disease, respecting which it is important our own cultivators should be informed as far as possible. Certain premonitory instances of the malady, it is said, were noted in 1866 and 1867, but it was not until the summer of 1868 (a season, it will be remembered, of remarkable heat, following upon a severe winter) that the evil assumed proportions, the magnitude of which has been steadily increasing ever since. At present it is confined to two districts—viz., the valley of the Rhone and the department of the Gironde. In the latter, the damage is of limited extent. The Medoc country has escaped altogether; but in the former the results have been truly deplorable. The crops have been reduced to one-tenth of the average of former years. On the right-bank, certain districts have hitherto escaped; but on the left, which possesses a different geographical conformation, wide plains and valleys watered by numerous streams, the disease has been almost universal. Out of 60,000 acres in Vaucluse, 20,000 have been utterly ruined. Many proprietors (including some of the most skilful, the prize growers of these districts) have been compelled to abandon the culture within the last twelve months. Around Bouquemard and in Le Gard entire vineyards have been grubbed up, and the sticks sold as fuel at 4d. per cwt. (82c. per 100 kilos.) It is a curious fact, that the greater the distance from the banks of the streams, the less severe the ravages appear to be. Everywhere the symptoms are identically the same—healthy plants die off suddenly without any apparent cause, the stems turn black, the leaves fade and drop off, and close examination shows that the roots are rotten throughout. The whole of a vineyard is not attacked at once; the disease appears to establish itself in a number of independent centres, from whence it radiates rapidly in all directions, until the entire area is infected.

A New Anodyne.—Dr. Oscar Liebreich, to whom we owe protagon and the now well-known chloral, is said to have discovered a new anodyne, to which the name of chloride of æthylide *(Æthylidenchlorid)* has been given. This substance is said to be more rapid and agreeable in its effects than chloroform, and has been repeatedly used, with perfect success, in the clinical hospital of Dr. Langenbeck. Its chief merit is that it can be administered without interfering with the free and natural breathing of the patient. Its effect being transient, the dose must be repeated in a lengthened operation.

Speed of Electric Signals. — Professor Gould has found that the velocity of the electric waves through the Atlantic cables is from 7,000 to 8,000 miles per second, and depends somewhat upon whether the circuit is formed by the two cables or by one cable and the earth. Telegraph wires upon poles in the air conduct the electric waves with a velocity a little more than double this; and it is remarked, as a curious fact, that the rapidity of the transmission increases with the distance between the wire and the earth, or the height of the support. Wires buried in the earth likewise transmit slowly, like submarine cables. Wires upon poles but slightly elevated transmit signals with a velocity of 12,000 miles per second, while those at a considerable height give a velocity of 16,000 or 20,000 miles.

Dutch Education. — Under the Dutch system, the local authorities have also to provide infant schools for children between the ages of two and six. It would be difficult to find a more pleasant sight than that which one of these schools presents. The little children are taught their letters, singing, and a simple drill, and every effort is made to amuse them. When I entered the room, the teacher was telling tales about various animals which she had drawn on the black board. The authorities supply these schools with toys, dolls, models of different animals, and other things for amusement and instruction. I noticed a large case, containing samples of corn, rice, starch, tea, coffee, cloves, oats, peas, &c., &c., and the children were taught to know and to find each article by its name.—*National Education League Monthly Paper.*

MEETINGS FOR THE ENSUING WEEK.

Mon......R. United Service Inst., 8½. Discussion on Capt. Hoseason's paper on "The Necessity for an Extension of our Naval Transport Fleet for Military Purposes."
Asiatic, 3.
London Inst., 4.

Tues ...Statistical, 8. Mr. W. E. A. Axon, "On Free Libraries."
Ethnological, 8½. (Special Meeting at the Royal United Service Institution.) Mr. David Forbes, "On the Aymara Indians of Bolivia and Peru."

Wed ...Geological, 8. 1. Dr. H. A. Nicholson, "Notes on the lower portion of the Green-slates and Porphyries of the Lake District." 2. Mr. R. Brough Smyth, "Succinct Observations on some Vegetable Fossils." 3. Mr. J. W. Hulke, "On Plesiosaurian Remains from Kimmeridge Bay." 4. Rev. T. G. Bonney, "Notes on the Geology of the Lofoten Islands." 5. Messrs. Albany Hancock and Richard Howse, "On *Dorypterus Hoffmanni*, Germar, from the Marl-slate of Midderidge, Durham." (Communicated by Prof. Huxley.) 6. Commander Kerr, R.N., "Notes on Ice-marks in Newfoundland." (Communicated by the Royal Geographical Society.) 7. Mr. C. E. De Rance, "On the Glacial Phenomena of Western Lancashire and Cheshire." 8. Mr. C. E. De Rance, "Post-glacial Deposits of Western Lancashire and Cheshire." 9. Rev. W. Bleasdell, "Observations on Modern Glacial Action in Canada." (Communicated by Principal Dawson.) 10. Mr. G. W. Stow, "On some points of South African Geology." (Communicated by Prof. T. Rupert Jones.) 11. Rev. J. M. Mello, "On an altered Clay-bed and Sections in Tideswell Dale, Derbyshire." 12. Mr. James Wood Mason, "On a new Reptiliferous Bed in the Great Oolite in Oxfordshire."
R. Society of Literature, 8½.
E. India Assoc., 3½. (AT THE HOUSE OF THE SOCIETY OF ARTS.) Sir Bartle Frere, "On Indian Public Works."

Thur ...Royal Society Club, 6½. Annual Meeting.
Statistical, 4. Annual Meeting.

Fri ......R. United Service Inst., 3. Col. Gerald Graham, "On Shelter Trenches."
Quckett Club, 8.

Sat ......R. Botanic, 3¾.

Journal of the Society of Arts.

FRIDAY, JUNE 24, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

INDIA COMMITTEE.

This evening (Friday, 24th inst.) a conference will be held on the subject of overland routes between India, Eastern Thibet, Assam, and China. The conference will be opened by Mr. T. T. Cooper.

ANNUAL GENERAL MEETING.

The One Hundred and Sixteenth Annual General Meeting, for the purpose of receiving the Council's report, and the Treasurers' statement of receipts, payments, and expenditure during the past year, and also for the election of officers, will be held, in accordance with the Bye-laws, on Wednesday next, the 29th of June, at four o'clock, p.m.

The Council hereby convene a Special General Meeting of the Members of the Society to ballot for members, such meeting to take place at the close of the Annual General Meeting.

By order,

P. Le Neve Foster, *Secretary.*

Society's House, Adelphi, June 20, 1870.

FINANCIAL STATEMENT.

The following statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye-laws, which provides that, at the Annual General Meeting, the Council shall render to the Society a full account of their proceedings, and of the receipts, payments, and expenditure during the past year; and a copy of such statement shall be published in the *Journal* of the Society on the Friday before such general meeting:—

TREASURERS' STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING MAY 31st, 1870.

Dr.

	£	s.	d.	£	s.	d.
To Cash in hands of Coutts and Co., 31st May, 1870	569	12	11			
Do. do. Secretary	6	1	9			
				575	14	8
To Subscriptions received during the year, from Members and Institutions in Union	5,606	6	5			
Life Contributions	333	18	0			
				5,940	4	5
To Dividends on Stock:—						
Consols, £4,746 19s. 5d.	139	9	0			
Do. North London Exhibition Trust £167 7s. 3d.	4	18	2			
Reduced 3 per cent., £134 8s. 6d. ...	12	15	2			
To New 3 per cents.:—						
Dr. Fothergill's Trust, £388 1s. 4d. ...	11	8	0			
India 5 per cent. Notes, 52,000 Rupees ...	251	11	7			
				420	1	11
To Examinations:—						
Royal Geographical Society's Prizes ...	10	0	0			
Royal Horticultural Society's Prizes ...	46	0	0			
Tonic Sol fa Association	8	0	0			
Mrs. Chester, Prize	5	0	0			
T. Twining, Esq., Prize	5	0	0			
The Bishop of Exeter, donation to Examination Fund	5	5	0			
Candidates's Fees	6	18	0			
				86	3	0
To Sale of Books, etc.:—						
Sale of Photographs, Examples to Art Workmen	14	2	9			
Sale of Books	7	3	7			
Sale of *Journal*	44	1	3			
				65	7	7
To the Prince Consort's Prize	26	5	0			
House and office	3	0	0			
South Australian Institute	500	0	0			
Educational Reports (General Eardley Wilmot)	15	0	0			
				544	5	0
				7,631	16	7
Overpaid by S. T. Davenport				3	10	6
				£7,635	7	1

Cr.

	£	s.	d.	£	s.	d.
By House and Premises:—						
Rents, Rates, and Taxes	243	13	2			
Insurance, Gas, Coal, and House Charges	234	3	1			
Repairs and Alterations	74	5	10			
				552	2	1
By Office:—						
Salaries, Wages, and Commissions ...	1,798	2	11			
Stationery and Printing	288	2	10			
Advertising	125	1	4			
Postage Stamps and Parcels	159	15	7			
				2,371	2	8
By *Journal*, including Printing, Stamps, and Distribution to Members	1,689	19	9			
Library, Bookbinding, &c.	197	5	8			
Conversazione	250	12	5			
				2,137	17	10
By Union of Institutions, including Examination Prizes, Postage, Stationery, Printing, &c.	882	4	11			
Art-Workmanship Prizes	82	4	10			
Society's Albert Memorial Medal ...	21	15	1			
				986	4	10
By Exhibition of 1871	2	8	5			
Exhibition of Prints	34	0	6			
				36	8	11
By Committees:—						
General Charges	43	15	6			
India Committee	100	4	10			
Musical Committee	3	13	0			
Artistic Copyright Committee ...	11	8	6			
Education Committee	177	15	3			
Tablets Committee	36	10	0			
Drill Committee	13	14	7			
Cab Committee	12	4	3			
Postal Committee	2	6	0			
Food Committee	38	15	1			
Science Conference	6	3	3			
Channel Steamers	2	18	9			
				449	9	0
By South Australian Institute	392	8	1			
Prince Consort's Prize	26	5	0			
				418	13	1
By Cantor Lectures				146	4	3
				7,098	2	8
By Balance in hands of Coutts and Co., 31st May, 1870				532	3	6
Do. do. Secretary... ...				5	0	11
				£7,635	7	1

Liabilities.

	£ s. d.	£ s. d.
To Sundry Creditors:—		
Sir W. C. Trevelyan (for Prize) ...	70 0 0	
John Murray (for Building Fund) ...	50 0 0	
Prince Consort's Prize	26 5 0	
Art-Workmanship Prizes	191 10 0	
North London Exhibition Trust ...	7 7 1	
Examination Prizes (Society's) ...	139 0 0	
Do. Metric Prizes by Lord Fortescue, and balance of donation by the Metric Committee of the British Association	7 0 0	
Do. Royal Horticultural Society ...	16 0 0	
Do. Royal Geographical Society ...	5 0 0	
Examiners Fees	168 18 0	
Education Report	15 0 0	
Food Committee	10 10 0	
Tradesmen's Bills	1,402 18 5	
South Australian Institute	175 16 4	
		2,285 4 10
By excess of assets over liabilities		3,117 9 1
		£5,402 13 11

Assets.

	£ s. d.	£ s. d.
By Reduced 3 per Cent. Stock, £434 8s. 6d., at 92¾	402 19 6	
Consols, £146 19s. 5d., at 94½ ...	138 17 8	
Invested in India 5 per Cent. Rupee Notes	353 11 6	
Subscriptions due and in course of collection, £2.226, valued at ...	1,780 16 0	
Barry's Pictures and other Property ...	2,000 0 0	
Prince Consort's Prize	26 5 0	
Royal Horticultural Society's Prizes ...	16 0 0	
Lord Fortescue (Metric Prize) ...	5 0 0	
Commissioners of Exhibition of 1871 ...	20 14 10	
Journal	1 5 0	
		4,745 9 6
Cash in hands of Coutts and Co. ...	532 3 6	
Do. London and Westminster Bank, on account of Sir W. C. Trevelyan's Prize	70 0 0	
Do. in hands of S. T. Davenport, on account of J. Murray's donation to a Building Fund	50 0 0	
Do. in hands of Secretary, Petty Cash	5 0 11	
		657 4 5
		£5,402 13 11

P. Le Neve Foster, *Secretary.*

Stock standing in the name of the Society at the Bank of England.

Consols	£4,914 6 8
New 3 per Cents.	388 1 4
Reduced 3 per Cents.	434 8 6
India 5 per Cent. Rupee Notes	Rs. 52,000

Trust Funds included in the above.

Swiney Bequest	£4,500 0 0	Consols, chargeable with a sum of £200 once in five years.
John Stock's Trust	100 0 0	,, chargeable with the Award of a Medal.
North London Exhibition Trust	167 7 3	,, chargeable with the Award of the Interest as a Money Prize.
Fothergill's Trust...	388 1 4	New 3 per Cents., chargeable with the Award of a Medal.
Cantor Bequest	5,049 9 7	Invested in India 5 per Cent Rupee Notes, 52,000 rupees.

The Receipts of the Society set forth above have been credited by Messrs. Coutts and Co.
The Payments set forth above have been made by authority of the Council.
The Assets, represented by stock at the Bank of England, and by cash balance at Messrs. Coutts', have been duly verified.

Society's House, Adelphi, 20th June, 1870.

George C. T. Bartley,
J. A. Franklin, } *Auditors.*

"JOURNAL" ADVERTISEMENTS.

The Council announce that they have entered into an arrangement with Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, with regard to the advertisements in the *Journal*. All communications on that subject must therefore, after the 24th inst., be addressed to them only.

LIBRARY.

The following works have been presented to the Library:—

Annual Report of the Adelaide Philosophical Society for 1869.

Report of the Special Commissioner of the Revenue upon the Industry, Trade, Commerce, &c., of the United States for 1869.

Report of the Bureau of Statistics of Labour, from the 2nd August, 1869, to 1st March, 1870, inclusive.

Statistics of the United States in 1860.

Manufactures of the United States in 1860.

Memorial of the Boston Sanitary Association to the Legislature of Massachusetts, asking for the establishment of a Board of Health and of Vital Statistics.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

ANNUAL CONFERENCE.

The Nineteenth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held on Wednesday, the 22nd instant, at 12 o'clock noon, in the Lecture Theatre of the South Kensington Museum. Lord Henry G. Lennox, M.P., Chairman of the Council, presided.

The following is a list of the Institutions and Local Educational Boards represented at the Conference, with the names of their respective representatives:—

Aberdeen Mechanics' Institution	Mr. Henry Ambrose Smith.
Battle Mechanics' Institution	Mr. Horace Martin.
Bromsgrove Literary and Mechanics' Institute......	Mr. R. P. Amphlett, Q.C., M.P. Mr. H. F. Vernon.
Burnley Mechanics' Institute	Mr. Richard Shaw, M.P. Mr. U. Kay-Shuttleworth, M.P.
Carlisle Mechanics' Institute	Mr. Edmund Potter, M.P. Sir Wilfred Lawson, Bart., M.P.
Crewe Mechanics' Institute..	Mr. George Pottie.
Derby Mechanics' Institute..	Mr. John Rickard. Mr. T. Coulthurst.

Derby Working Men's Association, and the St. Peter's Evening Schools	Mr. H. M. Holmes.
„ Local Board	Mr. H. M. Holmes.
Devonport Mechanics' Institute	Mr. J. D. Lewis, M.P. Mr. Radford. Mr. J. W. Ryder.
Epsom and Ewell Literary Institution	Mr. J. J. Carrey. Mr. G. M. Coppard. Mr. W. O. Reader.
Farnham and Aldershot Board	Mr. J. J. Bevan. Mr. Carnegie.
Gilford (Co. Down) Young Men's Mutual Improvement Society	Mr. George Benson.
Glasgow Institution	Mr. Alexander Craig.
„ Andersonian University Popular Evening Classes.	Mr. Colin Brown.
„ Tonic Sol-fa Choral Society	Mr. W. M. Miller.
Guildford Institute	Mr. E. Waller Martin. Mr. B. Ichet. Mr. Francis Whitburn.
Kendal, Christian and Literary Institute	Mr. C. L. Braithwaite.
Lancashire and Cheshire Union of Institutions	Mr. Alderman Rumney. Dr. R. M. Pankhurst Mr. Thomas Lawton.
Lockwood, Mechanics' Institution	Mr. R. J. Bentley. Mr. Josiah Berry.
London, Beauvoir College	Rev. John Curwen. Mr. Robert Griffiths.
„ Birkbeck Literary and Scientific Institution	Hon. Dudley Campbell. Mr. Thomas Lyle. Mr. J. Rigby Smith. Mr. George M. Norris.
„ City of London College	Rev. R. Whittington, Principal. Rev. J. G. Wrench. Mr. James Knight. Mr. J. H. Levy.
„ Lambeth Evening Classes, Hercules-buildings, S.E.	Mr. W. W. Jones. Mr. T. E. Heller.
„ Royal Polytechnic Institution	Rev. C. Mackenzie.
„ South London College	Mr. W. B. Bellars. Mr. W. Rossiter. Mrs. Rossiter.
South Staffordshire Educational Association	Mr. F. Talbot.
Southampton, Hartley Institution	Dr. Francis Bond.
Weston-super-Mare, Albert Memorial Night School	Mr. W. Mable.

There were also present :—

Lieut.-Col. H. Y. D. Scott, R.E.; Captain Donnelly, R.E.; Messrs. G. C. T. Bartley, John Blackbourn, William Botly, Charles Brooke, F.R.S., Edwin Chadwick, C.B., J. Chesman, Alan S. Cole, Henry Cole, C.B., William Gibson, A. C. King, W. Matchwick, C. Purling, H. Sandham, E. C. Tufnell, Henry Vaughan, James T. Ware, W. H. Whiffin, J. F. Wingate, and J. C. Witt.

The Educational Officer read the following

Report.

To the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—

1. It becomes my duty, as the officer of the Society entrusted with the educational department, to submit to the Council, for the information of the Conference, a report of the Society's proceedings during the past year, so far as they bear upon that branch of its operations.

2. The subject that naturally first claims your attention is the one more immediately interesting to the Institutions—the Society's system of Examinations. It will be remembered that a very important modification was made in the programme for 1870, as compared with those of former years. The Council decided to remove from it those subjects in which the Science and Art Department of the Government holds Examinations, which, as is well known, were largely taken advantage of by the same class of persons as those who sit at the Society's Examinations. It is well known that the Examinations of the Society of Arts date so far back as 1856, and the example thus set has been followed by the two Universities in their Middle Class Examinations, and by the Government, in the Examinations held under the Science and Art Department, and it was felt that, in the words of Mr. Foster's report last year, "for the Society to continue doing on a small scale that which the Government is now doing on a much larger scale, and with equal efficiency, would seem to be a waste of its power and funds, and with no adequate advantage to the Institutions."

3. Sixteen subjects were therefore removed from the Society's list. This change, of course, renders it unfair to attempt any numerical comparison (except as to individual subjects) between the candidates this year and on former occasions; but while the total has been thus necessarily reduced, the number of those taking the subjects in which the Society still examines is sufficient to show that there has been no deterioration in the interest and appreciation with which these Examinations have, for so many years, been regarded by the members of the Institutions. As might naturally have been expected, the number of Local Boards has diminished, they being only 100 this year as compared with 139 last year; and the total number of candidates has fallen from 2,165 to 1,162, which is no more than might have been anticipated from the diminution in the number of subjects. On the other hand, in several subjects, such as book-keeping, geography, English history, French, and the theory of music, there has been a slight increase, while in that of English literature, the nature of the examination in which, it will be remembered, was considerably modified in the present programme, the number has more than doubled. One gratifying fact may be mentioned, which shows that the Local Boards have worked much more efficiently this year—and that is the large increase in the per-centage of candidates who have passed. While, last year, out of 2,165 can-

didates examined only 1,508 were successful in passing, or 69 per cent., this year, out of 1,162, no less than 953 obtained certificates, or 82 per cent.

4. As a remarkable instance of creditable working, on the part of both Local Board and candidates, I may mention Devonport, where every candidate succeeded in passing, no paper having been worked there without obtaining either a first or second-class certificate.

5. There were certain novel features in this year's programme. For the first time prizes were given for specimens of writing from dictation, for which 96 candidates appeared, several of their productions being highly creditable to them. Four prizes were also given for the best specimens of handwriting, as shown in any of the papers worked in any subject, and the gentleman appointed to make the awards, Mr. Arthur Trendell, had a somewhat difficult task in examining the 1,609 papers worked by the various candidates, and deciding upon those that best satisfied the conditions, namely, "the letters being well formed, and the writing distinct and legible." Prizes were also offered by one of our Vice-Presidents, Mr. Henry Cole, for the best specimens of writing and manuscript printing together, for which 19 candidates appeared, none of whose productions, however, were considered by the examiner to have complied with the conditions, or to be of sufficient merit to warrant the Council in awarding them a prize.

6. Another novelty in the programme was a suggestion by Mr. Hyde Clarke, a member of the Council, that such Local Boards as might have facilities for doing so should hold *vivâ voce* examinations in modern languages. The ground for that gentleman's proposal was, as stated in a memorandum kindly furnished by him, "the observation that, from the want of knowledge of local languages, Englishmen are supplanted by Germans in many countries, particularly of late years, and, as a consequence, English goods are being supplanted by German imitations, with forged English trade-marks and labels;" and he urged that many who had not time or opportunity to learn a language, so as to write it classically, might still pick up enough of it to enable them to make use of it in commercial and other matters, and that it was important thus "to give the working classes and the poorer middle classes better chances of employment in all occupations where the practical knowledge of a foreign language can be of use." Mr. Hyde Clarke's proposal, however, has virtually as yet met with hardly any response, only one Local Board, that of the Birkbeck Institution, having held an examination of this kind, and reporting favourably of two candidates in French. It is hoped that, in future years, this very useful and practical proposal will be more extensively carried into practice.

7. This year, the Prince Consort's Prize of twenty-five guineas, a gracious gift by which her Majesty signifies, year by year, her continued interest in the Society's educational action, has been awarded to a candidate connected with the Southampton Athenæum, Edward Turner Sims, jun., aged 22, clerk, who has obtained the largest number of first-class certificates in this and the three preceding years, the subjects being arithmetic, political and social economy, geography, English history, book-keeping, English literature, logic and mental science, and the metric system.

8. It is to be regretted that the Council were not able to award the prize of ten guineas for female candidates, no qualified candidate having fulfilled the conditions, and that only one of the twelve other prizes offered specially to females has been taken, facts which do not speak encouragingly as to the progress of education among women of the class who take advantage of these examinations. On the other hand, it should be noted that the second prize in political economy has been gained by a female candidate.

9. The prizes offered by the Royal Horticultural Society, for the encouragement of gardeners in obtaining a knowledge of their art, have been awarded, as also that offered by the Royal Geographical Society, for proficiency in geography; but the prizes offered by the proprietors of the *Gardeners' Chronicle*, by Mr. T. Twining, a Vice-President of the Society, in domestic economy, and by Mrs. Harry Chester in political economy and civil government, have not been awarded.

10. The remarks of the examiners, printed in the appendix, present no new feature, but their general tone is certainly favourable to the candidates; and, on the whole, the examinations of the present year may be regarded as successful, especially when we consider the sweeping change made in the system by the omission of so many subjects.

11. The Elementary Examinations, held by local examiners using the papers furnished by the Society of Arts, call for no special remark. The results are given, as usual, in a tabular form, but as no return has been received from the Yorkshire Board of Education, any numerical comparison between this year and last is extremely difficult. As, however, a very large number of sets of papers, no less than 950, were applied for and forwarded to that Board, it may fairly be concluded that, if the returns had been complete, they would have shown a larger total than last year, when 2,634 candidates were examined, and 1,348 passed. This year (excluding the Yorkshire return) 2,199 candidates were examined, and 1,248 were successful;

ELEMENTARY EXAMINATIONS, 1870.

NAME OF UNION OR LOCAL BOARD.	Number of Centres.	HIGHER GRADE.				LOWER GRADE.			
		Male Candidates.		Female Candidates.		Male Candidates.		Female Candidates.	
		Examined.	Passed	Examined.	Passed.	Examined.	Passed.	Examined.	Passed.
Cheltenham Working Men's Club	1	..	..	..	..	20	20	..	..
Farnham and Aldershot District	2	41	33	4	4	33	26	15	9
Hertford	1	13	8	1	1	55	34	16	2
Lancashire and Cheshire Union	72	280	156	6	6	1,076	550	470	296
Lichfield	1	..	..	..	..	6	3	..	..
London (South London Working Men's College)	1	8	4	2	2	6	4	3	3
New Swindon	1	10	6	..	..	14	9	23	13
Portsmouth	1	9	9	3	3	5	5	3	3
Rugby	1	..	..	9	3	1	..	14	6
Stamford (St. Martin's School of Art)	1	5	5	..	..	19	13	..	..
Weston-super-Mare	1	7	3	1	1	21	8	..	..
*Yorkshire Board of Education	..	..	..	..	..	..	..	..	..
Totals	83	373	224	26	20	1,256	672	544	332

* N.B.—No return has been received from this Board, to which, however, 700 sets of Lower Grade papers, and 250 sets of Higher Grade papers, were forwarded in accordance with an application made by the Secretary to the Board.

a larger per-centage than last year. One feature in these Elementary Examinations that should not be overlooked is the important stimulus they give to female education. The table shows that, out of 1,700 candidates in the lower grade, 1,256 were males and 544 females, the former giving only 672 as successful, while the latter give 332, a considerably higher proportion. But few females (only 26) appear to have attempted the higher grade papers, but here also the proportion passing is higher than that of the males. On the whole, it is believed that in the districts where the Society's papers are made use of, these Examinations give a very useful encouragement to the acquirement of elementary knowledge.

12. I have dwelt at some length upon the Examinations, as being the work especially undertaken by the Society for the benefit of the Institutions; but I need hardly say that they by no means represent the whole of the Society's efforts in the promotion of education, in all of which the Institutions and their representatives cannot fail to be interested.

13. An important educational work has been undertaken by the Society, in connection with the International Exhibition to be held in 1871. As mentioned in the circular calling the present conference, the Society has undertaken, with the aid of a large and influential Committee, to make arrangements for the Educational Section of that Exhibition; and it was felt that this would be a suitable opportunity of drawing the special attention of the Institutions in Union, and other local bodies interested in education, to this branch of the Exhibition, which it is hoped will be specially interesting and valuable. With this view, some members of the Education Committee are now present, and will be happy to afford to the representatives of Institutions any information they may desire in reference to it, and also to discuss with them the best modes of bringing local influence to bear in obtaining the most suitable objects for exhibition in this section.

14. It may be mentioned that the Educational Committee has held two meetings, the first under the presidency of His Royal Highness the President of the Society, and has divided itself into sections, and appointed secretaries to each, so that its organisation for work is now complete. It is hoped that the representatives of Institutions, most of whom have experience in educational matters, will give every aid in their power in rendering this Exhibition a creditable and complete representation of the present state of "educational works and appliances."

15. The subject of technical education, as bearing directly upon the chartered objects of the Society—Arts, Manufactures, and Commerce, has for years past occupied its attention in various forms; but of late, the fact that it is impossible to impart scientific instruction to persons ignorant of the first rudiments of knowledge, has more and more forced itself upon public attention, and the importance of establishing an efficient system of primary education throughout the country, as a preliminary step to technical teaching, has, within the last few years, been more fully appreciated than formerly. The Society has promoted the holding of meetings in some of the great manufacturing centres, notably in Manchester, at which a deputation from the Council, with the Secretary, attended,

the immediate object being the promotion of the establishment of science colleges.

16. Another useful work undertaken by the Society was the obtaining from gentlemen, specially competent for the duty, reports upon the existing state of education in various districts, with a view to ascertain how best to supply the deficiency so generally acknowledged. Three such reports have already appeared, and are probably familiar to most of the members of the Conference. The instructions issued for this inquiry were very carefully drawn, and are published with the first report, which treated of the districts of Ealing and Brentford, and is by Mr. Paynter Allen, who also reported upon the Richmond, Twickenham, and Mortlake district. A report of a somewhat similar character, prepared by Mr. G.C. T. Bartley, one of the auditors of the Society, and entitled "The Educational Condition and Requirements of One Square Mile in the East-end of London," which was published as a pamphlet, attracted considerable attention, and contained a large amount of information, in a condensed and readable form, as to the educational state of the densely-populated district chosen for investigation, which included certain portions of Bethnal-green, Kingsland, Hoxton, and Haggerstone. In reference to this district, Mr. Bartley says "it is hardly possible for any district to give a better example of the inefficiency of existing schools for educating the poorer classes, nor could a locality be found giving a better opportunity for creating a really efficient and organised plan of schools, all working together under one management and having one aim." A series of papers by the same gentleman, on district schools, will probably have been read with interest by most of those present.

17. I must not dwell upon these reports, which are not to be the only ones of the kind prepared under the auspices of the Council, but I will pass to another subject, the mode in which the Council have dealt with the great question of primary education now before the country, especially in its bearings upon the Education Bill. It will be remembered that, in the autumn of last year, two very influential organisations, known as the National Education League and the National Education Union, were formed, the distinctive views advocated by each of them being now so well known, that I need not occupy your time by stating them, further than to mention that in many points they are diametrically opposed to each other. The Council of the Society of Arts, however, recognising in both an earnest desire that means should be taken to educate every child in this kingdom, sent a deputation to each body, and moreover, subscribed to the funds of each. In their letter to the first-named body, they say that "they cordially concur in the programme of the League, in so far as its object is to ensure the groundwork of instruction to all the children of the United Kingdom, and that they shall not be less well educated than children in Germany, Switzerland, Sweden, and Norway; but, as a question of general policy, and as representing many different opinions among the numerous members of the Society, they hesitate to pledge the Society to all the details of the League programme. The Council think it desirable that all the various modes of ensuring universal instruction to the children of the United Kingdom should be amply discussed from many points of view."

18. In its instructions to the delegates who attended these meetings, the views of the Council are clearly expressed. Intentionally neglecting or putting aside the difficulties now so constantly being discussed at excited meetings throughout the country, such as the religious question and the like, they go directly to the practical point of how best to teach children, and point out the great waste of power that the present system involves, and how important it is to improve, to the utmost point, the system of elementary teaching, for "time saved in learning is, to the mass of the population, time gained for earning; and time saved in improved primary learning is also time gained for improved art and technical learning, and for the augmentation of efficiency in the great national earning." I can only, on the present occasion, direct your attention to this document, which is well worth perusal, and was issued as a supplement to the *Journal* in December last.

19. Continuing to carry out, as far as possible, this principle of impartiality, and wishing, at a comparatively early stage in the agitation of the question, to afford a neutral platform for its discussion, they called together a Conference, which was held last February, in the Society's Great Room, under the presidency of your chairman, Lord Henry G. Lennox. On this occasion a programme was put forward, in which an attempt was made to combine and supplement, in a practical scheme, the best features of the Union, the League, and the Manchester Education Bill Committee. A full report of this Conference appeared in the Society's *Journal*, and it is hoped that it contributed something at least towards preparing the way for the settlement of some of the questions connected with this subject, which, however, it must be confessed, are still many of them unsettled. Those present on the occasion must have noticed the strong tendency the speakers showed to wander from the subject of the particular resolution under discussion, usually in the direction of the "religious difficulty." The Council have continued to watch the progress of the Education Bill, and in the last number of the *Journal* an important

document appears, expressing their views in reference to it, and setting forth a series of amendments, which they have requested their chairman to bring under the notice of the Prime Minister.

20. An attempt has been made to record, week by week, in the *Journal*, in the briefest possible form, the principal meetings that have been held in London and in the provinces for discussing the education question, and to notice, as far as possible, the most important speeches, articles, and letters that have appeared upon the subject. It is hoped that any one wishing hereafter to write the history of the educational agitation of the last few months, would find in the Society's *Journal*, a considerable portion, at least, of the materials ready to his hand.

21. In conclusion, I may venture to express a hope that the vexed questions therein so often referred to, will be satisfactorily settled when the Government Bill passes through committee; and though many points may require re-adjustment hereafter, and some heart-burnings may remain amongst those whose views are so firmly fixed that they can listen to no compromise, each of those who have taken a part, however humble, in this great educational movement, will have the satisfaction of feeling that he has contributed his share towards removing the veil of ignorance from this land, and that though the present generation must remain, to a large extent, uninstructed, the children of the poor, as well as of the rich, will no longer be deprived of that rudimentary knowledge, without which even the first step in "education" cannot be taken.

I have the honour to be, gentlemen,
Your obedient servant,
Charles Critchett,
Officer for Education.

Appendix.

EXAMINERS' REMARKS.

The Examiner in *Arithmetic* says:—"As a whole the papers are superior to those of last year. Some of them display much acuteness in arithmetical operations, and in nearly all I have been much struck with the legible character of the figures and the neatness of the writing."

The Examiner in the *Metric System* says:—"This year's papers show an increase in the number of candidates, and a higher level of attainment throughout. Out of the 52 candidates, 25 passed in the first class, 17 in the second, 5 in the third, and only 5 failed entirely to satisfy the Examiner. The advocates of the metric system have here a practical and powerful argument in their favour. From those of the working classes who have set themselves to master this system scientifically, only 10 per cent. have failed, whilst 50 per cent. find themselves competent to work any arithmetical problem that may be given them on the subject. Whilst much gratified at the result of this year's examination, I would recommend future candidates to be concise and methodical in the working of their papers, and thoroughly to acquaint themselves with decimal arithmetic before competing for this examination. In these respects, however, I have no fault to find this year."

The Examiner in *Book-keeping* observes that "the papers, on the whole, are not this year equal to the average of former years."

The Examiner in *Mensuration* says:—"The number of candidates in this subject has fallen from 100, in 1869, to 63; but the number classed is this year 53 against 63 in 1869, so that the diminution in the number of candidates is perhaps due to a more effective sifting. Although 3 only are in the first class, only 10 have failed to pass, against 44 last year. The questions relating to figures, bounded by straight lines, have been very generally done, and for the most part well done; those which relate to the surfaces and contents of solids have often not been attempted, and the attempts have but seldom achieved complete success."

The Examiner in *Floriculture* says:—"The greatest deficiency this year occurs in the spelling of the names of plants. Candidates should endeavour, as far as possible, to answer all the questions set, since, in some cases, the first-class certificates have just been missed owing to certain of the questions being altogether passed over. It will be quite evident that the total number of marks gained is considerably influenced by such omissions."

The Examiner in *Fruit and Vegetable Culture* says:—"I remark in the papers that have been submitted to me at this Examination, that there has been a falling-off in quality from those of former years; and especially so in those subjects which test the faculty of observation in the candidates. On practical questions the answers are generally good; but when the questions treat on subjects requiring careful and discriminating observation to acquire a knowledge of them, there is a marked faultiness."

The Examiner in *Domestic Economy* says:—"There are much fewer candidates in this subject this year than last, but; upon the whole, the papers presented are of a better quality than in past years. There are none inexcusably bad, but I have still to complain of frequent mis-spellings in the great majority of the papers."

The Examiner in *Political Economy and Civil Government* says:—"The papers to which I have awarded first-class certificates possess great merit, and show a firm grasp of principles and considerable reading. This is, in a less degree, true also of some of the second-class papers, and, in general, the answers show intelligence, and are written in a clear and fluent style, even where, as is sometimes the case, the candidate is deficient in preparation and knowledge of his subject."

The Examiner in *Geography* says:—"Merit of a very high order attaches to the papers that entitle their writers to first-class certificates. The results of the examination are, on the whole, satisfactory, but the number of failures is large, a result obviously due (as I have been led to remark upon former occasions) to insufficient recognition on the part of candidates of the real nature of the task they undertake, with accompanying absence of the preliminary study necessary to its successful accomplishment."

The Examiner in *English History* says:—"With few exceptions the papers for this year are fully equal to those of the last. I have to express my satisfaction with the knowledge of English History in general displayed by the candidates, and the accuracy with which the questions were answered. In some few instances the candidates failed to number the pages of their papers, and as the leaves were carelessly put together, to restore them to their proper order was a work of great trouble. I have therefore to express a hope that this kind of negligence may not occur again."

The Examiner in the *English Language* and *Literature* says:—"Nearly forty per cent. of the candidates have acquitted themselves with credit, and above ten per cent. are deserving of high praise. I am by no means disappointed in these proportions. But I am bound to add that considerably more than a third of the papers painfully exemplify the very imperfect way in which English grammar is taught in most of our schools.

TABLE I.

RESULTS OF THE FINAL EXAMINATION OF 1870.

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No of Candidates Examined at Final Examination.	No. of Candidates who Passed at Final Examination.	No. of Papers Worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Aberdeen	40	25	26	23	26	4	9	10	...	3
Accrington	24	20	5	4	7	...	3	2	...	1
Alderley Edge	...	...	1	1	2	1	...	1	...	...
Ashford	10	10	14	13	14	8	4	1	1	1
Bacup	40	35	11	9	18	3	8	5	...	2
Belfast (People's Literary Institute) ..	7	7	10	10	13	1	4	7	...	...
Birmingham and Midland Institute ...	36	30	34	31	42	8	11	19	...	3
Blackburn (Science School)	...	...	1	1	2	2	...	...	...	...
Bollington	...	...	2	2	3	2	1	...	...	...
Bolton (Mechanics' Institution)	24	24	9	..	9	...	...	...	...	9
,, (Church Institute)	...	...	16	7	30	2	5	7	4	9
Bradford	17	16	20	16	24	3	8	8	...	4
Brighton	1	1	3	...	3	...	...	...	...	3
Bristol (Young Men's Christian Association)...	10	10	7	6	9	3	1	4	...	1
Bromsgrove	2	2	1	1	1	1	...	...	...	...
Burnley	...	10	9	6	12	2	...	5	...	3
Bury St. Edmunds	2	2	2	2	3	...	1	2	...	...
Carlisle (Mechanics' Institution)	7	7	18	16	21	3	10	5	...	2
Chelmsford	1	1	1	1	1	...	1	...	...	...
Cheltenham (Working Men's Club) ..	8	8	9	8	27	3	9	8	...	1
Cork (Catholic Young Men's Society) ...	8	6	5	5	7	3	2	2	...	...
Crewe	5	5	18	13	26	...	6	11	...	5
Dean Mills	...	...	7	7	7	1	5	1	...	...
Derby	1	1	3	3	5	1	4	...	...	...
Devonport	...	6	15	15	21	11	10	...	4	...
Dudley	1	1	2	2	2	...	...	2	...	...
Edinburgh (Watt Inst.)	16	15	20	18	32	1	5	18	1	2
Farnham and Aldershot	12	12	14	10	20	4	6	4	...	4
Faversham	1	1	1	1	1	...	...	1	...	...
Freetown (Glossop)	...	1	4	4	4	1	3	...	...	...
Glasgow (Athenæum)	29	28	27	25	31	8	10	11	4	2
,, (Institution)	45	33	20	17	23	4	10	6	...	3
,, (Mechanics' Institution)	44	43	52	48	63	15	23	17	1	4
,, (Popular Evening Classes, Anderson. University)	30	28	37	35	51	15	15	15	1	2
Gloucester	...	...	3	1	3	...	...	1	...	2
Halifax (Mechanics' Institution)	16	16	15	11	23	3	8	6	...	4
,, (Working Men's College)... ...	26	22	28	22	35	8	8	9	1	6
Haslingden	...	8	3	...	3	...	...	...	...	3
Hebden Bridge	...	3	3	3	6	...	...	5	...	...
Hertford	...	...	1	...	1	...	...	...	...	1
Hitchin	2	2	2	...	2	...	...	...	...	2
Holbeck	1	1	3	3	4	1	2	1	...	...
Huddersfield	9	9	4	3	4	...	..	3	...	1
Hull	14	14	14	14	16	5	10	1	1	...
Hulme	...	19	17	16	21	...	10	9	...	1
Ipswich	10	8	7	7	7	2	3	2	...	...
Keswick	5	5	11	4	15	...	1	4	...	7
King's Lynn...	6	6	6	6	7	...	5	1	...	...
Leeds (Church Institute)	10	10	14	12	23	1	10	6	...	2
,, (Mechanics' Institution)	...	11	12	9	23	5	6	6	...	3
,, (Young Men's Christian Association) ...	27	27	32	21	51	5	13	9	...	11
Liverpool Inst.	36	36	32	24	55	10	14	18	4	8
Lockwood	...	...	1	...	2	...	...	...	...	1
London (Beauvoir College)	10	10	14	13	17	6	5	5	...	1
,, (Birkbeck Literary and Scientific Institution)	58	48	60	53	90	23	30	24	5	7
,, (Bromley, Middlesex)	32	32	28	23	30	3	7	15	...	5
,, (City of London College)... ...	43	41	57	52	89	17	40	22	2	5
,, (Dunn's Literary Inst.)	1	1	1	...	3	...	...	...	...	1
,, (Royal Polytechnic Institution) ..	13	12	19	16	38	4	15	15	1	3
,, (St. Stephen's, Westminster) ...	6	6	6	5	8	...	3	4	1	1
,, (South London Working Men's Coll.)	...	...	5	2	8	...	...	2	...	3
Macclesfield	42	29	11	...	17	...	...	...	...	11
Manchester	60	56	92	81	117	21	45	35	1	11
Mossley	3	2	6	6	8	...	...	6	...	...
New Mills	...	5	5	2	5	...	1	1	...	3
New Swindon	12	12	9	6	11	1	3	4	...	3
Newcastle-on-Tyne (Church Inst.) ...	...	...	2	2	2	...	1	1	...	...
,, (Excelsior Temp. Society)	7	7	6	2	10	...	...	3	...	4
,, (Mechanics' Institution)...	...	...	4	4	6	1	3	2	...	...
Newton Heath (No. 2 School)	1	1	2	1	2	...	1	...	...	1
Oldbury	6	6	2	..	3	...	...	...	...	2
Oldham (Lyceum)	30	21	19	18	28	2	7	14	...	1
Paisley	9	5	8	8	12	4	5	1	1	...
Parsonstown...	3	3	1	...	1	...	...	...	...	1
Patricroft	3	3	2	1	2	...	...	1	...	1
Pembroke Dock	9	9	9	9	10	6	2	2	...	...
Penzance	9	9	7	5	8	3	1	1	...	2
Portsmouth	3	3	4	4	9	3	6	...	...	...
Preston (Avenham Inst.)	4	4	4	2	8	1	...	3	...	2
Rawtenstall (Irwell Inst.)	12	8	4	3	7	...	3	...	...	1
Richmond	5	5	5	5	10	5	1	3	4	...

TABLE I.—(Continued.)

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No. of Candidates Examined at Final Examination.	No. of Candidates who Passed at Final Examination.	No. of Papers Worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Rotherham	2	2	2	2	2	...	...	2	...	...
Salford (Working Men's College)	39	39	50	47	70	18	31	14	4	3
Slough	5	4	4	3	4	1	1	1	...	1
Smethwick (Messrs. Chance's Schools) ...	5	5	5	5	7	...	4	2	...	...
Southampton	9	9	17	17	22	7	12	3	4	...
Stamford (St. Martin's School)	8	6	5	4	9	1	3	3	...	1
Stockport (Mechanics' Institution) ...	12	10	6	4	8	...	3	3	...	2
,, (Sunday School)	...	12	10	6	14	...	2	4	...	4
Stocksbridge...	...	...	5	...	5	...	...	...	...	5
Stockton-on-Tees	...	...	1	1	2	...	...	1	...	...
Stourbridge (Associated Institutes) ..	...	...	1	...	1	...	...	...	...	1
,, (Church of England Inst.) ..	...	6	4	4	5	2	1	2	...	...
Tottington	...	...	3	3	5	...	3	2	...	...
Wakefield	10	5	4	2	5	...	3	...	...	2
Walsall	2	2	2	2	3	2	1	...	...	...
Wednesbury (St. John's Inst.)	26	17	10	6	14	...	1	9	...	4
Weston-super-Mare	...	...	1	1	2	1	...	1	...	...
Whaleybridge	1	1	3	2	4	...	1	2	...	1
York	2	2	5	5	7	1	2	4	...	...
Totals	1,085	1,032	1,162	953	1,609	283	513	468	45	209

Number of Local Boards, 100.

N.B.—Ninety-six Candidates came forward in Writing from Dictation, and nineteen in Writing and Manuscript Printing, but, as Certificates were not given for papers in those subjects, they are not included in the above Table, but the Prizes awarded in the first of these subjects, and also the prizes offered by the Council for handwriting generally, are included in the list.

TABLE II.

Number of Papers Worked in each Subject in the Four last Years; with the Result for the Year 1870.

SUBJECTS.	1867.	1868.	1869.	1870.				
				No. of Papers Worked.	No. of First-class Certificates.	No. of Second-class Certificates.	No. of Third-class Certificates.	No. of Papers in respect of which no Certificate was awarded.
Arithmetic	520	528	621	501	100	169	99	133
Metrical System	..	..	42	52	25	17	5	5
Book-keeping	235	255	253	290	43	117	106	24
Mensuration	55	78	98	63	3	19	31	10
Floriculture	9	16	12	9	5	3	1	..
Fruit and Vegetable Culture ..	9	13	9	8	1	4	2	1
Domestic Economy	34	32	31	13	2	4	4	3
* { Political Economy and ..	8	7	*19 }	25	2	11	5	7
{ Civil Government	..	..	*8 }					
Geography	98	114	99	103	10	26	25	42
English History	86	99	94	120	29	39	32	20
English Literature	29	33	37	82	10	23	29	20
Logic and Mental Science ..	4	9	24	16	3	5	3	5
Latin	9	21	17	20	3	10	5	2
French	118	148	140	145	2	17	78	48
German	12	16	26	26	3	12	9	2
Italian	2	3	9	3	1	1	1	..
Spanish	6	6	13	10	5	3	2	..
Theory of Music	71	97	69	72	36	22	10	4
Elementary Musical Composition (Tonic Sol-fa System)	..	..	57	51	..	11	21	19
Totals	1,305	1,475	1,698	1,609	283	513	468	345

* These two subjects are now united.

Nearly one-fourth of them fail to entitle the candidates to certificates."

With reference to the candidates for the prizes for *Writing from Dictation*, the same Examiner says:—"Their exercises are, for the most part, very well done. It has been a matter of no slight difficulty to select and arrange, in the order of merit, the three best of them."

The Examiner in *Logic and Mental Science* observes that "the papers have kept up very nearly to the standard of last year. One half of them fall into the 1st and 2nd class, and those below them show, for the most part, an accurate apprehension of the comparatively few questions which they undertake to answer."

The Examiner in *Latin* says:—"The Virgil, especially the second passage, might have been prepared more carefully. There were too many mistakes in the perfects of common verbs like *soleo*, *respondeo*, and in the termination of the second person plural of perfects. Great attention should be given to style in translation, so that every sentence should be pure idiomatic English. *You* and *thou* should not be used promiscuously in the same sentence, but either one or the other. On the whole, there were signs of considerable preparation, intelligence, and knowledge of Latin."

The Examiner in *French* says:—"On the whole, the proportion of certificates obtained is satisfactory, amounting altogether to 97, against 48 'not passed;' but as many as 78 of these certificates are only third-class, leaving 17 second-class, and but two first. The amount of inaccuracy throughout the papers is excessive, and betrays a very desultory mode of studying the most precise of languages. It is quite clear that our candidates have not yet realised the fact that, whilst the elements of French are very easy, the difficulties of the syntax are not equalled in any other language, and a tolerable mastery of them can only be the reward of a very painstaking and well-directed industry. One gratifying feature, however, on this occasion, has been the almost total absence of candidates trying for a certificate beyond their reach, the result being altogether to their advantage."

The Examiner in *German* says:—"I consider the general result of this examination very satisfactory, and in many respects far more so than that of last year, more particularly as regards the candidates for second and third-class certificates. The passages for translation were selected from different parts of the works which had been set to the candidates, and still the renderings were, almost without exception, very creditable. There were none of those absurd translations and statements which are not unfrequently met with in the answers to examination questions, and this speaks favourably both for the general state of education of the candidates, and for their special application to the subject in question. Some candidates who aspired to first-class certificates were not quite successful in their attempts, but, with a single exception, they have done their work sufficiently well fully to deserve a second-class certificate. The principal defects in their works were the same which I pointed out last year, with regard to the general character of the candidates' answers, viz., want of grammatical correctness, and inaccuracy in the translations from English into German. I am, therefore, obliged to repeat my former recommendation to future candidates, to acquire first of all an accurate knowledge of German accidence, and then to devote greater attention to the acquisition of a certain facility in translating from English into German. They should make use of such grammatical works as give the theory of German grammar in a systematic form."

The Examiner in *Italian* says:—"The improvement I observed last year in the work done by candidates is well sustained this year. I perceive that greater attention generally is given to the study of primary grammar. A deficiency is still observable in the knowledge of idioms, a fault, to overcome which a more extensive reading, in prose especially, is needed."

The Examiner in *Spanish* says:—"Although the number of candidates is not so large, the general average of the present year is not inferior to the last, and the best paper is very nearly equal. Nevertheless, most of the candidates require to study carefully a good grammar, and to read frequently some of the books recommended in the programme."

The Examiner in the *Theory of Music* speaks of this year's papers, as "very good."

The Examiner in *Elementary Musical Composition* says:—"It witnesses strongly to general musical ability in this country that, in the class to which the candidates belong, so many persons are able, without reference to an instrument, to produce coherent specimens of composition. I regret that the exercises of this year have less average merit than those of last. The pieces which evidence the best power of invention are not the most free from grammatical faults. Not one candidate has given the correct answer to a subject for a fugue, which accounts for the low number of marks, as compared with those of last year, when this was not one of the questions."

TABLE III.

This Table shows the Ages of the 1,381 Candidates from whom Return Papers were received. Of these 1,162 underwent the Final Examination:—

Age.	No. of Candidates.	Age.	No. of Candidates.
16	168	33	9
17	158	34	4
18	178	35	2
19	176	36	6
20	152	37	1
21	111	38	6
22	100	39	1
23	55	40	2
24	48	42	1
25	47	43	3
26	39	46	1
27	35	47	1
28	24	48	1
29	17	53	1
30	15		
31	11	Total	1,381
32	8		

TABLE IV.

Occupations, Present or Proposed, of the 1,381 Candidates from whom Return Papers were Received:—

Accountants (and Clerks)	11	Buyers	2
Agents	2	Cabinet-makers	8
Architects (and pupils)	3	Card-makers	2
Art-student	1	Carders	3
Artificial limb-maker	1	Carpenters	5
Artist	1	Carpet-roller	1
Assistants—shop, &c.	14	Cartwright	1
		Cattle dealer	1
Bakers	2	Chemists	9
Bandsmen	2	„ and dentist	1
Boat-builders	2	„ and druggists	2
Boiler-makers	3	Chorister	1
Bookbinders	2	Civil engineer	1
Book-keepers	32	„ service	3
Booksellers and assistants	9	Clerks, bankers, commercial, &c.	474
Boot finisher	1	„ in Educ. Office	1
„ and shoemakers	7	„ law, &c.	18
Brass finishers	2	„ in Ord. Survey	3
Bronzer	1	„ post-office	1
Brush-makers	3	„ railway	10
Bugler	1	„ shorthand	1
Builder	1	Cloth dresser	1
Butcher	1	„ lapper	1

Cloth looker	1
Coach-maker	1
Cold-steel roller	1
Collectors	3
Commercial travellers	4
Compositors	2
Confectioners	2
Cork-cutter	1
Corporal	1
Correspondents	2
Currier	1
Customs' officers	3
Designers	3
Dispensers	2
Drapers and assistants	14
Draughtsmen	9
Drawing-master	1
Dyer	1
Engine-fitters	4
,, smith	1
Engineers (apprentices and students)	38
Engravers	5
Factory operatives	6
Fellmonger	1
Filer	1
Fitters, &c.	16
Flymaker	1
Fruit-dealer	1
Gardeners	16
Glass engraver	1
,, painter	1
,, stainers	3
Goldsmith	1
Governesses	7
Grocers, &c.	7
Gun and pistol-case maker	1
Hacklemaker	1
Hat trimmer	1
Hatter	1
Hosiers, &c.	2
House factor	1
Insurance office, in	5
Iron merchant	1
Ironmongers, &c.	4
Jewel-case maker	1
Jewellers (and assistants)	5
Joiners	10
Knotter	1
Labourers	4
Leathercutter	1
Lithographers	2
Linen lapper	1
,, trade, in the	1
Machine-man	1
,, tool fitters	2
Makers-up	4
Manufacturers	2
Masons	4
Mat makers	3
Mathematical instrument maker	1
Measurer	1
Mechanics	19
Medical student	1
Merchants	5
Messenger	1
Micro-machinist	1
Mill-man	1
,, wrights	4
Miller	1
Minders	5
Moulders	3
Muslin printer	1
Newsagent	1
Normal student	1
Office boys	8
Overlookers	3
Packers	3
Painters (house, &c.)	3
Pattern-makers	4
,, book maker	1
,, card maker	1
Pawnbrokers	2
Photographer	1
Pianoforte maker	1
,, tuner	1
Piecers	7
Pilot	1
Pipe maker	1
Plumber	1
Porters	4
Portmanteau maker	1
Potter	1
Press maker	1
,, tool maker	1
Printers	7
Pupil teachers	45
Putter-out	1
Reporter	1
Roller maker	1
,, turner	1
Rope makers	2
Saddlers' ironmonger	1
Salesmen	9
Sawyer	1
School-masters	16
,, mistresses	3
Screwer	1
Seal-engraver	1
Serjeant in county constabulary	1
Shipwrights and apprentices	11
Shop boy	1
,, keeper	1
,, man	1
Silk finisher	1
,, striper	1
,, weigher	1
,, worker	1
Smiths	6
Soda-water maker	1
Soldiers	5
Spindle-maker	1
Spinners	6
Stationers, &c.	8
Stone-cutters	2
,, masons	2
Striker	1
Stripper	1
Surgical instrument maker	1
Surveyors	2
Tailors	5
Teachers (other than pupil teachers)	47
Terra-cotta works, in	1
Theological student	1
Throstle doffer	1
,, jobber	1
Timber trade, in the	1
Time keepers	3
Tin-plate workers	4
Tobacco manufacturers	2
Townsman	1
Turners	12
Tutor	1
Umbrella maker	1
Upholsterers	3
Upholsteress	1
Waiter	1
Warehousemen and lads	84
Warp dressers	2
Warper	1
Watchmakers	2
Weavers	19
Weigher	1
Wire drawer	1
Wood engravers	3
Woollen printer	1
,, waste dealer	1
Wool sorters	2
Writers	4
Undetermined, or not given	64
Total	1,381

The report of the discussion at the Conference will appear in the next number of the *Journal*.

DRILL REVIEW.

The Review of Schools took place on Tuesday, June the 21st, at the Crystal Palace, in the presence of His Serene Highness Prince Teck and a distinguished company, among whom were the following :—

Lord Henry G. Lennox, M.P. (Chairman of Council); Lord Gerald Fitzgerald, Field-Marshal Sir John Burgoyne, K.C.B., Major-Gen. Sir Wm. Napier (Director-General of Military Education), Major-Gen. Eardley-Wilmot, Sir Chas. Russell, Bart., V.C., Col. Ewart, R.E., Captain Donnelly, R.E., Rear-Admiral Ryder, Rear-Admiral Erasmus Ommanney, C.B., F.R.S., Captain Phipps, R.N., Mr. Henry Cole, C.B., Mr. Edwin Chadwick, C.B., Mr. E. C. Tufnel, one of her Majesty's Inspectors of Schools, Mr. W. S. Fitzwilliam, Mr. J. T. Ware, Mr. Seymour Teulon, Mr. G. C. T. Bartley, Mr. J. A. Franklin, Mr. John Bell, &c.

The ground was efficiently kept by a company of the Grenadier Guards; and a Guard of Honour, with band, under Captains Larkins and Crowle, was furnished by the 37th Middlesex Rifle Volunteers.

The following schools took part in the review :—

Royal Caledonian Asylum, Holloway, N.	41
Lambeth Industrial Schools, Norwood	133
Central London District School, Hanwell, W.	263
St. Mary, Islington, Hornsey-road, N.	60
St. Marylebone School, Southall, W.	100
Children's Establishment, Limehouse, E.	125
Royal Naval School, Greenwich	800
S. Metropolitan District School, Sutton, Surrey	300
Royal Military Asylum, Chelsea, S.W.	294
British Schools, Brentford	100
Shoreditch Industrial Schools, Brentwood	85
Mile-end Industrial Schools, Bancroft-road	80
Strand Union School, Millfield House, Edmonton	100
Homeless Boys of London, viz, *Chichester* Training Ship and Refuge Farm School	200
Marine Society's Training Ship *Warspite*	150
British School, Richmond	40
Newport Market Refuge and Industrial School	50

After the review, the following schools competed in swimming, not more than six boys from each school being allowed to compete :—Central London, 4; Shoreditch Industrial, 2; Limehouse, 6; South Metropolitan, 6; Strand Union, 6; Royal Marine Hospital, 6; Royal Marine Society, 6; Mile-end Old Town, 6; St. Marylebone, 6.

Six prizes were awarded, two for each division; a first prize of 10s., and a second prize of 5s.

The boys competed in three divisions:—1st, boys under 12 years of age—both prizes won by Royal Greenwich School; 2nd, between the ages of 12 and 14—first prize won by Greenwich School, second by Marine Society's School; 3rd, between 14 and 16—first prize won by Greenwich, second by Strand Union.

A competition also took place in gymnastics between nine boys from various schools, Evens and Washington, both of the Greenwich School, taking the first and second prizes.

A prize banner was awarded, after competition, to the Royal Military Asylum School for proficiency in drill, and in consideration of the creditable manner in which the boys of the Limehouse School acquitted themselves, a second banner was awarded to them.

At the close of the competitions, the members and their friends partook of a cold collation, at which Sir Charles Russell, Bart., V.C., presided, during which the Central London School band played. The other bands played in different parts of the palace and grounds, and the Marylebone School band was selected to play operatic selections in the grand orchestra, under the direction of Mr. Sibold, the military bandmaster, who directs the musical education of these children. Six selections were played, and three were repeated in honour of calls by the large audience.

In summing up the day's proceedings, it may be fairly said that the review was a success. The boys marched past with great precision, and though some of the schools would have looked better had the boys been dressed in a little smarter uniform, the appearance of all was most creditable. The music of the bands was excellent, and the way in which the military movements were gone through on the Cricket-ground elicited the very highest commendations from the eminent officers of the Army and Navy who witnessed them, and the soldiers and volunteers were vigorous in their applause at the smart manner in which the boys drilled. A sign of the healthy emulation such competitions excite is to be found in the fact that any exercise well done was loudly cheered and applauded by those boys who were looking on.

The arrangements made by the Crystal Palace authorities were admirably carried out. The cost of the transit of the boys from the various schools was defrayed by them, and they also provided cake, &c., for them after the review, for which some of the schools could not, however, stay.

The following account of the day's proceedings is taken from the *Times*:—At the time at which the review was fixed to commence the whole of the galleries of the Palace, and the grounds as well, were thronged with spectators, and the bands of the various schools were told off in regular military order opposite the Royal dais, erected in a central part of the grand terrace, on which the Prince and the committee were. The march past was led off by the boys from the parish schools, the Strand Union boys from Edmonton leading the first column, and company by company, column by column, the whole of the little army marched past the Prince with astonishing precision. There were some of the smallest boys seen out of cradles among the parish schools, and the "uniform" of some was not in good taste, being of the old degrading workhouse character, but still the impression they made upon the onlookers was that much care was now being taken with the training of the chidren. The Shoreditch, Marylebone, Central London, Lambeth, and Limehouse boys had no workhouse associations in their dress. The boys of the Royal Asylum were, on the average, much older than the "Union" boys, and the Chichester training ship lads were manly youths, and formed a well-trained and excellently-drilled ship's company. It is fair to say some of the companies were put to severe test at the moment of going past by the bands striking up fresh tunes, and thus causing a break in the step. In each case the difficulty was overcome by the companies themselves, and the step was caught at once. The rear was brought up by the boys of the Scotch school, who wore their picturesque national costume. The columns marched off to the bottom of the garden, to the cricket ground of the Palace, where the companies were formed into "open order," and the Prince, accompanied by the Committee and officers of the Society, made a general inspection. The drill-masters, most of them old soldiers, were called to the front, and questioned as to the character of the schools they drilled. The Prince especially congratulated two boys in the Royal Naval School on having, by general merit, won the silver medals bearing Nelson's profile. The schools were then exercised in the different movements of a battalion in the field, and the manner in which they formed lines, broke into a battalion in open column, formed close column, faced in square, "prepared" to receive cavalry, re-formed companies, and opened out into column again, was perfect, for their execution was rapid and certain, and without noise. The South Metropolitan School was especially well drilled in these movements, and the drill-master had not only to move the column as a whole, but he had to direct distinct companies, he having no captains to half his force. There will be no surprise felt in the fact that the sons of the old soldiers, the boys of the Royal Military School of Chelsea, took the first prize for drill, and it is a great credit to the far East of London that the battalion of very small boys from Limehouse should have been awarded a second and similar banner after a long and severe examination. There were also gymnastic competitions, in which the Greenwich boys came in first, and in the swimming competitions, which were witnessed by the Prince from a barge on the great lake, the Greenwich boys again came in first, the Marylebone and the Strand boys also winning prizes.

The following statement explains the object for which the review was organised and held:—

The very special interest of the Society of Arts in these schools arises from the conclusion that, whilst children are occupied in elementary schools, as they now generally are up to their thirteenth or fourteenth year, in learning only the "three R's" tolerably well, there is no room for secondary education for the children of the great mass of the middle classes, who cannot afford to let them remain out of productive service beyond that time. But about two-thirds of the boys reviewed—all those of the district Poor-law schools—are "half-timers," that is to say, boys who, instead of being kept in school for five or six hours each day, are generally in school little more than four hours on alternate days, the other days being devoted to some industrial occupation out of school. A large proportion of the boys appeared in the clothes and marched in the shoes made in the schools. In other instances, the half-timers' school work is three hours daily. In all these district schools, moreover, there is a division of educational labour, the elementary teaching being given usually in not less than six classes, one teacher to each class, teaching one thing at a time, and that thoroughly, and all classes kept all going on simultaneously. By this method the half-timers—in *hours* of school days—are got through the "three R's" in half the time in *years* that are occupied in the common schools, and are got through, and ready for productive occupation in little more than three years instead of six or seven; so that children of the wage classes, who it is complained now very generally leave school half-taught, may be completed on this system before their eleventh year. Indeed, those who begin in a good infant school—which makes between one and two years difference—are got through between the ninth and the tenth year. This of course gains three or four years of time for secondary education, before the fourteenth year. This increased speed and efficiency, obtained by the division of educational labour, is gained at a reduced expense, or at an average

of £1 per head per annum, instead of £1 10s., the average stated by Mr. Gladstone; but it is £1 per head for three years, as against £1 10s. for six years or more. In the smaller annual charge is usually included the expense of the industrial training of the hand, the eye, and the legs, as a preparation for labour on the part of the orphan and destitute children; also, in some instances, elementary free-hand drawing; and in all the naval and the military drills exhibited on the present occasion. The whole of these half-time schools are presented as a type of what is generally obtainable in national elementary education by school unions.

The general, moral, and economical outcome of the half-time district schools is stated to be that, whereas formerly two-thirds of the children educated in the same houses with the adult paupers, and in schools under single masters, and without any drill or physical training, went "to the bad," now the number of failures to get good service and keep it is very small indeed, within 3 per cent. As compared with bodily untrained and uneducated or ill-educated of the same class, it is declared that three have imparted to them the efficiency of five for all purposes of ordinary labour.

The review has a sanitary aspect, to which it is proper to advert. Many of the children are small for their age, and of an inferior type. But however pitiable may be the present aspect of any part of them, they come from classes that were far worse not many years ago. They are the children of utter misfortune, and come from the worst-conditioned districts, the "fever nests" of the metropolis. It is the concurrent testimony of experienced medical officers of these district schools that, as the sanitary conditions of the lower districts, whence these children chiefly come, have been mitigated, their type has been improved, and they are less undersized and less unapt for manual labour on account of their low physical condition. The progress of sanitary science is displayed in its application to the places for the reception and treatment of these children. Formerly the farm-houses where they were received were, from bad ventilation, filth, and overcrowding, the seats of devastating children's epidemics. With the exception of ophthalmia, which has not been got completely rid of in two of the institutions, children's epidemics of spontaneous origin are now almost unknown in them. In one institution, after house drainage and ventilation, the sickness and death-rates were reduced by one-third; after the introduction of frequent and almost daily head-to-foot ablution, the death-rates were reduced by another third; and now it appears by the returns that the average sickness and death-rates do not exceed one-third of the death-rates prevalent amongst the children of the same age of the general population.

VITALITY AS INDICATED IN 1869 BY THE DEATHS OCCURRING IN THE FOUR DISTRICT SCHOOLS BELONGING TO LONDON.

Name of School.	Deaths in 1869.	Cause of Death.	Age.	Whether admitted ill of disease which caused death.	Number admitted during the year.	Number discharged during the year.	Average number in school during the year.
Central London District School	Four	Acute rheumatism, gastritis, and pleurisy	12	No	538	508	986
		Embolism	5	Yes			
		Inflammation of lungs	4	No			
		Convulsions	8	Yes			
South Metropolitan District School	Three	Brain disease	7	No	711	676	1,301
		Pericardial inflammation	6	Yes			
		Soft cancer	13	No			
North Surrey District School	Three	Pneumonia	4	Yes	760	702	875
		Pneumonia	13	Yes			
		Disease of kidneys and embolism	12	Yes			
Forest Gate District School	Nine	Tuberculosis	7	Yes	872	815	887
		Tuberculosis	3	Yes			
		Meningeal fever	7	Yes			
		Meningeal fever	10	Yes			
		Meningeal fever	11	Yes			
		Tuberculosis	6	Yes			
		Phthisis	13	Yes			
		Pneumonia	14	Yes			
		Tuberculosis	8	Yes			

It is worthy of note, that in the North Surrey District School in the preceding year (1868) there were no deaths at all, though 89 of those admitted were immediately sent to the infirmary; and the average number in the school during the year was 800, and 1,131 were admitted and discharged.

The conclusion from the above table is, that 19 deaths occurred in 1869 among an average of 4,049 children, or less than 5 per 1,000. Of these, 15 entered the schools ill of the disease which caused death; 8 were under the age of 8; the rest were above 8, none being older than 14. As the proportion of deaths of 5 per 1,000 is calculated on the average numbers, which are made up by taking into account the difference between those who enter and those who leave, and as those who leave are all well, while many of those who enter are ill, while the number leaving and entering in the year exceed the whole average by 1,533, perhaps it would be fairer to consider the proportion of deaths as occurring among at least double the average of children, *i.e.*, of about 2 per 1,000.

In respect to the religious difficulty, it is to be observed that it is overcome in the district schools, and outbursts of denominationalism are prevented by the intervention of the central Poor-law Board. In the army schools, such as the one reviewed, it is overcome, and respect for the rights of conscience and religious peace is maintained by the intervention of the Minister of War, by whose authority it is provided that the children shall be set aside for religious instruction, those of English soldiers of the Church of England by the Church chaplain of the regiment, the children of Scotch soldiers by the Presbyterian chaplain, and the children of Irish or Roman Catholic soldiers by the Roman Catholic priests. The religious teaching of the Church of England children is examined by the Chaplain-General, the Rev. Mr. Gleig. The Bible readings in the Royal Military Schools are from the "Bible Lessons" of Stow, of Glasgow, which the Dean of Salisbury declares are excellent.

But the special interest in the day's review is a military interest—to judge of how much economy of military force may be obtained by the transference of as much as possible of military training and exercises from the productive adult stages to the non-productive and school stages of life; how far a predisposition to a higher order of voluntary recruitment, and of aptitude for the new arms of precision, which require more and more of intelligence and aptitude to wield them, may be diffused amongst the general population. In this point of view, the review was prepared by a special committee, comprising Field-Marshal Sir John Burgoyne; Major-General William Napier, Director-General of Military Education; General Sir Fenwick Williams, Bart., K.C.B.; Major-General Eardley Wilmot; Sir Charles Russell, Bart., V.C.; Colonel Ewart, R.E.; Captain Donnelly, R.E.; Rear-Admiral Ryder; Admiral Erasmus Ommanney; Lord Gerald Fitzgerald; Henry Cole, C.B.; Edwin Chadwick, C.B.; and E. C. Tufnell, one of Her Majesty's Inspectors of Schools.

It is demonstrated that, as compared with the common system of single-chambered and single-mastered parochial schools, if the system of graded half-time schools of mixed physical and mental training, exhibited to-day, were made general as a national system, under direct governmental initiation, between two and three millions of expenditure on elementary education would be saved annually, a secondary education would be gained for the middle classes and those who could be kept at school to the fourteenth year; there would be an immense gain of earnings to the industrial classes under a compulsory system; hereditary mendicancy would be suppressed; and the great bulk of the male population might be constructed into an inexpensive reserved force for military purposes.

PROCEEDINGS OF INSTITUTIONS.

Farnham and Aldershot Local Educational Board.—The following satisfactory result of the elementary examination of soldiers and their children of the division, by the Local Board of Examination in connection with the Society of Arts, was published on Monday for general information:—Nine soldiers and 52 children from the camp were examined, out of which 37 obtained certificates, and two obtained prizes for needlework, without certificates; 24 prizes, amounting to £6 11s. 6d., were awarded to the candidates, who stood first and second on the list for either subject of examination. The Lieutenant-General (the Hon. J. Y. Scarlett, G.C.B.) has much pleasure in notifying to the division the expression of his Royal Highness' satisfaction at the success of the military candidates at the above examination:—"It is gratifying to observe that the examination for distinction at these annual examinations is on the increase, and it reflects credit, not only on the candidates themselves, but on the expansive course of instruction obtainable in the army schools by adults, as well as soldiers' children, desirous of improving themselves."

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

THE EXHIBITION BUILDINGS.

The buildings in which the Exhibition of 1871 will be held have been designed by Lieut.-Col. Scott, R.E., and are to be of a permanent character. Those persons familiar with the Horticultural Gardens know the long ornamental arcades parallel with the Albert and Exhibition-roads. At the back of these arcades is a piece of waste ground, some 200 feet wide, extending to the road. On these strips of land the two main exhibition buildings are to be built. At their northern ends, these main buildings will be placed in communication with the conservatory of the Horticultural Gardens, and through it with the new Albert Hall of Arts (the grand promenade of which will be utilised for exhibition purposes, the educational collection being placed therein) by covered approaches, which are being made upon the top of the arcades connecting them with the conservatory. The southern ends of the main buildings will communicate with the permanent portion of the Exhibition building of 1862, which forms the southern boundary of the Horticultural Gardens. This building is now used for the exhibition of objects in connection with the South Kensington Museum. By this means, the building will completely surround the gardens, to which the public will be admitted at certain times, and under special conditions, which have yet to be decided upon. It is also proposed to connect this series of buildings with the South Kensington Museum, by means of a covered way under the Exhibition-road, and also in the same manner with the Metropolitan Railway. Between the outer walls of each of the two exhibition buildings and the roads upon which they abut, there will still remain a long strip of waste ground, some 160 feet wide, which will allow of the buildings being laterally extended at some future time.

The length of the main buildings, on the ground floor at each side, will be 1,100 feet, on the upper floor at each side, 600 feet. Their width throughout will be 30 feet, and the height of the two floors 60 feet. The level of such a length of building will be broken each side by four raised pavilions or dwarf towers; four of these, on either side of the north and south extremities, will be 35 feet wide, the two centre ones being 65 feet.

The ground-floors of the buildings consist of a series of chambers, broken in equal lengths by the varying dimensions of the central portions, the light for which is obtained from large windows in the east and west sides of the respective buildings, but there can, of course, be no windows in the sides which adjoin and continue the present arcade walls.

The lower story will be set aside for the exhibition of woollen fabrics, manufactures, tools, and machinery. The upper floor will be a repetition, on a smaller scale, of the picture-gallery of the Exhibition of 1862; the galleries will have no side windows, but will be lighted with a single centre ridge glass roof. The floor will be fire-proof, made on the Fox and Barret principle, of rolled iron girders filled in between with ten inches of concrete, and tiled on the upper surface. Provision is made in the built girders for heating the buildings by means of hot-water pipes, and also for ventilation. These galleries, which are to be 30 feet wide by 25 feet high, will be used exclusively for the exhibition

of works of art and art-manufactures, such as painting, bronzes, sculpture porcelain, decorative furniture, jewellery; in fact, every kind of artistic work, whether applied to objects of ornament or domestic use.

On the side of the Albert and Exhibition roads, the buildings will not be excessively decorated. In the front, overlooking the Horticultural Gardens, the greatest beauty of the new buildings will be seen. The arcades of the Horticultural Gardens, which are only twelve feet wide, are being finished off entirely, and their massive stone capitals and cornices are being carved from designs by the South Kensington art-students. The arcades, which are at present only temporarily covered, are being roofed over in a solid and permanent manner, and will form a promenade on a level with the floor of the picture and art galleries of the upper saloons, with which they will communicate through wide doorway entrances. The side next the gardens will have a handsome terra-cotta balustrade, from which rise light ornamental carved wood columns, supporting a trellis-work of iron running along the whole length and breadth of the walk. This trellis-work will be interwoven with vines and creepers. The balustrade will contain vases filled with flowers, and a pleasant view will be obtained over the whole extent of the gardens beneath.

The buildings are in the decorated Italian style, with mouldings, cornices, columns, and courses in buff-coloured terra-cotta; the brickwork being of the hard red Fareham bricks, so as to match the garden architecture, and harmonise with the new Museum buildings which are rising in front of them. The terra-cotta and red Fareham bricks are more durable against a London winter than even granite. The buildings altogether will accommodate 50,000 people.

NEWSPAPER POSTAGE.

The following correspondence has taken place between Messrs. Cassell, Petter, and Galpin, and the Post-office:—

15th June, 1870.

Sir,—We beg leave to state that Mr. Arthur Arnold, the Editor of the *Echo* newspaper, in reply to a communication he had addressed to the Post-office, received a letter, of which we append hereto a copy, dated 19th April, 1870.

By this letter we were led to understand, and we have made arrangements accordingly, that under the new postage regulations "it will be permissible to transmit newspapers in packets, under the arrangements of the book-post, at the rate of one halfpenny for every two ounces or fraction of two ounces in weight, whenever such a course would be more economical."

It has, however, been recently stated, in some of the public prints, and we have heard from other sources, that the Post-office Bill, if passed in its present terms, might be construed in a sense contrary to that above stated, and that, if the Bill be passed, it will not be permissible to transmit newspapers in packets at the rate of one halfpenny for every two ounces or fraction of two ounces, but that the halfpenny postage will have to be paid on every copy, although three or four might be made into a packet weighing less than four ounces.

As the point referred to is a matter of great public interest, as well as of private concern to us as newspaper proprietors, and as we understand the Bill is to come before the House of Commons to-morrow evening, we shall feel obliged if you will favour us with a reply immediately, to say whether you consider any clauses of the Bill to be open to an interpretation differing from the statement made in Mr. Benthall's letter of the 19th April last.

We have the honour to be, Sir,
Your obedient servants,
(Signed) Cassell, Petter, and Galpin.

John Tilley, Esq.,
Secretary, General Post-office.

(Copy referred to above)

General Post-office, London,
19th April, 1870.

Sir,—In reply to your letter of the 14th instant, addressed to Mr. Rivers Wilson, I have to inform you that the intention is, that a postage of one halfpenny shall be paid by means of postage stamps upon each newspaper not exceeding six ounces in weight, and that a postage of one halfpenny will not carry a packet of newspapers under six ounces in weight.

It will, however, be permissible to transmit newspapers in packets, under the arrangements of the book-post, at the rate of one halfpenny for every two ounces or fraction of two ounces in weight, whenever such a course would be more economical, and in the case of so light a paper as the *Echo* this might frequently be the case. I may add that further detailed regulations will be published in due course.

I am, Sir,
Your obedient servant,
(Signed) A. Benthall.

Arthur Arnold, Esq.

General Post-office, London,
15th June, 1870.

Gentlemen,—In reply to your letter of this day's date, I beg leave to acquaint you that it is clearly intended that several newspapers may, under the new regulations, be sent as printed matter, at the rate of one halfpenny for every two ounces or fraction of two ounces; and if the Bill now before Parliament leaves this doubtful, it will be amended.

I am, Gentlemen,
Your obedient servant,
(Signed) John Tilley.

Messrs. Cassell, Petter, and Galpin.

CORRESPONDENCE.

STUDY OF LANGUAGES.

Sir,—In the *Volsunga Saga*, an Icelandic version of our ancient national epic, the hero's accomplishments are represented to include the speaking of many languages. Such was the opinion and practice of our ancient forefathers; and it is to be hoped that this branch of education will not be neglected in our day, in submission to the sneers about polyglots.—I am, &c.,

Hyde Clarke.

RAILWAY REFORM.

Sir,—I read with much pleasure, in this week's *Journal of the Society of Arts*, that "the Council have appointed a committee to consider the means of promoting improved administrative economical and structural arrangements on railways." As one of the much-abused class of "directors," I feel confident that the suggestions of an intelligent and independent committee will be read with interest in every Board-room. Permit me, however, to suggest that, in order to secure attention, the labours of this committee should be directed to matters of practical utility, and that their time should not be wasted upon speculative theories of traffic and expenditure, such as have of late received serious consideration at the meetings of the Society, much to the amusement of the railway world. Such displays unfortunately tend to strengthen the conservative elements of railway management, by affording an obvious point to the moral of the large class who, whether in railway or other matters, have a personal interest in maintaining existing arrangements, and resist all change. To be of use, this committee must avoid speculations, and confine itself to facts and ascertained results, and the proposed means of improving upon them. In considering "ad-

ministrative arrangements," they will, at the outset, find a large field of inquiry as to the length of railway, having regard to the amount of capital employed and the extent of its traffic, which can be best administered by one board of directors and set of officials. Statistics show that neither the largest nor the smallest companies are the most economically managed. On the one hand, large boards of directors are expensive and of little use; on the other, a certain amount of local element is necessary among them, in order that the public requirements of the districts served by the line may receive due attention. The facts tend to prove that there is a medium in this matter, and both shareholders and the public are interested in fixing it. The nature and effect of the regulations of the Board of Trade; the utility of having three classes of passengers and fares; the uncertain and unlimited amounts obtainable from juries by way of compensation for accidents, are all subjects upon which much misapprehension exists, and into which an independent and impartial inquiry would be specially welcome.

In reference to economical arrangements, the committee will doubtless have no lack of suggestions. Let them, however, in the mass of minor details which are sure to be brought before them, and which are, in nine cases out of ten, best disposed of by traffic managers, bear in mind that the reduction of dead-weight in trains affords the most promising field for further retrenchments in working expenses. It is a generally acknowledged fact that the dead-weight required for each passenger and ton of goods is in excess of what it should be, and yet traffic managers are continually requiring greater strength (which implies greater weight) in their rolling stock. The stronger these are made, the more violent the drivers and porters become in their shunting operations, and further breakages give rise to new demands for additional strength. The English railway carriage is overladen with doors, handles, steps, buffers, springs, lamps, wheels—all elements of weight the committee should report upon, and the relative amount of dead-weight per passenger in an American car, on two bogie frames, with two doors and two central spring buffers, and in an English one, holding half the number of passengers, but fitted with more than double the number of these appliances. The great saving effected by the use of cast chilled-iron wheels in America and Germany should also be investigated. The committee will find a mountain of prejudice and vested interest opposed to their use in this country.

In the economical branch of the inquiry, attention should be directed to the plans which have been suggested for reducing the interest on borrowed capital, either by government guarantee or by the companies joining in a mutual guarantee, each company paying, at specified periods, its proportion of the general interest charge to a common fund, applicable to the payment of the interest of one common debenture stock.

The effect of the standing orders of the two Houses of Parliament should also be considered. The difficulties created by Parliament called into existence a special class of engineers and lawyers, whose business it is to overcome them, and who have absorbed a large amount of the funds of every company. An inquiry into the amount of capital thus unproductively expended would be useful so far as it produced practical suggestions, which might lead to the possibility of inducing capitalists to embark in the construction of new lines, by removing that most unsatisfactory of all items in railway accounts, viz., "Parliamentary and Law."

The consideration of structural arrangements is certain to bring before the committee inventors innumerable; but those who have directed their attention to increasing the durability and lessening the cost of "permanent way" are perhaps most likely to receive the largest share of the consideration of practical men. It should be borne in mind that the same road will not suit all railways. An American line, with two or three trains travelling over it per diem at a low rate of speed, requires a permanent way of a much lighter description than an English line, with fifty or sixty trains per diem running at high speeds, and with heavy loads of goods and minerals. The cost and goodness of permanent way must vary directly as the traffic, and carriage and locomotive expenses will vary inversely as the cost and goodness of the permanent way. Many other questions, such as that of packed parcels, where middle men reap profits which should either belong to the railway company or else be applied in reduction of parcels' rates, the policy of excursion-trains, and the arrangements with the post-office, will naturally suggest themselves; but it is not my wish to occupy your space by enumerating the various subjects to which this committee should direct its attention. My desire is rather to indicate the spirit in which they should undertake their labours, and some general objects upon which they may be usefully employed. Let us, therefore hope that they will approach the consideration of these questions free from the common errors that the interest of the shareholders and the public are opposed, and that railway directors are (to quote Mr. G. W. Jones) men with "dull heads," whose "aptitude for business is quite a matter of secondary consideration," and that their universal anxiety, as a class, is to obscure from the body of proprietors any trace of individual impropriety or neglect of duty;" and also, that the committee will not be above obtaining their statistics and information from reliable sources, and will consider particularly the opinion of practical men before jumping at conclusions. Their labours will then be appreciated by the railway world, and will probably lead to practical results.—I am, &c.,

C. Seale Hayne.

3, Eaton-square, June 20, 1870.

MEETINGS.

The East India Association, by permission of the Council, held a meeting in the Great Room of the Society, on Wednesday, June 22nd, at half-past 3 o'clock p.m., when a paper was read by Sir Bartle Frere, K.C.S.I., on "Public Works in India." Lord Lyveden presided.

NEW BOOKS.

Ruskin on Art. Six lectures before the University of Oxford, 1870. Price 6s. (Macmillan.)

Political Economy for Beginners. By Millicent G. Fawcett. Price 2s. 6d. (Macmillan.)

Geometrical Optics. By Osmond Airey, B.A. Price 3s. 6d. (Macmillan.)

First Principles of Chemical Philosophy. By Jos. P. Cooke, Harvard College, U.S. Price 12s. (Macmillan.)

Drawing for Carpenters and Joiners. By Mr. Davidson. Fifth series of technical manuals. Price 3s. 6d. (Cassell, Petter, and Galpin.)

Hydrostatics and Sound (elementary). By R. Wormell, M.A. Price 3s. (Groombridge and Sons.)

Rustic Adornment. By Shirley Hibberd, F.R.H.S. Price 21s. (Groombridge and Sons.)

Holyoake on the Preservation of Pictures. Price 2s. 6d. (Dalton and Lucy.)

Primitive Man. Translated from the French of Louis Figuier. Price 12s. (Chapman and Hall.)

Mammalia. Their orders and habits popularly illustrated by typical species. From the French of L. Figuier. Price 16s. (Chapman and Hall.)

In the Press.

Introductory Text-book of Meteorology for Schools and Private Students. By Alexander Buchan, M.A., F.R.S.E. (W. Blackwood and Sons.)

Hand-book of Physics. By W. Rossiter, F.R.A.S., &c. (W. Blackwood and Sons.)

The Ocean Telegraph to India. (In a few days.) A narrative and a diary. By Jos. Chas. Parkinson, author of "Places and People," &c. Price 12s. 6d. (W. Blackwood and Sons.)

GENERAL NOTES.

India Colonisation.—Great complaints are being made against the Maharajah of Kashmere for oppression and cruelty, and the government is being called upon to remove him.

Telegraphy over Long Circuits.—The greatest distance is that over the Indo-European line, from Telegraph-street to Teheran in Persia, a distance of about 4,700 miles. This has, since the opening of the line, been frequently accomplished, and business messages constantly transmitted through that great length of line with the same ease and rapidity as over a line one-tenth the distance.

Electrical Remedy for Incrustation in Steam-Boilers.—Mr. C. W. Harrison has provisionally specified an invention which consists in connecting the shell of the boiler with another body in opposite electrical polarity. One method by which he effects this object is by suspending a metal plate in the boiler, and attaching it to the shell of the boiler, so that the two shall constitute a galvanic combination. He so proportions the size of the two that the electro-chemical action on the interior surface shall be "nascent," or nearly so; and he finds it merely necessary, under ordinary circumstances, to impart a positive polarity to the shell of the boiler, in order to prevent the coherence thereto of precipitated matters.

The Chronoscope, exhibited at the conversazione of the Institution of Civil Engineers, is the invention of Captain A. Noble, for recording at one observation the velocity with which a projectile passes different points in the bore of a gun. It consists of a set of discs fixed on an axle, and which are set in motion by a heavy weight, their velocity being regulated by a train of toothed wheels. In operating with this apparatus, the rifle is held in a rest. Into the barrel are screwed, at intervals along its length, from the front of the shot to near the muzzle, six hollow plugs passing from outside the gun to the surface of the bore. The rifle being loaded and fired, the bullet is set in motion, and, as it passes the bottom of the first plug, it presses a cutter which projects from the plug into the bore, and by pressing it causes it to cut a wire passing through the plug to the outside of the gun. Coming to the second plug, the shot cuts a second wire; and so it continues its progress till all the six plugs are passed, and the six wires cut in succession. Each of these wires is the primary wire of an induction coil, and its rupture causes an instantaneous spark to pass between the secondary wires, which are arranged in the following manner:—Six thin metal discs, each 12-in. in diameter, and covered on their edges with white paper, coated with lamp black, are fixed upon a shaft which revolves with great rapidity by the action of a falling weight upon a train of gearing, multiplying the original speed 625 times. Each of these discs is connected with one of the secondary wires, and the other secondary wire is fixed to a discharger, placed so as to be just clear of the edge of the disc as it revolves. The pace of the revolution of the discs is ascertained with great accuracy by a stop-clock, and the gun is fired. The primary wire of the first coil is broken, and a spark at once passes between the discharger and the edge of the first disc, burning away the lamp-black at that point, and leaving a white spot on the paper. The same result takes place with each of the six discs in succession, and the experiment is completed. It now only remains to read, by these white spots on the disc, the velocity of the projectile between the several plugs in the gun. The outer edge of the disc moves at an average speed of 1,000 inches a second, and a vernier is used, dividing the inch into a thousand parts, so that the differences in position between the spots on the successive discs can be measured in intervals of space representing intervals of time in the motion of the shot as minute as the millionth part of a second.

The Mode of Warming Railway Carriages.—A new method of warming first-class carriages in express trains has been adopted in Bavaria. A special van is attached to the train, and contains a powerful "calorifere," and the heated air is conveyed to all the carriages of the train by means of india-rubber tubes. The experiment with first-class carriages is reported upon so favourably that the authorities have determined to apply it to all the carriages on the Bavarian lines, and it is expected that it will soon be adopted on all the German railways.

The Production of Ozone.—We have heard so much of late years about the beneficial influence exerted by the presence of ozone in the atmosphere, that even non-scientific readers may like to know how it can be artificially produced. Hitherto, electricity, phosphorus, and permanganate of potash have been the recognised sources of production, but Professor Mantegazza has discovered that it is developed by certain odorous flowers in a still greater amount. A writer in *Nature* states that most of the strong-smelling vegetable essences, such as mint, cloves, lavender, lemon, and cherry laurel, develop a very large quantity of ozone, when in contact with atmospheric oxygen in light. Flowers destitute of perfume do not develop it, and generally the amount of ozone seems to be in proportion to the strength of the perfume emanated. Professor Mantegazza recommends that, in marshy districts and in places infested with noxious exhalations, strong-smelling flowers should be planted around the house, in order that the ozone emitted from them may exert its powerful oxidizing influence. So pleasant a plan for making a malarious district salubrious only requires to be known to be put in practice.

Railway Traffic in India.—The miles of railway open in 1869, in British India, numbered 4,128, yielding a revenue of £5,513,000 sterling, or more than five times that of Denmark. Excluding the Conjeveram tramway of about 30 miles, stretching from the point on the Madras railway from which a branch diverges to meet the Bombay Extension to Conjeveram, the city of many pagodas sacred to Madras Brahmins, there are in all thirteen lines:—the East Indian, 1,131 miles; the Jubbulpore, 223; the Eastern Bengal, 113; the Calcutta and South-Eastern, 28; the Oudh and Rohilcund, 42; the Punjab, 246; the Delhi, 174; the Madras South-West, 492; the Madras North-West, 185; the Great Southern of India, 168; the G. I. Peninsula, 874; the B. B. and Central India, 308; and the Sinde Railway, 107. And in the classifying these according to their presidencies, and comparing the revenue of 1869 with that of the preceding year, it may be observed that the development of railway traffic in Bengal Presidency stands in striking contrast with the trade on the lines of the others. On the East India, the earnings, which averaged £36 5s. in 1868, had risen to £41 8s. per mile per week in the following year, and on the Eastern Bengal Railway a traffic of £7 2s. had been increased to £8 3s. per mile per week. The 28 miles of the miserable line grandly denominated the Canning State Railway may be excluded without endangering comparisons and proportions, and so may the 48 miles of the Oudh and Rohilcund line. The Punjab and Delhi line is the only other in the Bengal Presidency, and on that also there has been a proportionate expansion of traffic, from £6 9s. to £9 9s. In Madras, on the line between the Coromandel and the Malabar coasts there has been a fall of about £2,000 pounds in the year, and about £4 per mile per week on that portion opened to the north-west. The line meandering through the plains of Southern India has likewise suffered a small decrease, and even the Bombay railways have lagged behind Bengal in the expansion of their traffic during the period to which we allude. The G. I. P. Railway earnings have diminished from £1,470,000 to £1,425,000; B., B., and Central India Railway exhibiting a slight increase of £25 to £26 per mile.

Art Instruction in the United Kingdom.—The drawings and models which have been selected from the works executed by the students of the various schools of art in the United Kingdom, for the medals and prizes offered by the Science and Art Department for this year's "national competition," are now being exhibited in the South Kensington Museum. In consequence of the great want of space in the museum, they have been arranged in the Raphael Cartoon Gallery. The total number of works submitted for examination, from which this selection has been made, exceeds 87,000, sent up from 107 schools of art and 269 art night classes.

Bisulphide of Carbon, according to Sidot, renders wood very sonorous, and makes it an excellent conductor of heat and electricity. Sidot passed vapours of bisulphide of carbon over pieces of wood in a porcelain tube, first in the cold, in order to expel the air, and then at high temperature, the tube being slowly and gradually heated for an hour until it was red-hot. The various kinds of wood yield, by this treatment, a coal which is not surpassed by the most sonorous substances known. Sidot made a bell of oak wood, and subjected it to this treatment with bisulphide of carbon. The sound it gave after the process compared favourably with that of a metallic bell of equal diameter. The hardest kinds of wood seem to produce the purest and most harmonious tones. On account of its capacity of conducting heat and electricity, Sidot recommends the coal prepared in this manner for use in Bunsen's galvanic batteries, and for pencils of electric lights. Such pencils give a much intenser light than those made from the graphite of gas retorts; they become gradually white-hot throughout their whole mass, without burning at a single point, and cool down immediately as soon as the fire is removed. Linen, hemp, cotton, paper, and silk behave similarly to wood, and the action of methylated spirits (wood naphtha), hydrocarbons, &c., resembles that of bisulphide of carbon. The coal from wood has superficial metallic lustre, is denser than common charcoal, and has a greater absorbing power for gases.

The Sun.—Mr. J. Norman Lockyer, in the course of his fourth and last lecture on the sun, laid down the following principles as to the absorption and radiation of certain substances. Glass, he said, absorbs and gives out a great deal of dark heat. Rock salt absorbs and gives out very little dark heat. Opaque glass absorbs and gives out much light, whilst transparent glass absorbs and gives out little light. Carbon absorbs and gives out much light and dark heat. Air absorbs and gives out very little light and dark heat. He then went on to explain that the common candle-flame has a chromosphere and photosphere, and that when the flame is disturbed gases are thrown out from its interior towards its exterior, just as is the case with the sun. Moreover, when an image of the candle flame is thrown by a lens upon the end of a spectroscope, and portions of the flame are then examined through the slit, many of the phenomena presented by a spectroscopic examination of portions of the sun are likewise seen by the examination of the flame of the candle. When the blue part of the flame of the candle is thus examined, a tolerably fair bright-line gaseous spectrum is seen, projected upon a faint continuous spectrum. When examining sun spots, a general and a selective absorption is visible, especially in the sodium lines, which thicken in proportion to the abruptness of the declivity of the sides of a spot. The greater the pressure, the thicker are the absorption lines. In the course of this lecture he said that there are bright lines in the solar spectrum, and that these bright lines are far more unchangeable than the dark ones. He concluded by saying that if we accept the theory of Laplace, that the sun is nothing but the condensation of a tremendous nebula, there is evidence that it is a hot globe now cooling, which, after the lapse of untold ages, will roll as a cold, dark ball through space.

Submarine Attack.—Captain Ericsson has devised a projectile, which he is confident will overcome the difficulty caused by the resistance of the water, in the attempt to strike a vessel below the water-line. It is an elongated shell, charged with 300lb. of dynamite, and shot from a 15-inch gun at such an elevation as to enter the water near the hostile vessel, and strike the hull anywhere beneath the water. It is fitted with a percussion cap, which explodes upon very slight inpact against the hull, so that the velocity of the shell when it reaches its destination need not be high. The gun is carried on a swift armoured boat, protected by a turret. Captain Ericsson has challenged the new British iron-clad *Devastation* to come out and encounter his torpedo.

The Anglo-French Treaty.—The following facts and statistics with reference to the operation of the treaty, and the duty it imposes on certain branches of British industry, were laid before Sir Louis Mallet, of the Board of Trade, at a meeting in Macclesfield. A return of British trade and shipping with France two years before the treaty, and for the last two years in which returns have been published since the treaty, showed that the value of imports in 1858-9 were £15,071,000, while in 1867-8 it was £33,115,000 being an increase on the period subsequent to the treaty of 18,744,000. The exports of British products to France in the same period was as follows:—1858-9, £4,808,000; 1867-8, £11,387,000. The foreign and colonial exports were:—In 1858-9, £4,593,000; and in 1867-8, £11,881,000. The total increase of exports from this country to France being thus of the value of £13,870.000. The British shipping with France had increased £1,445,000 tons, and the increase in the shipping to those countries in Europe whose markets had been thrown open to British produce, through the instrumentality of France, since 1860, was 5,033,000 tons. The value of the foreign trade of England, backwards and forwards, with those countries with which treaties have been made since 1860 is no less than £84,000,000 sterling. As to the effect of the treaty on the local silk trade of Macclesfield, before the treaty there were 6,000 hand-loom weavers employed in Macclesfield. Now there is barely 2,000. 23 silk mills are standing idle, and about 1,200 houses are empty. During the past year the trade, especially in the "throwing" branch, has greatly improved; 742 houses which were empty last year are now occupied, and the workpeople are earning increased wages. The duties imposed under the treaty were found to be prohibitive to the mixed silk goods made in the town, and these duties required modification or remission. Double and threefold yarns were excessively taxed, as compared with single yarns, and the duties were much heavier than was apparent on the face of the treaty. This kind of yarn, used in the cotton lace manufacture, appeared to have been quite overlooked on the framing of the treaty. If the tariff on cotton goods and yarns were reduced, the duty ought also to be reduced on mixed silk goods, otherwise the English manufacturer would be placed at a great disadvantage in comparison with the French competitor. Sir Louis Mallet, in reply to the representations made to him, expressed his full approval of the principle and policy of the treaty; and, notwithstanding the admitted hardship which it had imposed on the silk trade, said that statistics proved that it had increased the trade of the country at large, and he believed it would do still more in proportion as other countries continued to reciprocate the principle.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. United Service Inst., 8½. Capt. J. P. Morgan, R.A., "On a very heavy Breech-loading Gun."
London Inst., 4.

Tues .. Medical and Chirurgical, 8½.

Wed ...SOCIETY OF ARTS, 4. Annual General Meeting.

Thur ...Philosophical Club, 6.
East India Assoc., 8. (AT THE SOCIETY OF ARTS HOUSE.)

Journal of the Society of Arts.

FRIDAY, JULY 1, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

ANNUAL GENERAL MEETING.

The Annual General Meeting, for receiving the report from the Council, and the Treasurers' Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held, in accordance with the bye-laws, on Wednesday, the 29th of June, at 4 p.m., Lord Henry Gordon Lennox, M.P., Chairman of the Council, in the chair.

The Secretary having read the notice convening the meeting, the minutes of the last Annual General Meeting, and of the subsequent Special General Meeting, were read and signed.

The Chairman then nominated Mr. W. Botly and Mr. C. Purling as scrutineers, and declared the ballot open.

The Secretary then read the following—

REPORT.

The Council, in compliance with the Society's Bye-laws, now lay before the members, at the annual general meeting, their report of the Society's proceedings during their year of office.

Albert Medal.

In 1862, this medal was founded for rewarding "distinguished merit in promoting Arts, Manufactures, or Commerce," and has each year since that date been bestowed by the Society on some eminent individual, in recognition of labours in promoting the objects for which this Society was instituted. On the present occasion, the medal has been bestowed on M. Ferdinand de Lesseps, "for services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal." The Council are confident that, in awarding the medal to M. de Lesseps, they are recording not only the unanimous verdict of the members, but of the world at large.

Medals.

The Council have awarded the Society's silver medals, for papers read before the Society at its evening meetings, as follows :—

To Mr. Thomas Dickins, for his paper "On Silk Supply."

To Mr. James Collins, for his paper "On India-rubber: its history, commerce, and supply."

To Mr. Wm. Bridges Adams, for his paper "On Tramways for Streets and Roads, and their Sequences."

Cantor Lectures.

Three courses of these lectures have been delivered during the session. The first, "On the Spectroscope and its Applications," was given by J. Norman Lockyer, Esq., F.R.S., and consisted of three lectures, which were numerously attended, and afterwards published *in extenso* in the Society's *Journal*. The second course, consisting of four lectures, was by Dr. Benjamin H. Paul, whose subject was "The Phenomena of Combustion, and the Chemical and Physical Principles involved in the use of Fuel, and in the Production of Artificial Light." These lectures have also appeared in the *Journal*. The third course was delivered by Professor A. W. Williamson, F.R.S., "On Fermentation," and consisted of four lectures, which were well attended. Reports of them will shortly be published in the *Journal*.

Art Workmanship.

The programme of prizes offered this year was of a similar character to that put forth in the previous year, which, it will be remembered, had been very considerably changed from those which had been for some years previously in use. The object in making the change was to meet the views so frequently urged upon the Council by the art-workmen, that more liberty in the choice and treatment of subjects should be given them. The Council are happy to announce that the competition this year has been on a larger scale, and of an improved character, and that the judges have been enabled to award a much larger amount of prizes than last year. The amount of prizes this year is £204 10s., contrasting favourably with £95 only awarded in the previous year. The judges in their report "congratulate the Society upon a more worthy response to their liberal invitations to the workmen, to forward good specimens of their handicrafts, than was made last year." The particulars are printed in the *Journal*, page 346.

As regards the coming year, the Council, having in view the International Exhibitions about to take place under the management of the Royal Commissioners for the Exhibition of 1851, have thought it well to suspend for a time the form hitherto adopted in offering prizes for art-workmanship, believing that a

change is likely to be beneficial to the object the Council have at heart, viz., to see the art-workmen of the United Kingdom occupying a good position in the coming International Exhibition, in comparison with those of other countries.

With this view they have decided upon offering a series of rewards for special excellence on the part of all concurring in the satisfactory production of works of industry of the highest character. They consider that they can most effectually ensure their object by offering to manufacturers the highest distinctions they have it in their power to confer, medals, and to workmen liberal money premiums.

They desire to obtain, from those who may be willing to compete for the prizes they offer, specimens of art-manufacture, which will have to be sent to the Society's rooms by the 14th January, 1871.

These will be immediately judged upon their merits, and the premiums, consisting of Gold and Silver Medals, and Money Prizes to the extent of £500, will be awarded to manufacturers, designers, and workmen. An endeavour will be made to effect arrangements by means of which every object receiving a premium, or selected for the distinction of being exhibited, will be placed in the coming International Exhibition as a contribution on the part of the Society of Arts, showing the results of recent efforts which have been made to improve art-workmanship in this country.

The specimens of manufacture sent in, in competition for the above rewards and premiums, will have affixed to them the name of the designer and of the workmen, in each special branch of industry involved in the execution of the work. Every workman will be eligible to receive money premiums proportionate to his merits, and to the degree in which he may have contributed to the successful results of the whole; whilst the manufacturer may receive the Gold or Silver Medals of the Society.

These works may obviously include specimens not only of the taste of the designer, but of the skill of the carver, inlayer, metal worker, chaser, bronzist, engraver, china painter, die sinker, cameo cutter, glass worker, enameller, mosaicist, and other art-workmen, either separately or in any arranged combination.

The full particulars of these prizes may be had on application at the Society's house.

Annual International Exhibitions.

In the year 1851, as the members will recollect, a large surplus remained in the hands of Her Majesty's Commissioners for the Great Exhibition, and a considerable portion of that amount was invested in the purchase of land at South Kensington, and has been appropriated generally in promoting art and science applied to industry, as laid down by their Charter of Incorporation. The Commissioners, in further fulfilment of the duties imposed upon them by their charter, have determined to hold, in 1871, the first of a series of Annual International Exhibitions of selected works of Fine and Industrial Art and Scientific Inventions, to be opened at South Kensington on the 1st of May, 1871, closing on the 30th of September. The Exhibition will take place in permanent buildings, now in the course of erection, adjoining the arcades of the Royal Horticultural Gardens, which, it will be remembered, are included in portions of the ground purchased by the Commissioners. The enormous size to which International Exhibitions had grown would appear to have reached a limit in the Paris Exhibition of 1867, which, for a time at least, would seem to have deterred any other nation from attempting an undertaking of such immense proportions. Her Majesty's Commissioners, recognising the vast importance and the beneficial bearing which international exhibitions ever have upon the arts, commerce, and civilisation of the world, have endeavoured to retain all these advantages, and, at the same time, bring the undertaking within more moderate, useful, and consultable limits. With this object in view, they propose annual exhibitions, in which, each year, shall be comprised certain sections only of industry, and in those sections again selected articles alone shall be admitted. Fine arts and inventions will be admitted every year. The exhibition of the coming year has the following divisions: — 1. Fine arts, applied or not applied to works of utility. 2. Manufactures, machinery, and raw materials, but limited to pottery, woollen and worsted fabrics, and educational works and appliances. 3. Scientific inventions and discoveries of all kinds. 4. Horticulture. In addition to the permanent buildings connected with the arcades before mentioned, the Albert Hall of Arts and Sciences, now in course of erection, and adjoining them, will be available for the purposes of the exhibition. In this building, capable of holding upwards of 10,000 persons, all ceremonials connected with the exhibition, notably those of opening and closing, as well as concerts and musical competitions on a large scale, will take place. Her Majesty's Commissioners have invited the aid of the Society of Arts in carrying out this undertaking, and the Council have had great pleasure, and they feel assured the members of the Society will heartily join them in rendering every assistance in their power to a scheme in which the Society of Arts, from its early associations with such Exhibitions, must naturally take a deep interest. The Council have undertaken the charge of Class 10 in Division II.,

"Educational Works and Appliances," having, as the members will recollect, conducted, with great success, in 1854, an International Educational Exhibition in St. Martin's-hall. The Council have sought and obtained the assistance of a very large and influential committee to take charge of this work. His Royal Highness the Prince of Wales, the President of the Society, has consented to act as its chairman, and, on the 4th of April last presided over the first meeting of the Committee in the Society's Rooms.

The Council have had much pleasure in placing the Rooms of the Society at the disposal of Her Majesty's Commissioners for meetings in connection with the Exhibition, and two such meetings have been held, one under the presidency of H.R.H. Prince Christian, for the Fine Arts, and the other under that of Lord Halifax, for Woollen and Worsted manufactures.

In order further to mark the Society's interest in the Exhibition, and to identify itself with the undertaking to its fullest extent, the Council have resolved to offer the Society's Gold Medal in each class of the Exhibition. The Council have also suggested the formation of a special fund, for purchasing out of the Exhibition specimens illustrative of fine art, science, and industry, which may be circulated among local institutions, on the same principle as objects are now circulated by the Science and Art Department of the Government; and Her Majesty's Commissioners have signified to the Society that they will be prepared to carry out this suggestion, by setting apart out of every three guinea season ticket for the Exhibition sold by or through the Society of Arts, one guinea, to be carried to a separate account on behalf of such a purchase fund. The Council trust that every member will exert himself strenuously to further this important object, and purpose to take measures for making the plan known throughout the United Kingdom.

Education.

This branch of the Society has now taken so important a position, that the Council have thought it right, in connection with the other changes made for the conduct of the *Journal*, to abolish the office of Assistant-Secretary, and to place the Educational Department in the hands of a special officer, and they have appointed to it Mr. Charles Critchett, who for the last thirteen years has filled the office of Assistant-Secretary. The proceedings of the Society under this head are fully given in the report of the educational officer, read to the annual conference of delegates from the Institutions in Union on the 22nd instant. It is unnecessary, therefore, to repeat them in detail, though not the less forming a very important branch of the Society's action. Improved education for all classes lies at the root of all progress, and without it the labours of the Society to promote the objects for which it is founded, in other directions, would be of little value, and hence the deep attention which the Council have paid to it. Improved education, by the introduction of science more generally into our schools and colleges, and the necessities for improved primary education, and extended means for the people at large to obtain it, have been prominently urged by the Council, and it is hoped that its labours have not been without effect. Still much remains to be done, and the Council urge upon the members not to relax their efforts in this direction.

Drill Review.

The importance of drill in the training of the young has been particularly brought to the notice of the Council, and on more than one occasion the Council have had the opportunity of witnessing the efficient manner in which it is carried out at the district schools of the metropolis. The Council have thought it important to draw public attention specially to it, and with that view organised a drill review at the Crystal Palace, of boys from the various military, naval, district, and other schools in the neighbourhood of the metropolis, which took place on the 21st inst., at the Crystal Palace. Three thousand boys took part in the review, in the presence of H.S.H. the Prince of Teck, and the review was a great success, whilst the excellence of the drill attracted much notice from all the eminent military officers present as well as from the public. The music of the bands was highly appreciated.

India.

The Indian Committee has continued its labours, and held several conferences on subjects of importance, while practical results have attended its measures of last year. The question of a gold currency for India was the occasion of a discussion, which was attended by some of those best able to take part in it. Besides the conferences held within this section, two ordinary meetings have been devoted to Indian subjects, one on the Suez Canal, and the other on the management of public works in India. Trade to the north-east has been discussed by Mr. T. T. Cooper and Captain Sprye. The time having arrived for receiving the prize essays on tea cultivation, they are now under consideration of the sub-committee of award. The applications of the Society to the Duke of Argyll in favour of improved agricultural administration in India has obtained the favourable notice of Indian authorities. The Committee continues to co-operate with the Manchester Cotton Association in promoting the advancement of cotton culture.

Besides the conferences held by the Indian Committee, the East India Association has been permitted to hold meetings in the Society's rooms, which have further tended to give publicity to Indian subjects. Altogether the Society has had reason to be satisfied with its efforts for making the wants of our great Indian empire better known.

Improved Channel Steamers.

The daily increased intercourse which is taking place between this country and the Continent, has drawn the attention of the Council to the serious want of accommodation, and the great defects in the present modes of transit across the Channel, and they therefore thought it right to draw special attention to it, in the hope of remedying the admitted defects of the system. They offered, in the early part of the year, the Society's Gold Medal and Silver Medal for the best and second best model of a steamer which should afford the most convenient shelter and accommodation to passengers, on the decks of a vessel crossing the Channel between France and England, such vessel not to exceed in tonnage and draught the best vessels now in use between Folkstone and Boulogne. Seventeen models were sent in competition, three only of which complied with the conditions laid down, but none of which, in the opinion of the experienced Committee to whom the matter was referred, presented sufficient novelty or merit to justify the award of the medal. The Committee, to whom the Society is indebted for their valuable report on this competition, which will be found on page 345 of the *Journal*, consisted of Lord Henry G. Lennox, M.P., Chairman of the Council; Seymour Teulon, Vice-Chairman; Rear-Admiral Ommanney, C.B., F.R.S., Admiral Ryder, E. J. Reed, C.B., Captain Boxer, R.N., C. W. Merrifield, F.R.S., H. Cole, C.B., and Capt. Tyler.

Journal.

The Council have had under their consideration the improvement of, and arrangements connected with, the Society's *Journal*, and they have thought it right to place it in charge of a responsible officer, as editor, whose duty it shall be to conduct it, subject, however, to the general control of the Secretary, and they have appointed Mr. W. G. Larkins to this office. They have also thought it right to revise the arrangements for the printing and the advertising department. After seeking tenders from a number of printing firms, among whom was the existing printer of the *Journal*, they determined to retain the printing in his hands on a revised scale of terms, but to place the advertising on a totally different footing and in separate hands. The Council trust that these new arrangements will lead to economy in working, increased revenue from advertisements, and improvement generally in the *Journal* itself. The Council anticipate a considerable saving in the distribution of the *Journal* when the promised half-penny postage on newspapers and printed matter comes into operation.

Food Committee.

This Committee have especially directed their attention to the various processes for the preservation of meat, with a view of rendering available in this country the large supplies which are to be found in foreign countries and in our colonies. The particulars of the proceedings of this Committee will be found in its report, page 707 of the *Journal*.

Postage.

The Council have had under their consideration the reduction of the rate of postage on newspapers and printed matter, as well as the subject of a parcel post. They have pressed these matters on the Post-office, and a deputation from a very numerous Committee formed by the Council to take charge of the subject, consisting of nearly 200 members, including 120 members of Parliament as well as representatives of the Press, had the honour of laying their views before the Postmaster-General on the 12th of March last. The Council congratulate the members that the Postmaster-General has taken a favourable view of the matter, and that they have been instrumental in obtaining a postal reform which, though still falling far short of what is needed for the extended commerce and wants of the kingdom, they believe will be of national importance to the progress of Arts, Manufactures, and Commerce. The Council have taken steps to urge on the Postmaster-General the absolute necessity of further reform in this direction, urging that six ounces weight passing through the post-office for one halfpenny should not be restricted to newspapers only, but that any matter, whether printed or not, exclusive of letters, should be entitled to the same privilege. The Council trust that their successors in office will continue this work, and not relax their efforts until the object is attained.

Telegraphs.

The chief conclusions advanced in the Society's discussions on the subject of the telegraphic post, that from unity of goverment management a fund was derivable for the benefit of the shareholders and the public—that to the shareholders might be given a better return for their capital, and to the public more extensive and convenient service at lower rates—have been adopted by the legislature, and are now in the course of practical and successful application. A large

augmentation of remunerative traffic has already been obtained, and there is every prospect that data will soon be afforded for pressing for the reduction of the shilling to sixpence, the equivalent to continental rates. The results of the principle of administrative reform applied to telegraphic communication are watched with interest for their application to the reform of railway communication, a commencement of which has been prepared for in Ireland.

In view, however, of the fact that the Post-office now exercises a monopoly of telegraph administration, the Council has considered it expedient to appoint a Committee to watch the influences of the department on the development of invention, and, in case of need, to secure the free exercise for its improvement by our men of science.

Ship's Life-boats.

The Council, taking into consideration that great loss of life at sea which occurs from the want of proper boat accommodation provided for ships' crews and passengers, have determined to offer the Society's Gold Medal for a ships' life-boat, suitable for the mercantile marine, and before finally awarding the medal, the Council have reserved to themselves the right of requiring the selected candidates to build full-sized boats, in order that the same may be practically considered. The terms and conditions of the competition have been laid down by a Committee, consisting of Lord Henry G. Lennox, M.P.; Vice-Admiral Sir Edward Belcher, K.C.B.; the Right Hon. G. J. Goschen, M.P.; Thomas Gray; Richard Lewis; Captain Nisbet; Rear-Admiral E. Ommanney, C.B.; E. J. Reed, C.B.; Rear-Admiral A. P. Ryder; Seymour Teulon; Captain Toynbee, R.N.; Captain Ward, R.N.; Lieut. C. P. Wilson; and Captain Tyler. The time for sending in models and plans has just expired, and the Council are happy to announce that a considerable number of competitors have entered for the Medal. The Committee will forthwith commence the task of examining what have been sent in, and the result will be announced in the *Journal*.

Conversazione.

This gathering of the members and their friends at the South Kensington Museum was more than usually attractive and well attended. Their Royal Highnesses the Prince of Wales, President of the Society, and the Princess of Wales honoured the party with their presence. Their Royal Highnesses expressed themselves much gratified with the arrangements, and with the manner in which they were received by the assembly.

Cabs and Cab Indicators.

The Society's offer of a Medal for improved hackney carriages has not proved fruitful; but as regards the indicators, the subject is more hopeful, eight instruments having been sent in, some of which exhibit great ingenuity and novelty. These, however, are still under the consideration of the Committee, who are not yet prepared to make their definite report.

Kindred Societies and Associations.

The Council have had much pleasure during the session in lending the Society's Great Room for the meetings of other bodies promoting objects allied to those which the Society is chartered to encourage. The following societies have held meetings in the Society's House, viz.:—The Social Science Association, British Association of Gas Managers, Æronautical Society of Great Britian, Royal Institute of Naval Architects, London Association of Church Schoolmasters, social meetings of the Working Men's Club and Institute Union, Workmen's International Exhibition of 1870, National Emigration League, Systematic Beneficent Society, Decimal Association, East India Association.

Finances.

The Council have already printed in the *Journal*, as required by the Bye-laws, the financial statement for the year, and the same must be taken as appended to this report. The Council congratulate the members on the increase which has taken place in the number of members. In the course of the year the Society has lost by death Mr. Alfred Davis, who was a liberal contributor annually to the Society's funds. By his will he has bequeathed to the Society a legacy of £2,000, to be held as a permanent fund, the income thereof to be applied by the Council for or towards the establishment of annual prizes, or in any other way the Council may in their judgment deem desirable for the encouragement of art and science. The amount, less the legacy duty of £200, has this day been paid by the executors to the Society's bankers.

Mr. Botly moved the adoption of the report, and expressed his great satisfaction at the very successful Session which had just closed.

Mr. Edmund Johnson seconded the motion.

The motion was then put and carried unanimously.

The Chairman being obliged to leave the chair, it was taken by Mr. Seymour Teulon, Vice-Chairman of the Council.

Mr. Lloyd Wise begged permission, if not out of order at this period of the proceedings, to say a few words in reference to the library, which he considered was not so convenient in its arrangements, for the use of those consulting it, as it ought to be. The shelves are not convenient for consultation, and the room in which the books are placed is so frequently used for other purposes—such as the display of models, and other objects, which are sent in to the Society for competition, &c.—that consultation of the books, especially the collection of patent specifications, is extremely inconvenient. He thought the Council should give their attention to remedy this grievance. The room also contained a collection

of models of machines connected with the transactions of the Society in past times, which he thought might better be stowed away elsewhere, instead of taking up valuable room, which might then be devoted to improving the arrangements for the books, and the accommodation of those consulting them.

The **Chairman** said the Council were not unmindful of what Mr. Lloyd Wise had stated. but it must be remembered that the Society had only limited space and limited funds at its command. The models, though somewhat slightingly spoken of by Mr. Lloyd Wise, were, in an historical point of view, very valuable, and could not be disregarded. It was, however, contemplated to remove them elsewhere, where they would be well taken care of and well displayed. To make the library all that it should be would require considerable expenditure of money, and it must be borne in mind that the Society dealt with so many other objects that it could not afford to appropriate a very large amount of money en this one.

Professor Tennant said that, historically considered' the models were very valuable, and that the specimens of marbles in the Society's possession were not surpassed anywhere.

Mr. Hyde Clarke said the Council were fully alive to the imperfections in the library, but there were many difficulties in making it what he should like to see it. Space and money were needed for this purpose, and Mr. Wise must bear in mind that, while he had his object in view, thero were other members who had their objects, on which they desired to see the money of the Society expended. The Council had only limited means at their disposal, and although the report just read, and the accounts appended to it, showed that the receipts on the present year had been increased, yet the expenditure had also increased. He also saw that, during the next year, the Society's connection with the Exhibition would involve an increased expenditure; but he hoped that a proportional increase in members and in receipts would follow from that connection. He, moreover, felt sure that the Council would give their best attention to Mr. Lloyd Wise's remarks.

Dr. Stenhouse, F.R.S., in complimentary terms, congratulated the Council on the successful session just past, and moved that the hearty thanks of the meeting be given to Lord Henry G. Lennox, Chairman of tho Council, and his colleagues, for the very satisfactory manner in which they had conducted the business of the Society during the session just closed.

Professor Tennant seconded the motion, which was carried unanimously.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following members had been elected to fill the several offices. The names in *Italics* are those of members who have not, during the past year, filled the offices to which they have been elected :—

COUNCIL.

PRESIDENT.

H.R.H. tho Prince of Wales, K.G.

VICE-PRESIDENTS.

Sir W. H. Bodkin (Assist. Judge)	Duke of Devonshire, K.G.
Lord Chancellor, F.R.S.	*Sir Charles W. Dilke, Bart., M.P.*
Henry Cole, C.B.	Earl Granville, K.G., F.R.S.
Sir Daniel Cooper, Bart.	William Hawes, F.G.S.
Right Hon. W. F. Cowper-Temple, M.P.	C. Wren Hoskyns, M.P.
Earl de Grey	Lord Henry G. Lennox, M.P.
Lord De l'Isle and Dudley	
Sir John Lubbock, Bart., M.P.	*Rev. W. Rogers*
Right Hon. Sir John S. Pakington, Bart., M.P.	*Sir Francis Sandford*
Samuel Redgrave	Seymour Teulon
	Thomas Twining

ORDINARY MEMBERS OF COUNCIL.

F. A. Abel, F.R.S.	*Bernhard Samuelson, M.P.*
Edwin Chadwick, C.B.	*Viscount Sandon, M.P.*
Captain Donnelly, R.E.	*George A. Spottiswoode*
Major-General F. Eardley-Wilmot, B.A., F.R.S.	E. Carleton Tufnell
Douglas Galton, C.B., F.R.S.	Henry Vaughan
Adm. Ommanney, C.B., F.R.S.	James T. Ware

TREASURERS.

G. C. T. Bartley | Hyde Clarke

AUDITORS.

Andrew Cassels | Jacob A. Franklin

SECRETARY.

Peter Le Neve Foster, M.A.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

The **Chairman** proposed a vote of thanks to the scrutineers, Mr. W. Botly and Mr. C. Purling, for their services, which was carried.

At the conclusion of the General Meeting a Special Meeting was held, when the following candidates were balloted for and duly elected members of the Society :—

Alforth, Charles Edward, 17, Gracechurch-street, E.C., and 4, Elgin-road, W.
Baillie, Thomas, 118, Wardour-street, W.
Blake, G. J., 9, Aberdeen-park, Highbury-grove, N.
Cadman, Edwin, Westbourne-house, Sheffield.
Cather, Rev. Robert G., LL.D., 8, Old Jewry, E.C.
Chatterton, Frederick, 14, Clifton-road, St. John's-wood, N.W.
Croggan, Major-General, R.A., 35, Tregunter-road, S.W.
Daw, Joseph, jun., Grove-lane, Camberwell, S.E.; and 69, Mark-lane, E.C.
Diamond, James, 11, Park-lane, W., and the Beeches, near Axminster.
Dixon, Jacob, 8, Great Ormond-st., Queen-square, W.C.
Evill, Henry, Ladbroke-house, Ladbroke-road, Notting-hill, W.
Flatau, J., 15, Douglas-road, Canonbury-park, N.
Hodgson, Edmund Dorman, 5, Paper-buildings, Temple, E.C.
Jones, Alfred, 64, Grosvenor-street, W.
Kendall, Richard, 65, Conduit-street, W.
Knight, Walter, 104, Great Russell-street, Bloomsbury, W.C.
Misa, Manuel, 106, Lancaster-gate, W.; and 42, Crutched-friars, E.C.
Noel, Albert Leland, 41, Onslow-gardens, S.W.
Price, C. W., 54, Threadneedle-street, E.C.
Reed, E. J., C.B., Admiralty, Whitehall, S.W.
Rougier, Henry, 1, Inverness-gardens, Bayswater, W.
Silber, A. M., 56, Wood-street, E.C.
Stanesby, John Tatam, 34, Sloane-street, S.W.
Sutcliffe, James S., J.P., Beech-house, Bacup, Lancashire.
Warren, James, Capel-house, Waltham-cross, S.W.
Whitworth, B., 11, Holland-park, Notting-hill, W.
Williamson, John William, 4, Stone-buildings, Lincoln's-inn, W.C.

AND AS HONORARY CORRESPONDING MEMBER.

Malarce, Auguste de, Membre du Conseil Général des Crèches, 102, Rue du Bac, Paris.

FOOD COMMITTEE.

This Committee has made the following report:—

The Food Committee have continued, during the past year, their examination of meats preserved by various processes.

In the last report of the Committee, mention is made of a mode invented by Mons. Shauer and adopted by Baron Fabrice, which, it was hoped, might enable meat to be kept exposed to the air for an indefinite period; but the specimens examined and repeated experiments made by the Committee have not satisfied them as to the success of the method pursued.

Several tins of preserved meat from Melbourne were forwarded to the Committee by Sir Francis Sandford, by direction of Earl Granville, for examination and report. The Committee notified to Sir F. Sandford that the specimens sent were equal, both in flavour and nutritive value, to other samples from Australia which had been before carefully examined and tested by the Committee; but the Committee having, at the same time, the opportunity of comparing them with meat preserved at her Majesty's victualling yard at Deptford, were unanimously of opinion that this latter was much superior in flavour, as well as in every quality which makes up food value. The Committee also suggested to her Majesty's government that a full detail of the methods adopted at Deptford should be forwarded to the Meat Preserving Company in Australia.

Mons. Thibierge's process, which consists in dipping the meat for a short time—a few minutes only—in very dilute sulphuric acid, has been under consideration; but, so far as the Committee have have had opportunities of examination, they have not arrived at a favourable opinion as to its ultimate success.

Mr. Collett forwarded to the Committee specimens of meat and other articles of food preserved in Canada by means of bisulphite of lime, employed in accordance with the process of Bailey and Medlock. The result was not successful, owing perhaps to adventitious circumstances. Manning's method of keeping raw meat in tins—one of the varieties of preserving processes by means of sulphuric acid gas—has also been examined, but not found satisfactory.

Comparisons have been instituted, to test the value of American beef purchased by her Majesty's government for the use of the Royal Navy as against meat cured at Deptford. Notwithstanding the excellent quality of the Deptford meat, the Committee considered the American specimens so specially good as even to exceed in value the British samples.

Further experiment has shown the value of the desiccated meat prepared at Queensland, and its great keeping qualities over a long period of time, and the Committee believe that this will become a very valuable article of commerce, and a cheap addition to our food resources.

Several trials have been made of Mr. Tallerman's Australian meat, and the Committee have had the advantage of the scientific aid of Dr. Thudichum, who has specially examined into and reported on its value. From these trials and report the Committee have arrived at the conclusion that the meat is highly impregnated with the salts used in its preservation, notably with chloride of sodium; that it has lost a considerable proportion of its nutritive qualities, and cannot be depended on, without the addition of fresh meat and vegetables to make it thoroughly life-sustaining. To these, Dr. Thudichum suggests the further addition of *Extractum carnis* (Liebig), in order to supply elements of value lost in the processes of preservation adopted.

The last results of Professor Gamgee's and Dr. Estor's plans appeared to the Committee more favourable than the previous specimens submitted to them for examination.

The Committee are still of opinion that these researches, if not as yet leading to any great and startling discovery, by which our food resources are likely to be largely and permanently increased, have still been of considerable value, not only in directing public attention to this most important subject, but also in guiding experiment, and encouraging those who have worked earnestly in endeavouring to accomplish the object the Society has in view—the general benefit of the community.

Benj. Shaw, Chairman of the Committee.

ANNUAL CONFERENCE.

The Nineteenth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held on Wednesday, the 22nd June, at 12 o'clock noon, in the Lecture Theatre of the South Kensington Museum. Lord Henry G. Lennox, M.P., Chairman of the Council, presided.

Since the publication, in the last number of the *Journal*, of the Educational Officer's report, the return of the Elementary Examinations held by the Yorkshire Board of Education has been received. As this renders the returns complete, the table is republished, and the numbers are thus seen (as anticipated in the report) to be higher than those of last year. It appears, then, that while, last year, 2,634 candidates were examined, and 1,348 passed, this year, 2,999 were examined, and 1,810 passed. The number of female candidates has considerably increased, and the per-centage of females passing is very much higher, for while, last year, there were in the higher grade 56 females, with only 18 successful, and in the lower grade 384, with 191 successful, this year, there are 65 in the higher grade, with no less than 41 successful, and 690 in the lower grade, with 430 successful. These results are certainly encouraging.

The report having been read,

The Chairman suggested that any questions which representatives might wish to ask, or any suggestions they might have to offer, with regard to the forthcoming International Exhibition, should be taken before the questions which had been circulated were discussed.

Mr. F. Talbot (South Staffordshire) said he wished to make a few remarks, especially with regard to the last section of the intended Educational Exhibition—the results of school teaching. He had been engaged in the work of education for some years in South Staffordshire, and there they had been in the habit of getting up exhibitions of school results, and had attained a certain amount of success. It had occurred to him that probably if prizes could be offered, either by the Society of Arts or any other body, it would facilitate the collection of results, such as might be useful to teachers generally. He perfectly well remembered the exhibition which was held in St. Martin's-hall, which he visited daily for a week, and he was exceedingly pleased with it. Since then, he had visited the exhibition in Paris, and that which came nearest to his view of a really satisfactory display of the results of school teaching was that of the Creuzot works, by Messrs. Schneider, and he was not aware that anything comparable to that had ever been shown in England. It would be very important if they could have a scheme elaborated showing exactly what was

ELEMENTARY EXAMINATIONS, 1870.

NAME OF UNION OR LOCAL BOARD.	Number of Centres.	HIGHER GRADE.				LOWER GRADE.			
		Male Candidates.		Female Candidates.		Male Candidates.		Female Candidates.	
		Examined.	Passed.	Examined.	Passed.	Examined.	Passed.	Examined.	Passed.
Cheltenham Working Men's Club	1	..	..	..	..	20	20	..	..
Farnham and Aldershot District	2	41	33	4	4	33	26	15	9
Hertford	1	13	8	1	1	55	34	16	2
Lancashire and Cheshire Union	72	280	156	6	6	1,076	550	470	296
Lichfield	1	..	..	..	..	6	3	..	..
London (South London Working Men's College)	1	8	4	2	2	6	4	3	3
New Swindon	1	10	6	..	..	14	9	23	13
Portsmouth	1	9	9	3	3	5	5	3	3
Rugby	1	..	..	9	3	1	..	14	6
Stamford (St. Martin's School of Art)	1	5	5	..	..	19	13	..	..
Weston-super-Mare	1	7	3	1	1	21	8	..	..
Yorkshire Board of Education	18	147	96	39	21	468	347	146	98
Totals	101	520	320	65	41	1,724	1,019	690	430

wanted, for he remembered perfectly, that at former exhibitions, he could not arrive at any sound conclusions as to what was being done in the country generally in the way of teaching, and what were the results of various modes of teaching in the schools. For instance, a great deal of unnecessary time was, he believed, spent in teaching reading and writing, and elementary drawing, and, in fact, the old-fashioned system of teaching writing by copy-slips prevailed almost universally. In the Paris Exhibition there had, however, been a considerable improvement shown in this respect, both in the writing and drawing, in the Creuzot schools. It would be exceedingly important if they could have sketched out some efficient means of teaching writing and drawing without the intervention of the numerous copy-books which were at present used. Almost the only writing that was of real use was small-hand, and it was a great pity that boys should be kept such a long time making pot-hooks and hangers. He should like to know if any means had been devised for an improvement in this respect. If one copy of sufficiently large size were placed in the front of the theatre in which they were assembled, everyone could see it, and copy it perfectly, and not only so, but the teacher would have ample opportunity of calling attention to every minute particular which was of importance, and seeing that it was faithfully copied. The same thing with regard to drawing. The whole of an elementary school might draw from the same copy, though, he was sorry to say, he did not know of any collection of drawing copies exactly adapted for such a purpose. Again, with regard to the decoration of schools, he saw no reason why they should not have mural decorations of the kind which he saw surrounding him (the cartoons of Raffaelle) if they could be produced at a cheap rate, but he had never been able to get anything of the kind, except at such a high price as to preclude the possibility of using them for the purpose specified. There was a general feeling in his district that they would like to aid in the forthcoming Exhibition to the utmost, but they wished to know exactly what was wanted, and how their services would be available. He would suggest that the Schoolmasters' Association, and other societies of a similar kind throughout the country, should be communicated with, so that every district might be well-informed as to what was wanted, and endeavour to get within its own particular locality a collection of educational results.

Mr. E. Chadwick, C.B., said the topic which had just been introduced was one of considerable importance, and he had no doubt the Council would consider whether they could not offer a set of prizes for the best method of teaching. For example, there was a means which now prevailed in all German schools, as he was informed, of teaching reading and writing together, and a German teacher, he understood, was now in London exhibiting this method. This was a most important matter, because if it were possible to teach those two elements in half the time, and with much more pleasure than at present, it would be one of the greatest boons to both master and pupil. There were other matters of the same kind which might be elaborated. Some results might be exhibited visibly, but others would require to be stated. A great deal of progress, he believed, was being made by school teachers in different methods, but the advantages were generally confined to their own schools, and not published in any way, whereas it was very desirable that such results should be stated, in order that others might adopt those systems which seemed most successful, and therefore it appeared very desirable that some prizes for the best means of teaching should be offered to school teachers. One great question was, how much knowledge could be imparted in a given time. On the previous day, there had been a drill review of a number of schools at the Crystal Palace, in many of which the "three R's" were taught in three or four hours a day on alternate days, and in one-half as many years as was required under the old-fashioned plan. The methods of doing that varied, he believed, in different schools; in the Central District School, which was under a very able teacher, one method was adopted, and others prevailed in other schools, and it would be very valuable to be able to compare the results of these different methods, and to know in what time a certain amount of instruction could be given. From the examples which had been already shown in sufficient abundance, it appeared evident that these elementary subjects might be well taught in half the time which was necessary in the old-fashioned schools throughout the country, but even this fact was not universally known. Very recently, he had attended a meeting of a school association in Yorkshire, at which it was stated that, unless the time taken up in primary teaching were shortened, it would be impossible to impart the necessary amount of scientific instruction to put English children on an equality with those of Germany. He should propose, for the consideration of the Council, the offer of a prize for the attainment of the "three R's" in the shortest time, and also a prize for the greatest amount of art and science instruction imparted in any school by the end of the usual period when the children of the

lower and middle classes left school, viz., the fourteenth year. Other prizes might usefully be offered, but these were leading features which ought to be prominently kept in view; and schoolmasters should have entire liberty to make trials of any methods of teaching which they believed would be successful. As far as he had observed, it was a great mistake to pay for results in progress instead of results accomplished. He thought substantial prizes should be given for accomplished results, leaving masters, teachers, and children to try various methods of producing the desired end.

Mr. Lawton (Lancashire and Cheshire Union) said he had recently, with the consent of the masters and mistresses, visited a great many of the day schools of Lancashire and Cheshire, and had been much struck with some of the plans there used for teaching. Many of the boys could read a difficult book, not only with fluency but with expression, after two or three years' study, and not only so, but he thought the teaching of three things might be combined, viz., reading, writing, and spelling. He had seen a large class placed before a black board, on which a few sentences were written, any of the words likely to be misspelt being underlined. The boys had these words explained to them, and were required to copy, as nearly as possible, what was upon the board. Having done so, the board was taken away, and the same sentences were dictated to them, and the results of this teaching were perfectly astonishing. After six months' trial, he had seen a class write with considerable ease a piece given to them from a difficult book. This was an example of the good results which might be obtained by adopting the suggestion Mr. Talbot had thrown out.

Mr. Mable (Weston-super-Mare) said that, some three or four years ago, application was made to him to teach the donkey-boys from the sands of Weston-super-Mare, who were considered the greatest nuisance in the place; and being without writing materials, he was driven to the use of the black board and slate and pencil. Beginning first with marking a straight line, then going on to a curve, and from that to letters, and then to words, he found the boys made very rapid progress; in fact, in a few weeks, many were able to imitate letters and even words. With regard to pictures for decorating the walls of school-rooms, they had lately established a museum at the place he had just mentioned, and had obtained several series of large pictures published by the Working Men's Society, which he explained to the elder boys, and they, in their turn, conveyed the information to the younger ones.

Mr. Lawton thought it would be desirable to have some notice taken of methods of teaching the blind to write. He had met with some remarkable instances in which this had been successfully done.

The Chairman said he quite agreed that the subject just mentioned was one of great importance. His attention had recently been particularly drawn to it by Miss Gilbert, daughter of the late Bishop of Chichester, who, having lost her sight through an attack of measles, had established an institution for teaching the blind, in which some most remarkable results had been achieved, but which institution, he was sorry to say, still stood much in need of public support.

Mr. Ryder (Devonport) said he believed that if the committees connected with schools would take more interest in them, it would be found in many instances that the results were much greater than were often supposed. In a workhouse school with which he was acquainted, finding the reports of the inspectors were not very satisfactory, the committee arranged for visiting it at short intervals. On the first occasion they found, as might be expected, the results were very poor, but on the following week there was a considerable improvement, and he believed this was, in a great measure, owing to the scholars getting more used to strangers, and better able to apply themselves to the work in hand. The same thing happened in another case, where the same means produced the same results.

Mr. Holmes (Derby), in reference to a remark made by a previous speaker, said that the Pure Literature Society supplied large prints at a very low rate, suitable for the decoration of schoolrooms.

Mr. Chadwick said the rapidity and agreeableness of teaching reading would be much affected if an improvement were made in the present mode of spelling. The German teacher to whom he had before referred found double the difficulty in teaching English as compared with German, because in the latter case words were spelt according to their sound. Although many persons were convinced that it was hopeless to attempt any general spelling reform, he still maintained that it would be practicable to train children, during their school-days, in an improved method of spelling, leaving them to fall into the old-established usage afterwards. He believed a step in this direction would be of great importance, and a "Spelling Reform League" had been started in Liverpool, for the purpose of advocating a return to the phonetic spelling of the days of Tyndal, Spenser, Milton, and others. Another matter to which he attached some importance was the teaching the children arithmetic simply on the decimal and metric systems, which would not only relieve them of much painful labour in the learning of many complicated tables (which could afterwards be learned if and when necessary), but also tended, as was stated by teachers, to improve their powers of reasoning. In the case of the present generation of adults, it was too late to do anything in this way, but he believed much trouble and valuable time might be saved to the children.

The Conference then proceeded to the consideration of the first question suggested for discussion, viz.:—

How far it might be possible to make the Institutions rather Elementary Technical Schools than places where only a few miscellaneous classes are held?

Mr. Norris (Birkbeck Institution) said the technical instruction spoken of seemed requisite for the working classes, but at present he believed the institutions were supported principally by the *élite* of the lower and a small portion of the middle classes, and if this suggestion were adopted, he apprehended they would lose a great portion of their members. It appeared to him, therefore, that while it would be very desirable to make them elementary technical schools, it would not do to exclude literary classes. At the present time, the majority of the institutions held classes in science, languages, arithmetic, and book-keeping, and though these might be considered in a sense technical subjects, they were hardly the ones intended, and if they were excluded, the whole affair would, in all probability, break down.

Mr. Lawton remarked that, in Lancashire and Cheshire, the evening classes were attended chiefly by the working classes, and during last winter there were about 3,000 undergoing instruction in scientific subjects. He hardly knew what was precisely intended by the expression "technical schools," but he apprehended it referred to a combination of classes with a workshop.

Mr. Levy (City of London College) did not think there could be much difficulty about the meaning of the word technical. General education was what a man required as a general member of society, but technical education was that which he required to fit him for the particular niche which he had chosen for himself. The technical education of a carpenter would have especial reference to this trade, and the same in the case of a clerk or a book-keeper.

The Chairman thought every one pretty well understood what technical education meant; but the question was, what was intended by the phrase "elementary technical schools"?

Mr. Lawton said that, last year, the word "technical" was defined to include not only the class in which the instruction was given, but the workshop in connection with the class-room. They had no such classes in Lancashire, and did not need them, because the workmen were in the shop during the day, and attended the classes in the evening to learn the theory.

Mr. Cole said he should say that an elementary technical school would mean a school where practical and plane geometry was taught, with the elements of practical mechanics, mechanical drawing, the elements of chemistry, organic and inorganic, and perhaps the elements of mineralogy and geology, with free-hand drawing, physics, and perhaps natural history. But if he were asked whether it meant anything connected with the application of that general knowledge to use in the way of trade, for instance, to teach planing, sawing, the use of tools, lathes, and so on, he should say no. There was not such a thing as a technical school in existence, except in one or two places abroad, where they were not very successful. He should go farther, and say that such an institution, if aided by the State, would be an interference with the freedom of trade. Why should the State try to make a carpenter? The world settled whether it wanted carpenters or not, and any interference in these matters on the part of the government would be an impertinence. There were certain technical schools to be found abroad, but they were almost all schools supported by government in some shape or other, on the assumption that they wanted to create an industry. For instance, in the Black Forest, there was a school connected with forestry. In that part of the world it seemed necessary that something of that kind should be done, but there was nothing analogous to this in England.

Mr. Radford (Devonport) said it was evidently very difficult to define words of this kind, but did they really require a definition? He apprehended that if a man was trained as an architect it was not necessary to bring into his office bricks and mortar, and the various other materials which it would be necessary for him to use in carrying out his operations, and the same with these schools. He did not see any necessity for a board being planed, or a nail being driven, but the scholar ought to be instructed in that kind of knowledge which it was pretty well agreed by competent authorities the English workmen did not as a rule possess. It would be a very good thing, therefore, if this kind of instruction could be given more generally in the various institutions referred to.

Mr. Mable said, from his own experience, he did not think there would be any difficulty in establishing workshops, if it were desired. The school with which he was connected began in a very small way, but it had gradually, from the good results it produced, obtained such support that they had added a library, museum, sick fund, and a workshop and printing office. The workshop was fitted up with a small steam-engine, a carpenter's bench, a lathe, a grindstone, and every other mechanical contrivance that they had been able to obtain. Amongst the works now going on, he might mention that one boy was making himself a tool chest, another was making a steam-engine, and another a rustic chair, and another tempering the spring of a bicycle. The beneficial effect of this kind of work was so great that their scholars were generally able to command very high wages, and were much sought after, and when they went away from the town very few came back. The instruction given in the workshop was entirely mutual.

Mr. Cole said there was no doubt that all knowledge, whether of the hands or head, was very useful, and it was desirable that children should begin learning very early to use their hands skilfully. Acting on this principle, he always kept his children employed, even when they were very young, in building card-houses, or something of that kind; and the operations spoken of by the last speaker were, no doubt, very useful, still that was not what he should call a technical school. Technical schools really did not exist in England, and those abroad were generally established to promote special industries. He had recently heard that one of the most noted, viz., the silk school at Lyons, was in difficulties.

Mr. Chadwick said it was due to his friend, Dr. Lyon Playfair, and others who advocated technical schools, to say that what they meant was general industrial instruction, and not with reference to any particular trade. There was no doubt that, amongst different boys, there were manual as well as mental aptitudes. In some schools in Germany they began even with the infants, teaching them how to use their fingers, and this was of great advantage in after years, whatever trade they were put to. Sir Joseph Whitworth was of opinion that, in England, the hand was not generally sufficiently educated, and that there should be a certain amount of special exercise given to the fingers. In that view some of the gentlemen at Oxford and Cambridge had been set to work planing regular surfaces, and exercising themselves with tools, not for the purpose of learning any special trade, but to give them a more perfect use of the hands than they would otherwise attain.

Mr. Lawton said that in the Union which he represented the plan adopted for establishing technical classes was simply this: — He had instructions from the council of the Union to find out all the districts where there were no classes in which artizans could learn the principles of the industries in which they were engaged; to find out what was the principal want in the district; and then to set to work, with the aid of the local committee and influential gentlemen in the neighbourhood, with a view of establishing science classes in that district. Having done so, the next thing was, to look out for a suitable teacher; and they had been so far successful, that no less than sixty classes had been opened within the last year.

Mr. Heller (Lambeth) said it appeared to him that the question now before them came forward at a most opportune time, if it meant what his Local Board took it to mean. By the exertions of the Department of Science and Art, and by those of the Society of Arts, classes had been formed in certain Institutions, but there was often but a very uncertain and fluctuating attendance at them, and the very existence of the class too often depended upon the residence or non-residence of a particular teacher. It appeared to them, therefore, that the object of the discussion was to see if they could not devise some means to aid in systematising and perpetuating the scientific instruction which they believed was already given in many schools. He would strongly urge upon the conference to come back to that subject, and to consider whether they could not, by centralising their schools in large towns, or by giving more stability to the plan upon which the payments to the teachers were determined, give more permanency and efficiency to the classes themselves. London itself was in a most lamentable condition in regard to these science classes. Some few years ago, he had taken an active part in connection with the Metropolitan Adult Association, founded by the late Mr. Harry Chester, but since that had been dissolved there was no society which could collect and utilise the voluntary agency which might be obtained, either in reference to elementary teaching in night schools, or to scientific instruction in connection with the Science and Art Department. He had striven hard to keep together two night-schools, and also to introduce science teaching into day-schools, but in the latter case he found the difficulties insuperable, and he was not able, therefore, to prepare the children for going into good night classes, owing to the age at which they left, and the uncertainty which attached to the payment of the

teachers who took those classes. If they could strike out any plan by which they could systematise the classes already in existence, or prevent classes being dependent on the caprice of a single teacher, it would help much to solve the difficulty.

Mr. Le Neve Foster said the discussion was useful, even if it had no other result than getting rid of the incorrect meaning which some persons seemed to attach to the words "technical education," as if they meant, not what was taught in school, but that which could only be learned in the workshop. It meant simply the learning of all those theoretical principles of knowledge which would be of use to a mechanic or anybody else in the business which he afterwards followed up.

The Chairman then announced for discussion question No. 2:—

What further arrangements can Mechanics' Institutions make for promoting the systematic Technical Education of the people in their several localities?

Mr. Norris (Birkbeck Institution) thought that one reason why there were not more science classes was that it was very difficult to start them, and what he would suggest, as a means of overcoming this difficulty, was this:—There were a few eminent scientific men, like Professor Huxley or Professor Tyndall, who would draw hundreds of working men to listen to any lecture which they might deliver, and this would be a very good introduction to a science class. The institution which he represented (the Birkbeck), commenced a science class some few years ago, but it was not at all successful, the reason being, he believed, that what they were doing was not generally known, for, on repeating the experiment last year, their efforts were well rewarded. He thought, therefore, that if eminent men, such as he had mentioned, could be induced to deliver lectures in large centres of population, and if these were immediately followed by the foundation of science classes, a great impulse would be given to the cause of technical education.

Mr. Lawton said this question came up very opportunely at the present moment, and he wished to make a few remarks upon it in the presence of Mr. Cole, for in his own district they did not know what to do in the coming session. The system of the Science and Art Department put them in a very awkward position. They had started classes, many of which had been going on year by year, doing all they could to promote systematic technical education, by forming a body of teachers to carry it out, but they were now thrown completely aback. The results were disastrous to teachers; the loss of confidence in the Department was so great, and the inconvenience to managers of institutions so serious, that they found themselves very awkwardly placed. Owing to the raising of the standard in his own district, 2,900 had failed, out of 3,300, in geometrical drawing, and teachers who had been giving thirty lessons received £1 for their trouble. Again, the teachers were now made dependent on the secretaries to the Committees, for whose default they were fined, and the same with regard to the instructions given by the Committee to the candidates, and the teachers said, not unnaturally, that with such conditions they could not undertake the duties. There were a large number under instruction in Lancashire and Cheshire, but the Committees were now saying that the classes must be given up unless they made themselves personally responsible to the teachers, which, in many cases, they would not feel justified in doing. The council he represented had already held one meeting on the subject, and would probably hold another before long, when the matter would be gone into thoroughly.

Mr. Rickard (Derby Mechanics' Institute) said the last speaker had given a most lamentable account of the state of things in his district, and though the institution which he (Mr. Rickard) represented desired to give the fullest attention to this, which might be called secondary education, it seemed to him that, if what they had just heard was correct, Committees, instead of engaging themselves in this work, had better avoid it, unless they were prepared personally to bear the expense, for the uncertainty in which they would be left by the action of the Department was highly inconvenient, to say the least. His Committee had been unable hitherto, from various circumstances, to commence science teaching, but intended doing so in the coming season; if, however, they had no sort of guarantee that something like an adequate payment for the teacher would be obtained, he should feel great difficulty in persuading his Committee to engage in this branch of instruction.

Mr. Cole said that, in any remarks which he might make on this subject, he should speak as a member of the Council of the Society of Arts, and not as representing the Department. If he or his friend Capt. Donnelly got into any difficulty, they must answer for it; and, no doubt, if the gentlemen in Lancashire and Yorkshire had any fault to find, their members would not be slow to do so in "another place." He could hardly think, however, that the results had been so disastrous as was represented, since, in the midst of all this uncertainty and persecution during the last three or four years, the schools and classes had risen spontaneously all over the country from 200 to 800, and the pupils had increased in the same proportion. It was impossible, of course, for any system to give satisfaction in all quarters. He was not aware how the results of the examinations of this year were coming out, or whether the inspectors were more drastic than heretofore, but they would all know in the course of a few weeks; and if the results were as had been represented, they would, no doubt, hear of it elsewhere, and on that very account he thought it would be inexpedient to discuss the details of the system at present.

Mr. Lawton begged leave to add that one of the examiners stated that he had not thrown out the papers because they were badly done, but because they failed to comply with certain conditions. For the first time, this year there were a number of instructions printed in small type, which were not noticed or understood by many of the candidates, and it had been stated that only ten per cent. of the rejected papers were actual failures.

The Chairman said he quite agreed with Mr. Cole that this was a matter on which he had better attack Mr. W. E. Forster in the House of Commons, rather than discuss it exhaustively there.

Mr. Le Neve Foster, as representing the Council of the Society of Arts, said he thought the noble Chairman was bound to take the matter up in Parliament. The Society had handed over to the government a large number of their pupils, on the faith that they were going to carry on the examinations in a satisfactory manner; and, therefore, he thought it was their duty to see that the government faithfully carried out the engagement which they had tacitly entered into.

The Chairman proposed that they should now consider question No. 3:—

Whether Teachers would not be stimulated in their efforts, if those who were most successful in their training of pupils (as tested by the results of the Society of Arts' Examinations) had their services recognised by the Society?

In point of principle, everyone must answer the question in the affirmative, and the only point was, whether the Society's finances were in a condition to enable them to give those rewards which appeared to be intended. No one could doubt that teachers would be stimulated in their efforts if their services were recognised.

Mr. Levy said he supposed as long as the Society of Arts held Examinations it would be their desire to get

as many pupils to attend them, and to have their candidates as well trained as possible, and if that were so, it seemed rather inconsistent to ignore, as the Society did at present, the teachers who produced the result. He did not suppose the finances of the Society would allow of any pecuniary reward being given, but the word "recognised" did not necessarily imply that particular mode of recognition. If a certificate or something of that kind could be given to successful teachers, he did feel it would be far better than to leave them, as at present, ignored by the Society in the work they were doing.

Mr. Heller thought, as a teacher, that the only recognition which would do much good would be money payments. At the same time he did not think it was the business of the Society to make such payments. It seemed to him that the results of the examinations, as now published, were a sufficient reward to teachers in the way of honour; and though he should be sorry to see the Society go out of its way to make money payments to teachers, he did not think any other form of recognition would answer the object in view.

Mr. E. Chadwick said his impression was that the demands for scientific instruction, or elementary technical education, throughout the country were utterly beyond Mechanics' Institutes, or even the Department, to deal with effectually, and that the only way to meet the difficulty was by improving the mode of teaching elementary knowledge, so as to give time for technical or secondary instruction in the regular school stages.

Mr. Lawton said, with the permission of the chairman, he would read a letter from the hon. secretary of the Salford Working Men's College. (The letter expressed the opinion of the writer that it was a great injustice to teachers, particularly those who were voluntary, that whilst their pupils were pressed to the front, and had all the honours of publicity, the teachers, who had sacrificed time and labour, were forgotten altogether in the matter.) He suggested that a certificate should be awarded to the teacher who produced good results.

Mr. Carnegie (Aldershot) thought the recognition of the services of schoolmasters by the Society, in the way of a certificate, would be of great benefit, and would be much prized.

The **Chairman** said it would be his duty to lay before his colleagues on the Council the feelings expressed by the meeting, and as it appeared they were asking for no more absolute reward than what each successful pupil obtained at the hands of the Society, he had no doubt the suggestion would meet with a favourable reception.

Mr. Norris introduced question No. 4:—

Whether much greater encouragement would not be given to the thorough acquisition of knowledge in the various subjects by the division of them, in all cases where more than one is included in the same Examination; and whether, as the number of subjects in which Examinations are held has been greatly diminished, it would not be advisable to include others in the Programme?

He thought it would be very advisable that political economy and civil government should be divided. On looking into the syllabus, it would be found that a thorough acquaintance with the subject of civil government was not required in order to pass; but if political economy were separated, a very good subject might be made of elementary law and civil government, and in that way they would secure a far more satisfactory acquisition of knowledge. He would also venture to propose that English literature and language should be divided. If English language were made one subject, with its history, grammatical construction, and all parts of the subject coming under that head, there would be a real and valuable amount of knowledge gained by the successful candidate. He should also recommend the separation of logic and mental science; and, if possible, he should like to see added another subject, general history, which might be divided into three periods, ancient, mediæval, and modern.

Mr. Carnegie, as representing the Farnham and Aldershot schools, suggested the addition of land-surveying to the programme.

Mr. Levy said the subject now under discussion was one of great importance, as the form which the Society of Arts' Examinations took in great measure controlled the kind of teaching given in various institutions throughout the country. If they sent up pupils for examination, they had to conform to a certain degree to the programme marked out by the Society, and therefore, as it was at present arranged, they could not start a class in political economy without at the same time starting one in civil government, which was really quite a distinct subject. Joining the two together encouraged superficial teaching, and also superficial examination. With regard to civil government, he fully concurred in the opinion expressed by Mr. Norris, that it should be joined to elementary law and constitutional history, which would thus make one good subject by itself, similar to that in which gentlemen were examined for the LL.B degree in the University of London. The same objections applied to the conjunction of logic and mental science, although there was not such a radical difference between them as in the case he had just referred to. If the number of candidates who presented themselves in metaphysics was so small that it would not be worth while to hold a separate examination in that science, he still believed it would be better to leave it out, and take logic alone. With reference to teaching general history, he might remark that, in his opinion, a great injury was done to the examinations in modern languages by tacking on to them the history of the particular country to which the language belonged. He could not help thinking that a good knowledge of French was quite sufficient to entitle a candidate to a certificate, without his being required to make himself acquainted with the history of France, and he would therefore suggest that history should be excluded from the examinations in modern languages, and made a subject by itself.

Mr. Thomas Lyle (Birkbeck Institution), desired to support the suggestion of Mr. Norris, more especially with regard to English language and literature.

Mr. Craig (Glasgow Institution) said he had very strong and urgent instructions to ask for the separation of logic from mental science. Great injury was done to the logic class by these subjects being joined together, because many working men could study the one subject when it was impossible for them to go into the other; and this was felt so much in Glasgow that the local board desired to protest against the combination of the two subjects.

Mr. Smith (Birkbeck Institution) also desired to support Mr. Norris's views. He did not think that the junction in the case of logic and metaphysics was so prejudicial as in the other two instances, but still, if it were possible to separate them, it was very desirable. With regard, however, to political economy and civil government, the junction seemed quite indefensible; the two subjects were wholly alien, and were joined together for no reason whatever. As had been remarked, a very good subject could be made by joining civil government with elementary law. Political economy itself was in a very undefined state, and could hardly be called a science, so that all that could be required of a candidate was a competent knowledge of certain text-books; still it was a most useful subject to examine in, and might well stand alone. English literature and language might, he thought, be very usefully separated; and with regard to literature, he thought it would be a great improvement if, instead of allowing the candidate to select any two from a given list of authors, he was compelled to study one general text-book, and choose in

addition any one author; a candidate would then have a general acquaintance with English literature and a particular knowledge of one portion of it, and he might fairly have a certificate that he knew something of English literature. With regard to modern languages, he apprehended a person might study French or German for what might be termed technical purposes, without desiring to make himself acquainted with the history and language of the country, and he did not see why he should not be encouraged to do so. The same thing did not apply to the study of the dead languages, because the natural course of his reading would make the pupil acquainted witb Latin or Greek history and literature.

Mr. Knight (City of London College) also objected to the junction of political economy with civil government. Political economy was of sufficient importance to stand alone, without anything being added as a makeweight; whilst civil government, with elementary law or constitutional history, would also form a good subject by itself. In the institution which he represented, the evil of the combination had been felt so much that he had himself offered a prize in political economy alone, in order that those who desired to thoroughly master it should not be overlooked. He hoped, therefore, the Society of Arts would dissolve the alliance. With regard to logic and mental science, he, with some others, thought that, under certain circumstances, these two might go together, but, at the same time, it seemed somewhat like handicapping logic, and a man who went in for a six or nine months' study of that science had quite enough to do, and in winning a first-class prize showed far higher powers than were required to take a similar honour in book-keeping, arithmetic, or even in a modern language. With reference to uniting the English language and literature, he thought similar objections existed.

Mr. Lawton wished the Council could see their way to re-introducing a few scientific subjects into the programme. These having been removed, the best pupils had been shut out from the Examinations, and the result was, that the number of local boards had been reduced from 139 to 100, and 25 out of the 39 which had been dissolved belonged to Lancashire. Nearly all the students in these institutions were members of science classes, and the Society's Examinations were now, therefore, of no use to them. In fact, in Lancashire and Cheshire, there had been a reduction in the number of certificates granted this year, as compared with last, to the extent of 200. He wished the Council could see their way, therefore, to reintroduce at least geometrical drawing into their programme. With reference to the *viva voce* examination in French and German, a very influential conference had been called together at the Town Hall, Manchester, to consider this subject, and the feeling of the meeting, which was principally composed of professors of these languages, seemed to be that the system of instruction at present adopted would not allow of sending up eandidates, as the principals of schools would not run the risk of failure. The pupils were taught to read and write, but in very few instances to converse in the language, and consequently, until the system of instruction was altered, they could not expect to have many candidates. Next winter, however, it was intended in Manchester to try and establish one or more classes for the special purpose of conversation and *vivâ voce* examinations, as sketched out in Mr. Hyde Clarke's memorandum. He regretted that the elementary examinations, for which the Society furnished papers, were only taken advantage of by comparatively very few Institutions. As the Science and Art Department did not require elementary knowledge as a *sine quâ non* for their examinations, the Institutions in his district were trying all they could to get pupils to avail themselves of the elementary examinations, and offered prizes for each subject in the higher and lower grade respectively, the consequences of which were a great increase in the number of candidates; indeed, no less than 2,200 persons persons in his district had applied for papers. If these examinations were more widely known, he believed they would be found of great service in preparing pupils for subsequent examinations by the Science and Art Department, as well as the Society of Arts.

Mr. Holmes (Derby) suggested the introduction of mining-engineering into the programme. One of the members of their Local Board, Mr. Jeffcock, who, unfortunately lost his life in the Oaks colliery accident, had intended himself to offer a prize in this subject; and in mining districts it was certainly very desirable to take every means for diffusing a thorough and practical knowledge of mining-engineering.

The Chairman said he should have much pleasure in laying before the Council the suggestions which had been offered, and he was much pleased with the freedom with which gentlemen present had expressed their opinions. The suggestions with reference to mining engineering, and land-surveying were, he thought, especially valuable; but he would remark that though several speakers desired to see some of the subjects separated, no one ventured to advocate the abandonment of any, and therefore it really eame to a question of finance, whether, in fact, the Society could increase the number of prizes they offered, and could pay a larger number of examiners. He was quite sure, however, that the Council would do all they could to meet the wishes of the Conference.

At this stage of the proceedings Lord Henry G. Lennox was compelled by business to vacate the chair, which was taken by **Mr. E. C. Tufnell** during the remainder of the sitting.

The fifth question:—

What measures can be taken to increase the number of Free Libraries in the United Kingdom?

was opened by

Mr. Cole, who said that Mr. Baines had recently obtained a return showing how many places had adopted the Free Libraries Act, and also those which had talked about it without adopting it, those included in the former category being, he was sorry to say, very few indeed. He did not see any other means which could be adopted than to constantly agitate the subject, and bring it up, year after year, until they succeeded. The Act gave power to a certain number of inhabitants to call a meeting, and to the majority present to carry out the Act. He was sorry to say that, with one exception, it had not been taken advantage of in London. It had been attempted in the City, and had failed, and in St. Pancras the people apparently thought themselves far too enlightened to require free libraries. The real difficulty was, that no one liked to pay an additional rate even of a halfpenny or a penny, and he saw nothing to be done but constant agitation.

Mr. Talbot said he was sorry a gentleman was not present who had been very successful in this way in the Midland Counties, Mr. Pratt, who was connected with one of the Birmingham newspapers. At Wolverhampton he had succeeded in establishing a library, and nearly so at Bilston and Willenhall, and before long it was anticipated that both these places would adopt the Act. There was a free library at Walsall, and there were several in Birmingham, and he only wished that those who had not seen the working of the Act could pay a visit to one of these libraries of an evening; he was quite sure they would be incited to join in the good work. One of the noblest sights to be seen in Birmingham was the manner in which these free libraries were used by the working classes and youths, and the reference library was one of the most complete he had ever seen.

The Chairman (Mr. Tufnell) said there were few things of more importance to national education than

the establishment of free libraries, for in many places it was utterly impossible that the great mass of the people could have access to books in any other way. He was well acquainted with the Birmingham libraries, and was much struck, two years ago, on entering one in the evening, by seeing it filled with men, and even boys, in their working dress, busily engaged in drinking at the fountain of knowledge. He did not believe there was any institution in London which could present such a sight. No one had yet suggested any particular mode by which the establishment of these libraries could be effected, and, indeed, he saw no other means than that of constantly bringing forward the question. He would also suggest that, at the British Museum and other public libraries, there were many surplus copies of valuable works which might well be made available by being sent to other libraries which did not possess them.

Mr. Talbot said he believed Mr. Pratt took advantage of the local boards of health to discuss the subject, securing, if possible, the attendance of members favourable to the scheme, and getting them to talk over others, particularly ratepayers.

Mr. Levy said the Act seemed to be coming into operation so slowly, that it might be worth the consideration of the Society whether they could in any way aid those libraries which were already established in connection with the various Mechanics' Institutions throughout the country.

Mr. Norris said there was nothing for it but continued agitation. An attempt had been made in Islington, which was nearly successful, but it failed on account of the invincible repugnance which people had to an increase in taxation. What was wanted was a few gentlemen like Mr. Pratt to deliver addresses showing the advantages of libraries, and at how small an expense to the ratepayers they could be established.

Mr. Heller suggested that a library rate might be included in a general education rate under the new Act.

The Chairman having announced for discussion question 6.—

What arrangements can be made to facilitate Visits by members of Institutions in the Provinces to the International Exhibition of 1871?

Mr. Holmes said the experience of 1862 might be profitable. On the occasion of that Exhibition, the managers of the various schools and institutions at Derby waited on the railway authorities, and succeeded in making arrangements, by which children under fourteen were conveyed to London and back for 1s. 9d., and adults for 4s. 6d., with an additional charge of 6d. in each case if they remained four days in town. In that way, they brought up a large number of visitors, paying the railway company very well.

Mr. Norris thought this was a very good suggestion, and as the railway company would be at no expense for advertising, they could well afford to make cheap terms.

Mr. Cole said the forthcoming Exhibition would have a special interest for all engaged in the work of education, as a large section would, as already mentioned, be devoted entirely to educational appliances, and to finding out in some systematic way the best methods of teaching various branches of knowledge, so as to produce the greatest results in the shortest space of time. Educational appliances would be exhibited from all parts of the world, including Japan, and therefore he thought it was an occasion on which it would be well for the managers of every educational institution in the kingdom to bestir themselves, and do what they could to induce visitors to come up. He had no doubt that, by properly bringing to bear the principle of competition, very economical arrangements might be made with the railway companies.

The Chairman said he did not think the Society of Arts could do more than issue a circular, stating what had been done on former occasions, and inviting managers of Institutions to follow the same course next year.

The proceedings then terminated with a vote of thanks to Lord Henry Lennox, who had kindly occupied the chair during the principal portion of the Conference, and also to Mr. E. C. Tufnell, which that gentleman duly acknowledged.

THE EDUCATION BILL.

Very important progress has been made with this Bill since the subject was last noticed in these columns. On the 16th June, Mr. Gladstone, on the motion that the House go into Committee on the Bill, explained the latest views and intentions of the government in regard to it. First of all he stated that they could not accept Mr. Harcourt's amendment (in favour of unsectarian and compulsory education); and premising that the leading feature of the Bill was no longer to allow the religious difficulty to stand in the way of a settlement, he sketched at length its leading provisions as originally introduced, and the objections taken to it. These last he divided under three heads—the insufficiency of the conscience clause, the application of public funds to religious instruction, and the discord which would be created by leaving too large a discretion to the local boards. The first objection had been met by the timetable clause. Discussing the second objection, Mr. Gladstone said the logical result led to secular education, which, however, was evidently not agreeable to the prevailing sense of the community. The real question, therefore, to be met was, the amount of discretion to be allowed to local boards. With regard to schools to be established hereafter out of local rates, the government had decided to accept the substance of Mr. Cowper-Temple's amendment—that in them no catechism or distinctive religious formulary shall be taught. The difficulty with regard to the schools already existing, and hereafter to be aided from the rates, showing that it was impossible either to compel or forbid the local boards to aid voluntary schools, he proposed to solve by severing altogether the tie between the local boards and voluntary schools. In lieu of the rate-aid now provided by the Bill, a contribution would be given from the Exchequer, both to aided and voluntary schools, not exceeding 50 per cent. of the expenses. As a compensation for this, the building grants would be abolished; and, moreover, it was proposed to do away with the "year of grace."

This statement of the Prime Minister called forth severe animadversions from Mr. Disraeli, who said he had come down prepared to support the Government Bill, but the statement just made converted this into an entirely new Bill. He strongly objected to the proposal to create "a new sacerdotal class," in the persons of the schoolmasters of the country, giving them a monopoly of the religious education. Before Mr. Cowper-Temple's amendment was accepted, the House ought to have some exposition of its character. He confessed himself utterly incompetent precisely to understand or to decide off-hand on Mr. Gladstone's complicated statement. He recommended that the Bill should be committed *pro formâ*, and reprinted, and that the House should have some days allowed to consider it in its new form.

After some further discussion, this was agreed to, and the Bill, as amended, has been printed.

It appears that the clauses (22 and 23) defining the assistance to be given to existing denominational and voluntary schools, and the clause (84), providing for additional grants in cases where a three-penny rate produced less than £20, have been struck out, and the Bill now contains, practically, no reference to existing schools, which it is proposed to continue in connection with the Education Department, as at present, under the

conditions above explained by Mr. Gladstone. The first important amendments are contained in the subsidiary sections (1 and 2) of clause 7. The first provides that no child shall be required, as a condition of being admitted into or continuing in any public elementary school, to attend any Sunday-school, or any place of worship, or any religious observance or instruction in religious subjects in such school; and the second, that the time during which any religious observance is practised, or instruction in religious subjects is given, at any meeting of the school, shall be either at the beginning or at the end, or at the beginning and the end, of such meeting, set forth in a time-table to be approved by the Education Department, and that any scholar may be withdrawn by his parent at such time or times, without forfeiting any of the other benefits of the school. In the 9th clause, the "year of grace" is abolished, and the word "forthwith" substituted; and clause 81 is amended, so as to provide that no parliamentary grant shall be made to a public school after the 31st March, 1871, instead of 1872. The most important amendment is inserted in a sub-section (2) of clause 17, and is as follows:—"No religious catechism or religious formulary which is distinctive of any particular denomination shall be taught in the school;" and the second sub-section of 65 (which gives power to the school boards to form bye-laws) provides "that no such bye-law shall prevent the withdrawal of any child from any religious observance or instruction in religious subjects." After clause 19, a new clause is inserted, giving school boards powers to purchase sites. The other amendments of the clauses are only of a verbal character, but an important addition is made to the second schedule, to the effect that the voting for school boards appointed by vestries shall be by ballot, that each ratepayer whall have only one vote for each candidate, and that in the case of an equality of votes, the inspectors shall decide by lot upon the person to be elected.

On the 20th June, on the motion for going into committee, Mr. Richard moved a resolution, to the effect that the grants to the existing denominational schools should not be increased; and that, in any national system of elementary education, the attendance should be everywhere compulsory; and that the religious instruction should be supplied by voluntary effort, and not out of the public funds. Sir C. W. Dilke seconded the motion, which was opposed by Mr. G. Hardy, and gave rise to considerable discussion, in the course of which Mr. W. E. Forster pointed out that there was no force in the plea that it was unfair to tax persons for religious teaching which they did not approve of, since there were thousands who, with equally conscientious motives, would object to pay for State education without religious instruction. There was no analogy between paying for religious teaching and for religious worship.

The debate was continued on the following day, and was resumed by Mr. Miall, who described the new scheme as a denominational system, assisted by rate-aided schools. He thought it would not last twenty years; it was opposed to the general current of opinion; and though he admitted the services of the denominational schools, the country, he asserted, was disappointed at seeing a new germ of vitality given to them, and would have preferred to merge them in a truly national system of education. Lord R. Montagu said the effect of the amendment would be to starve the religious schools; and the secular system, he maintained, had utterly failed in the United States. Mr. M'Arthur, who spoke from the Wesleyan point of view, agreed with the amendment in condemning the increase in the denominational grants and in supporting the principle of compulsion; but he objected to the omission of religion from education, and supported Mr. Harcourt's idea of an unsectarian education.

On the succeeding day Mr. Dixon objected to the Bill in its amended form on the ground that it prevented the amalgamation of all the schools of the country into one great system of national education and the adoption of a general system of compulsion, and also that it made no provision for free schools. He objected altogether to assistance being given to denominational schools, which, be contended, under the new scheme, would be supported solely by the grant and the school-pence, dispensing altogether with private subscriptions. Though believing in the possibility of establishing a generally satisfactory form of unsectarian education, he supported the amendment. Mr. Baines gave a hearty "but discriminating" support to the Bill, and saw no difficulty in giving a religious education in which all Christians might combine.

The fourth day's debate was opened by Mr. Mundella, who argued in favour of the first two points in Mr. Richard's amendment—the discouragement of denominationalism and compulsion—but opposed the third point, secular education. The great object of education, he urged, should be to inculcate the highest motives into children, and this could not be done without the influence of religion. The debate was continued by various speakers, and was concluded by Mr. Gladstone, who first vindicated the title of the Bill to be regarded as a great scheme of national education. Discussing next the case of the rate-aided schools, he admitted the Bill was a compromise, but he maintained that it was not illiberal to the Secularists or to the Nonconformists. The Church, he pointed out, had surrendered the use of distinctive formularies and denominational inspection, and had accepted a stringent conscience clause, and that without any corresponding concessions from the Dissenters. He treated as absurd Mr. Harcourt's assertion that Mr. Cowper-Temple's amendment was pure and undiluted denominationalism, and showed that, while it secured full liberty of conscience, it provided against the kind of denominationalism which tended towards proselytism. As to the "voluntary schools," as he preferred to call them rather than "denominational," he argued that the last amendments obviated several abuses which would have been possible under the original Bill, and he professed his readiness to secure that the amount of the Privy Council grant should not be larger than would cover the cost of the secular education, and that a void should always be left to fill up by private subscriptions. He concluded by stating that feeling deeply the responsibility of postponing the question, the Government would push the Bill on with all the energy in their power, so as to send it up to the Lords at the earliest possible moment.

On a division the resolution was defeated by a majority of 361, only 60 voting for it, and 421 for going into committee.

On the 27th June the House went into Committee on the Bill. The first four clauses were agreed to without comment, and on clause 5, Mr. Walter moved an amendment making compulsory the creation of a school board in every school district. This was rejected by 303 to 112.

The "time-table conscience clause," which is contained in clause 7, was the subject of considerable discussion. Mr. Corrance wished to except existing voluntary schools from its operation, but was persuaded not to press his amendment. Mr. Pease next moved to strike out the words fixing the hours of religious instruction to the beginning or end of each school-time, so that they should be left to be settled at the discretion of the managers or teachers. He was supported by Sir J. Pakington, Mr. Hardy, and others, who argued the matter entirely as one of practical convenience, and Mr. Forster resisted it on the same grounds. On a division, the amendment was rejected by 222 to 122.

Other amendments of less importance having been proposed, and dropped or negatived without a division, Mr. Dixon moved an amendment, with the view of securing that the children dissenting from religious instruction shall be withdrawn from the school altogether during those hours, but Mr. Forster resisted it as an interference with the discipline of the schools.

On a division, Mr. Dixon was beaten by a majority of 344—379 to 35.

An amendment was moved by Mr. M'Arthur, with the view to prohibit the inspectors from examining into religious subjects, and in the end Mr. Forster consented to a slight modification in the clause, so as to make it declare that examination into religion is no official part of their duty.

The discussion in committee was resumed on the 28th, by an amendment on clause 7, moved by Lord Robert Montagu, which was considered at much length. His object was to have the conditions under which the education grant is to be distributed inserted in the Bill, with the view of protecting the voluntary schools against the caprice of some future Minister, or a change of policy, but Mr. Gladstone pointed out that it would be impossible, at this period of the session, to re-model the Revised Code, and give it legislative force in this Bill, and moreover he saw no reason for doubting that the grant would continue to be dispensed on the same liberal principles which had already received the sanction of Parliament. Mr. Harcourt repeated his objections to the increase of denominational grants, and his promise of constant opposition to them. Mr. Disraeli recommended Lord R. Montagu to be content with the moral assurance given by the government, and the amendment was then negatived.

Mr. Harcourt next moved an addition to the clause, giving the parents of the children attending the schools a share in their management. He was supported by Mr. Winterbotham, Mr. A. Herbert, and others; but on a division, the amendment was negatived by 329 to 81, and clause 7 was agreed to.

On clause 8, which relates to the proceedings to be taken by the Educational Department, to determine the deficiency of public school accommodation in every district, Mr. Forster, in deference to remonstrances, withdrew a proposal he had made that the religious opinions of the inhabitants shall be taken into consideration. Mr. Harcourt moved an amendment, providing that only those schools shall be taken into consideration which conform in all respects to the requirements of Clause 7. Mr. W. E. Forster undertook that there should be a satisfactory definition of "suitable education," and the amendment was not pressed.

CORRESPONDENCE.

INTERNATIONAL MONEY OF ACCOUNT.

Sir,—Allow me, in justice to myself, sufficient space for a few personal explanations. Mr. Franklin rallies me on having deserted my "old standards" as a member of the Decimal Association; but I never was a member, although I did attend, at the late Sir William Brown's invitation, the various deputations of that now defunct association, to the Treasury and Board of Trade. The only principle by which, some 10 or 15 years ago, I knew the Decimal Association was distinguished, was its advocacy, in which I concurred, of the subdivision of the pound sterling into one thousand parts, or mils, instead of into 960 parts, or farthings, both as coins of circulation and coins of account. My views on this are quite unchanged; and it was but a few weeks ago that I gave evidence to that effect to the Conseil Supérieur, now sitting at Paris, on the monetary question, under the presidency of the Minister of Commerce. But this does not at all involve an adhesion to the separate principle that the sovereign, of its present normal weight of 123·274 grains troy, will cease to be the palladium of British commerce and credit if it be reduced by 20 centimes worth of gold, in order to suit the changed conditions of the world, and which have led to a league for international coinage by other countries possessing a collective trade far greater than that of the United Kingdom, and a compact gold circulation $2\frac{1}{2}$ times as extensive (220 millions sterling, not 20 millions, as misprinted in your report of my remarks at the discussion). If Mr. Franklin thinks that this fetish-worship of the pound sterling of 25 francs and a fraction is the right thing, and that all else, including the pound of the future of 25 francs exactly, is revolutionary, well and good. But some of us will request an equal degree of liberty to think otherwise, and to remind Mr. Franklin that not all the discussions that have been held on the subject, nor all the small jokes about clipping the sovereign (as if any one proposed doing so without giving compensation), have deterred practical men from receiving this project with favour, as the best solution yet offered for the removal of the difficulty our country experiences in making its coin international. As an illustration of what I am now advancing, I beg to refer to the report to the Associated Chambers of Commerce of the United Kingdom, dated January last, and made at the unanimous request of a meeting held at Birmingham on the 16th and 17th November, 1869. This report, signed by Col. Akroyd and Mr. Whitwell (both members of Parliament and manufacturers), and by Mr. Behrens and Mr. Field (both commercial and practical men), arrives at precisely the same views as I have, however inadequately, upheld at the London and Paris Commissions, upon the policy and expediency of a reduction of the sovereign to 25 francs exactly, always provided identical mint regulations and a uniform seignorage of 1 per cent. be charged by all countries included in the convention, which would then be, for coinage purposes, as one single country, and without disturbing the time-honoured units of account—pounds sterling, dollars, florins, and francs—until, at some more advanced and better-educated period of the world, the common consent of the nations concerned can be obtained to a single unit of account. When the report of the Paris Commission shall have been published, this report of the Associated Chambers will be found translated into French, as well as translations of the memorandum for the Treasury, signed by myself and Colonel Smith jointly, on the 3rd March, 1869, respecting international seignorage, and of the memorandum for the Treasury, signed by the late master of the Mint (Mr. Graham) and Colonel Smith jointly, on the 6th April, 1869, respecting seignorage from an English point of view exclusively. I mention these documents as explaining the details of a matter too complex for very brief description, lest some of your readers should be led, by the course of the remarks of Mr. Franklin, to think that the views of some of us who think well of international coinage, are merely scientific notions, with no basis of practical reasoning at their foundation. Mr. Franklin in writing—out of order it seems to me—of proposing adjournment of a discussion at our Society from our own rooms to City ground, takes it for granted that we should have some different light shed upon the subject there, than what we can get at the Adelphi. Well, we will wait for that light; and let us hope that it may not take a biassed tone, like the "mercantile theory" of commerce long upheld in our city, and that it may not be in the form of a discursive discussion, but something in writing — practical and positive—to prove that it is against the interests of England to promote international coinage, and that the reporters to the Chambers of Commerce were wrong when they urged that the difficulties existing from the difference of our coins and those of other nations, and which make them bullion only when they are exported, diminish our sales in countries not having the same coins as ourselves, and induce foreign merchants to buy their goods in places where measures and prices are expressed in figures that are familiar to them, so that the situation of England, from this point of view, daily gets worse, particularly since the date of the convention between France, Switzerland, Belgium, and Italy. And by entering the monetary union (their report goes on to observe), we should suppress in a great measure these

obstacles to the development of our trade; and as Great Britain is the country which has the largest general trade, she would also be the country that would most profit from an international monetary system.

As one of the members of the Conseil Supérieur observed to me at Paris, after speaking of the advantages to those countries which have joined in the monetary convention:—"A Swiss or Italian merchant wishes to purchase textile fabrics of Rheims or Roubaix; the same fabrics are made in England, at Bradford. At an equality of price, or nearly so, it is obvious that the merchant would much prefer to go to Rheims or Roubaix than to Bradford, supposing the transit charges to be the same; for in the two towns first mentioned he will find his own monies and his own measures, whilst in England he will find difficulties in exchange and in measures, and which, without counting the trouble, turn to his disadvantage."

Mr. Franklin takes exception to what I said about M. Chevalier. My remarks arose out of what was stated about that gentleman by Mr. Franklin in his paper. I had not time at the discussion to fully explain my meaning. The impression I was under, and which coincided, I believe, with that of Mr. Seyd, who has also been recently examined by the Paris Commission, was that M. Chevalier did not object to international coinage generally, nor to the 25-franc piece being coined by other nations than France, although he did seem to object to France coining it, on the ground that she has already a convenient piece of 20 francs, and which, in his opinion, could not well circulate in France at the same time as the 25-franc piece. At the same time, M. Chevalier has not the smallest compunction in the world in advocating that France and all other countries should disturb their pound, napoleon, and dollar, as coins of circulation, by the introduction into all countries of his decagram of gold, or, in other words, coins worth £1 4s. 7d. nearly, of present coinage, or £1 4s. 9¾d. nearly, at the equation of £1 equal to 25 francs. To return, however, to the 25-franc piece. If M. Chevalier be against it, the governments of the United States, Austria, and of Sweden are for it, and those countries will doubtless coin it for circulation. And, according to the letter and the spirit of the Monetary Convention, it cannot be excluded from the countries of the convention as the leading multiple of 5 francs, whether France coin such a piece or not. There are Bills both before the Canadian and the United States House of Representatives, for equalising 5 dollars and 25 francs, so that the infusion of 25-franc pieces into the French circulation is inevitable, and it thus becomes of minor importance whether the Commission now sitting decide in favour, or the contrary, of France coining some 25-franc pieces herself; although, as it was justly observed by Mr. Lowe, it would give an additional stimulus to certain other countries to join the Monetary Convention.—I am, &c., Frederick Hendriks.

Kensington, June 10th, 1870.

NEW BOOKS.

Report to the Tottenham Local Board of Health on the Disposal of the Sewage of their District, May, 1870. Price 3s. (E. & F. N Spon, 48, Charing-cross.)

A Critical Account of the Drawings by Michael Angelo and Raffaelo in the University Galleries, Oxford. By J C. Robinson, F S.A, Hon. Member of the Academies of the Fine Arts of St. Luke, in Rome, Florence. Bologna, and Lisbon, formerly superintendent of the Art Collections and Art Referee of the South Kensington Museum. Price 4s. (Macmillan and Co, the Clarendon Press, Oxford.)

History of the Cathedral Church of Wells, as illustrating the History of the Cathedral Churches of the Old Foundation. By Edward A. Freeman, M.A, formerly Fellow of Trinity College, Oxford Price 3s. 6d. (Macmillan and Co)

The Cultivation of the Speaking Voice By John Hullah. Price 3s 6d. (Macmillan and Co., the Clarendon Press, Oxford.)

Mushroom Culture. By W. Robinson, F L.S. Price 6s. (Fred. Warne and Co.)

Grave Mounds and their Contents A Manual of Archæology. By Llewellyn Jewitt, F.S.A. Price 10s. 6d. (Groombridge & Sons.)

A Critical and Commercial Dictionary of the Works of Painters, with notes on the subjects and styles of various artists in the schools of Europe between the years 1250 and 1850 By F. P. Sequier, Picture Restorer in ordinary to the Queen. Price 21s. (Longmans, Green, and Co.)

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The Earl de Grey and Ripon presided on Tuesday, at 32, Abingdon-street, over a meeting of the General Purposes Committee, appointed by her Majesty's Commissioners for the Exhibition of 1851, to carry out the proposed series of Annual International Exhibitions, the first of which is to take place in 1871. There were also present his Royal Highness Prince Christian, Sir Stafford Northcote, Mr. Edgar Bowring, Mr. Cole, Dr. Lyon Playfair, Mr. Thring, and Lieut.-Col. Scott, R.E. (Secretary).

EXHIBITIONS.

The Midland Counties Exhibition at Derby.—This collection of works of art and industrial products was opened, on the 5th May, by the Lord-Lieutenant of the county, the Duke of Devonshire, and the Bishop of the diocese, Dr. Selwyn. The exhibition is held in the new Volunteer Drill-hall, and the more immediate object in holding it is to raise a sum of money to pay the debt on the hall in which it is held. The following description has been sent by a correspondent:—Immediately on going through the turnstile, the visitor finds himself in an open space covered in with glass, one half of which has been partitioned off and converted into a most beautiful and fairy-like grotto, with a fountain, waterfall, aquariums, and ferneries, for seeing which he has to pay the modest sum of one penny. The other half of this space is occupied by specimens of terra-cotta, from the Denby Pottery, lithographic and printing presses, lent by Messrs. Bemrose and Sons, a small gas-engine, and a ribbon-weaving loom. Pictures are the main feature of the collection, and among them are "The Lost Path," by F. Walker; Landseer's "Laying down the Law," and his still more celebrated work of "Bolton Abbey in the Olden Time." Besides these, we have specimens of R. Wilson, Ansdell, Morland; a beautiful work of Louise Rayner's, "Roslin Chapel;" a very fine landscape with sheep, by Charles Jones; a pair by J. Linnell; another pair of moonlight scenes, by Arthur Gilbert; a very fine Gerard Dow; two particularly fine works of Cooper's, "Sheep in a Snow-storm" and "Group of Cows Drinking." Among the water-colours there are several specimens of Cattermole's; a most truthful work of Louis Haghe, "Monks at Matins;" "A Highland Drove," by Rosa Bonheur. Of the old masters, Raffaelle, Rubens, Correggio, Vandyck, Rembrandt, Quentin Matsys, Ruysdael, Vandevelde, Van-der-Capellan, Cuyp, Claude, Teniers, Rogers of Bruges, and Both, are to be seen. A very prominent feature of the collection of pictures is the room containing portraits of Derbyshire worthies, the great part of which are painted by Wright, who was born at Derby in 1734, and died in 1797. Besides portraits by this artist, there are several by Sir Joshua Reynolds and Gainsborough. Leaving the pictures, there is a small room devoted almost entirely to photographs. Over the fire-place in this room there is a small collection of well-executed fretwork carving. In the north avenue are collections of Indian, Chinese, and other foreign products, many of which were kindly lent by the India Museum. In the glass and china department there is a stall of Venetian glass from the manu-

factory of Messrs. Salviati. Mr. Carter, of Derby, has two stalls of most exquisite articles in glass and china. Mr. Hancock, of the Derby China Works, also shows specimens. There are excellent collections of English and foreign lace, cases of cutlery, and electro-plate and ornamental articles. The exhibition will remain open for about two months longer.

GENERAL NOTES.

Amsterdam Ship Canal.—Next to the Suez Canal in magnitude, is the Amsterdam Ship Canal, which has been in progress about five years, and is expected to be completed in 1876. The canal is being formed through two lakes, both of which are shallow, first, by making embankments on each side of the line of canal, and then by dredging out the material between to the requisite dimensions. A deep excavation is being rapidly formed from the lakes to the North Sea, through the sandhills, and outside this piers built of large concrete blocks are in progress, which will extend about a mile into the sea, and enclose within them an area of about 200 acres, which will be dredged to a depth of 24 feet below low water. The canal will also have three locks at the North Sea entrance, a little eastward of the harbour. The canal will have a width at the bottom of 88 feet, which is 16 feet wider than the Suez Canal; a width at the top of 195 feet, and a depth of 23 feet. The locks will be wide enough to admit of ships of the largest class.

The Extent of the Sidereal System.—Wonderful as is the extent of the sidereal system as thus viewed, even more wonderful is its infinite variety. We know how largely modern discoveries have increased our estimate of the complexity of the planetary system. Where the ancients recognised but a few planets, we now see, besides the planets, the families of satellites; we see the rings of Saturn, in which minute satellites must be as the sands on the sea-shore for multitude; the wonderful zone of asteroids; myriads on myriads of comets; millions on millions of meteor-systems, gathering more and more richly around the sun, until in his neighbourhood they form the crown of glory which bursts into view when he is totally eclipsed. But wonderful as is the variety seen within the planetary system, the variety within the sidereal system is infinitely more amazing. Besides the single suns, there are groups, and systems, and streams of primary suns; there are whole galaxies of minor orbs; there are clustering stellar aggregations, showing every variety of richness, of figure, and of distribution; there are all the various forms of nebulæ, resolvable and irresolvable, circular, and elliptical, and spiral; and lastly, there are irregular masses of luminous gas, clinging in fantastic convolutions around stars and star-systems. Nor is it unsafe to assert that other forms and varieties of structure will yet be discovered, or that hundreds more exist which we may never hope to recognise. Even more wonderful than the infinite variety of the sidereal system, is its amazing vitality. Instead of millions of inert masses, we see the whole heavens instinct with energy,—astir with busy life. The great masses of luminous vapour, though occupying countless millions of cubic miles of space, are moved by unknown forces like clouds before the summer breeze; star-mist is condensing into clusters; star-clusters are forming into suns; streams and clusters of minor orbs are swayed by unknown attractive energies; and primary suns, singly or in systems, are pursuing their stately path through space, rejoicing as giants to run their course, extending on all sides the mighty arm of their attraction, gathering from ever new regions of space supplies of motive energy, to be transformed into the various forms of force,—light, heat, and electricity,—and distributed in lavish abundance to the worlds which circle round them.—*From a Royal Institution Lecture, by R. A. Proctor, on "Star Grouping."*

Iron Lamplighters.—Mr. Hunter, an engineer, has produced an apparatus to be worked by hydraulic power. The peculiar feature is, that by one operation the tap is opened, a match struck, and the gas lighted. A service-pipe is to be laid throughout the district to be lighted, with branches to each lamp. The pipes are charged with water, and the pressure required is given and maintained from a tank placed at the required elevation. Inside each lamp-post is to be placed a small cylinder, to the piston of which is attached a rod. The top of this rod is serrated, and gears into a toothed wheel attached to the plug of the lamp-tap, which is turned round, and opened as the rod rises. A small fusee drops from a reservoir, and is carried by a swivel-plate to a piece of roughened spring, on which it is rubbed and ignited. It is then carried round past the burner, the gas is lighted, and the fusee drops to the bottom of the lantern. In the morning, when the gas is to be extinguished, the pressure of water is taken off the cylinders, and an escape-tap opened, the pistons drop with the weight of the rod, and the taps are turned off. It is proposed that, as the lamps are cleaned weekly, the lamp-cleaner shall supply the reservoir with a week's supply of matches.

Statistics of the Bavarian Railways.—There are three groups of railways in Bavaria, viz., that belonging to the State, the Eastern Company of Bavaria, and the United Companies of the Bavarian Palatinate. During the session of 1868, ten new lines belonging to the State were sanctioned, measuring 448 English miles in length, and involving an expenditure of £7,698,500 sterling; the cost of construction, stations, and rolling-stock averaging £17,184 per mile. The State had 217 miles in course of construction, making the entire length of 665 miles. Under the same Act, the Eastern Company of Bavaria were authorised to make 194 miles, at a cost of £3,916,667 sterling, averaging £20,137 per mile. The United Companies of the Palatinate were likewise authorised to make 90 miles, at a cost of £1,447,083 sterling, averaging £16,276 per mile. The railways open for traffic, July, 1869, comprised an entire length of 1,606 miles; consequently, with those already making and projected, there will be, when completed, as follows:—Government railways, 1,716 miles; Eastern Company, 571; Palatinate, 338, a total of 2,625 English miles in the kingdom of Bavaria. According to the returns for twelve months (1867), when the total length was 1,587 miles, and the cost of construction had been £22,596,459 sterling, being at the rate of £14,238 per mile, the number of passengers travelled was 10,204,409; luggage conveyed, 21,272 tons; carriages, 1,886; horses, cattle, &c., 1,048,680 head; goods and coal, 5,504,536 tons. Total receipts, £2,724,913, at £1,717 per mile; expenses of administration, £1,190,096, at £750 per mile; aggregate net revenue, £1,534,821, at £967 per mile. Upon the lines making, the government guarantees both companies $4\frac{1}{2}$ per cent. upon the capital expended till 31st December, 1904, the companies being bound to pay over a certain portion of profits when they exceed $5\frac{1}{2}$ per cent. At the end of 99 years, the government will have the right of taking over the railways, on reimbursing the companies for the capital laid out.

MEETINGS FOR THE ENSUING WEEK.

Mon......Royal Inst., 2. General Monthly Meeting.
Entomological, 7.
Asiatic, 3.
London Inst., 4.

Wed ...East India Assoc., $3\frac{1}{2}$. (AT THE HOUSE OF THE SOCIETY OF ARTS.) Adjourned discussion on Sir Bartle Frere's paper on "Indian Public Works."
Obstetrical, 8.

Sat ......R. Botanic, $3\frac{3}{4}$.

Journal of the Society of Arts.

FRIDAY, JULY 8, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

THE BELGIAN COMMISSION.

The Belgian Commission met in general assembly on the 9th of June, under the chairmanship of His Royal Highness the Count of Flanders, President.

M. T'Kint de Naeyer, having at the commencement of the sitting thanked His Royal Highnesss for the honour he had conferred upon the Commission, in coming to preside over the assembly, the Prince replied in the following terms:—"I beg to thank the honourable president for the kind words he has just spoken. It has given me happiness to be at your service, gentlemen, and to come here to-day to preside over your deliberations. Everything which can increase the reputation of Belgium in the estimation of the foreigner is dear to my heart. I am here to testify to you my entire sympathy with the work you have undertaken; and I am delighted to be able to express to you the same sentiments in the name of the King. I have no doubt but that what we send to London in 1871, being prepared with care, will meet with all the success to be desired in that *par-excellence* practical country, and that our national arts and industries which will be summoned to take their place in that new international gathering will hold the rank there which justly belongs to them."

After these words, which were welcomed on every side with applause, M. Corr-Vandermaeren gave an account of the mission which, at the request of the Belgian Commission, he had fulfilled in London, with the design of obtaining from the British Commissioners additional space, the absolute necessity of which the committee of the Commission had recognised from the beginning. The insufficiency of the space placed at the disposal of the Belgian school especially had at this point struck the Sub-Commission of the Fine Arts, so that it had proposed that it should withdraw altogether in the event of there being no account taken of the requests of the Commission.

The proceedings adopted by M. Corr have been crowned with complete success. A gallery of 60 ft. by 30 ft., and measuring 2,400 square feet of available surface, after allowing for doors and openings, will be applied for the exhibition of Belgian paintings; and, besides this, separate places will be assigned for the works of our sculptors, our engravers, our designers, our industrial artists, our photographers, &c. These places, in the aggregate, will offer a means of development amounting to at least three times the space allotted to us at the first distribution. Sufficient room for table, counter, or partitition will be in the same degree offered to our manufacturers in the sections of industrial productions, which are to comprise, in 1871, pottery-ware and woollen fabrics, with all the branches of work which belong to these important industries. All the expenses arising from the placing, arranging, and overlooking of these productions will be at the exclusive charge of the British Commissioners.

M. Corr, in the interesting account which he laid before the assembly, and which is hereafter given, noticed a very important act of the French Commission. It had secured in London, in order that an annexe might be built there, a vast space, which should be put in communication with the galleries of the French department, and where the exhibitors should be authorised to sell their productions, so far as specimens of these productions should have figured in the exhibition itself. Every object sold during the day might be delivered to the purchaser the same evening, after the doors were shut; but it would be necessary to replace each article with another of the same kind the next day, before the opening of the doors.

Such an annexe, well arranged and managed, would certainly render the greatest service, each industry being bound to find there a sure means of developing the sale of its productions, in providing new openings, and a continually fresh body of purchasers. Immediately upon this communication, His Royal Highness the Count of Flanders expressed a wish to see our industrial departments imitate this example, and unite in profiting by the advantages which the Exhibition offers them in a mercantile point of view. He has invited the members of the Commission to fix the serious attention of our manufacturers upon this matter, since they have so great an interest in extending the circle of their customers. Some members have furnished explanations upon the result of the proceedings undertaken in view of getting assistance for the enterprise. M. Offerman especially has given hope that the industrial departments of Vervier will take part in the Exhibition of 1871, and M. Piret-Pauchet has promised the concurrence of several pottery establishments from the province of Namur, amongst others, of the important association for the manufactory of refractory ware at Audenne.

Upon this occasion, the President begged his colleagues to continue their efforts, the time being not far distant (the 1st of August) when the several inscriptions ought to be notified to the British Commissioners. It appears from instructions furnished by these Commissioners, that the artisans who co-operate in manufacturing the objects of industrial art, which the programme classes in the fine arts section, will be admitted to exhibit them.

Lastly, M. T'Kint de Naeyer gave an account of a sitting held on the 31st May last, by the Sub-Commission of Horticulture, and in which it was decided that the confederation of the horticultural societies of Belgium should be charged to organise and to arrango all the details of the part Belgium shall take in the special exhibition, and at the fortnightly exhibitions, which will bo held during the Exhibition of 1871, from first to last, under the care of the Royal Horticultural Society of London. The confederation should receive, to cover the expenses of this participation, a fixed sum, the use of which it will arrange under its own responsibility, and in the way that it shall deem most beneficial to the interests of our horticulturists.

Dr. Masters, who assisted at that sitting in the quality of delegate from the British Commissioners, has furnished the Sub-Commission with some very useful instructions respecting the character and mode of the exhibitions, and the projected conferences by the Royal Society.

Below is given, *in extenso*, the report which was read by M. Corr at the meeting of the Belgian Commission, and which was delivered as follows:—

Gentlemen,—To obtain information, and with the view of satisfying the desire expressed by the Sub-Commission of Fine Arts, I presented myself, on the 31st of May, at South Kensington, where I received from Lieut.-Colonel Henry Scott, Secretary of the Commission of the Exhibition of 1851, and from Mr. Henry Cole, the learned director of the South Kensington Museum, the warmost welcome. These gentlemen have given fresh attention to the distribution of the spaces originally reserved for the several foreign countries. This work has resulted in placing at the disposal of our section of the fine arts a stage gallery, perfectly light, of 60 ft. by 30 ft. in size, giving a useful surface of wall of 2,400 square feet, deducting the doors and openings. To this space may be added panels or partitions, which the English Commission offers to erect there, if it be deemed necessary. This re-arrangement in favour of our country was submitted to the approbation of the Commission, into the heart of which I was summoned. This Commission met on the 2nd of June, under the presidency of his Royal Highness Prince Christian, in the absence of his Royal Highness the Prince of Wales, the president. His Royal Highness received me with extreme kindness. I made some observations upon the insufficiency of the gallery proposed to receive all the objects of Belgian art. It was decided, after discussion, that this gallery should be specially reserved for pictures, and that a sufficiently large space should be assigned to us besides, in the galleries of the rotunda, for engravings, lithographs, industrial designs, &c. The sculpture shall be placed on the ground floor. I expressed myself satisfied and grateful for these arrangements. As to the sections of pottery and woollen manufactures, these, as you know, are to be mixed and grouped amongst the similar industries of other countries. Industrial fabrics shall appear in the rooms on the ground floor. The Commission gave me the assurance that the productions belonging to these sections should easily be arranged under the most favourable conditions. Counters, tables, sheets of glass, &c., shall receive, without any expense for exhibiting them, all the objects which demand this kind of arrangement. From and after the adoption of these measures, all the expenses of keeping, taking care of and placing, in a word, the whole expense of the disposition and management in the interior of the exhibition, shall be defrayed by the British Commission. Gentlemen, an unexpected circumstance has just arisen, and one which is likely to give to these annual exhibitions a very great importance in regard to the extension of the sale of the productions of art and industry. It is this. The delegate of the French Commission, with the hope that his countrymen would take a large share in those annual exhibitions, has asked for and secured a very considerable space in the Exhibition of 1871. But besides this—and this is the remarkable innovation—he has succeeded in obtaining authority to construct, at the expense of France, a spacious annex, which will cost, they tell me, from 250,000 to 300,000 francs. This structure, separated from the principal building, is to be placed, by means of a gallery, in direct communication with the French departments. It is intended to receive, being put there for their sale, all the objects which the French exhibitors should wish to send there, with this one stipulation that the productions be of the same nature with those which shall appear in the place itself of the Exhibition. Every object sold during the day may be delivered to the purchaser the same evening, after the doors are closed; it must, however, be replaced by an article of the same kind the next day, before the exhibition is opened. The exhibitors themselves shall alone be there for the sale of their productions in the annex. The English Commission has not only granted the authority solicited, but it has resolved to take measures to make it general, by according it to other countries who may wish to follow their example. It is certain that such an annex, skilfully managed by those who are themselves instructed in it, will be the perfect completion of these annual exhibitions, which are themselves the practical *resumé* of all preceding exhibitions. The annex will become the free storehouse, where every industry in its turn will find a sure means of giving activity to, and developing the sale of its productions, by opening relations with all the countries where English commerce is to be met with. The pottery and woollen industries commence, in 1871, the series of annual exhibitions. In 1872, the iron and flax manufactures will be called for; then those of glass and cotton; so that in the lapse of seven or eight years, all the principal modern industries will succeed each other in the palace of South Kensington. I have reason to believe that the pottery and woollen manufactures will not return before 1878 or 1879; it is therefore important that they should be well represented at the actual exhibition. The fine arts and the industrial arts are admitted every year. It is impossible to doubt but that, profiting by the knowledge of these favourable circumstances, several Belgian industries will learn how to avail themselves, at South Kensington, of new and important openings. I have assured myself, with pleasure, that a great part of the iron employed in building the palace at South Kensington will be of Belgian manufacture. The sale of the productions is the definite aim of our efforts, and—I repeat it—the annex is the practical means of attaining this end. However, I do not at all propose to the Commission to imitate France, by occupying itself with the organization of an annex for Belgium, I only mention it to you, gentlemen, in order to draw your attention, and that of Belgian commerce in general, to the necessity of utilising a means so practical of extending our commercial relations. It is for private enterprise to take the initiative, and study this project attentively, and carry it into execution, if it is to take place. The annual exhibition at South Kensington is itself exclusively due to the efforts of certain private individuals, who formerly composed the Commission of the International Exhibition of 1851. This Exhibition, the first in point of time, and which has left so profound an impression of admiration in the minds of all those who had the opportunity of witnessing this bold and grand enterprise, has furnished the Commission that organised it an excess of receipts over expenditure of 4,500,000 francs. Formed into a corporation, the Commission has imposed upon itself the mission of perpetuating the benefits of the work of Prince Albert, so fruitful as it was, by applying its revenues to a system of complete and permanent organisation for instruction in the arts of design and manufacture. It has purchased, since 1852, the important property of Kensington-gore; and, after twenty years' persevering study and effort, it is at last on the eve of attaining the end proposed. The palace of the Annual Exhibitions, the Kensington Museum, and the buildings of the Royal Horticultural Society, harmonising in their architecture, are united, so as, in some sort, to form a single establishment, the proportions of which wear the most imposing character. Groups of industrial specimens will be found there, which will be distinguished either by the excellence, or by the novelty, or by the cheapness of the fabric, and the selection of which, made with the greatest care, will have excluded all fastidious repetition of the same productions or the same modes of manufacture. By the side of these will be developed, on a large scale, splendid collections of works of art, of models of industrial art, of machines, of tools, and of manufactured objects, the property of the South Kensington Museum. All these riches, by also comprising within them horticultural collections, will constitute a permanent source of fruitful instruction, which will be completed every year by an international exhibition of scientific and industrial discoveries and inventions. One would not know how to imagine, as it seems, a more practical and complete organisation. The Commission of the Exhibition of 1851 has thus created, by private initiative, and without the pecuniary intervention of the State, an establish-

ment alone of its kind in all the world. I lay stress upon this point, because such an example may serve to encourage those of our countrymen who wish to establish an annex for the Belgian department at South Kensington. This annex will be the practical complement of the annual exhibition. It will give a grand development to the exportation of our industrial and artistic productions, and will yield, I am convinced, a satisfactory remuneration to those who are charged with the task of establishing it. It will be a source of honour and profit.

THE EDUCATION BILL.

The Committee have made very important progress with the Bill during the past week. On the 31st ult. they resumed the consideration of clause 9, which settles the mode of giving notice to a district of the insufficiency of its school accommodation. Mr. Corrance wished to insert a provision for taking a poll for or against the establishment of a school board, but he met with no support, and did not press his amendment. An important change in the clause was then made, Mr. Forster agreeing to substitute for the obligation on the districts to provide school accommodation "forthwith," a requirement that it shall be furnished within a period limited in the notice of the Education Board, and not exceeding six months. This was objected to strongly by Mr. V. Harcourt and others; but they did not press their opposition to a division.

To clause 10, which prescribes the steps to be taken by the Education Board to form school boards, Mr. Forster moved an addition, enabling them to be formed, on application from the electors, and where the Education Department is satisfied that the managers are unable or unwilling to maintain the existing schools. Mr. Samuelson desired to give the power of calling for the creation of a school board to not less than twenty inhabitant householders; but this alteration was lost by 240 to 63, and the clause as amended was agreed to.

On clause 14, which relates to the management of schools by the school boards, an amendment was moved by Sir Stafford Northcote, with the view of striking out the prohibition against teaching distinctive religious catechisms or formularies. This prohibition, he insisted, violated the original principle of the Bill—perfect freedom of religious teaching combined with perfect freedom of withdrawal. Mr. Pease and Lord John Manners supported the clause; and Mr. W. E. Forster said that, in the face of the reluctance expressed by those who would constitute the local boards to undertake the duty, it was impossible to throw the discretion as to religious teaching on them. Neither was it possible, in the present state of public opinion, to resort to secular teaching. This, therefore, was the only practicable course, and he saw no difficulty in giving a religious teaching which should be entirely unsectarian. Mr. Beresford Hope declared that the clause carried with it perpetual dilemma, while Mr. Dixon declined to be responsible in any way for it. Mr. Gladstone admitted that there was much logical force in Sir Stafford Northcote's amendment, but the clause as it stood now offered a more certain prospect of speedily settling the religious difficulty on a satisfactory basis. It gave every security against proselytism, it fell in with the views of the local bodies, and at the same time it provided a religious teaching which could not degenerate into mere formalism. Mr. Disraeli supported the amendment, which, however, was rejected by 252 to 95.

Sir J. Pakington next moved an amendment, requiring that the Holy Scriptures shall form part of the daily reading and teaching; but it was pointed out by Mr. Forster that this would prevent the establishment of secular schools, and therefore would violate the principle of freedom on which the Bill was founded. The amendment was rejected by 250 to 81.

Several amendments relating to the religious difficulty were withdrawn in favour of a proposal made by Mr. Jacob Bright, that in any school in which the Bible is read and taught, the teaching shall not be used or directed for or against the distinctive tenets of any religious denomination. This was opposed by Sir Roundell Palmer, Mr. Cowper-Temple, and Dr. Playfair; while, on the contrary, Sir G. Grey insisted on the importance of Parliament expressing an opinion that the education in the rate-aided schools should be unsectarian; and Mr. Whitbread supported the amendment. Mr. W. E. Forster urged, in opposition to the proposal, that it would perplex the schoolmaster, and could never be put into practical operation; and Mr. Gladstone objected that it would virtually set up a new-fangled State religion. On a division the amendment was negatived by 251 to 130. Clause 14 was agreed to.

The Committee resumed on the 1st inst., and made progress from clause 15 to clause 26.

On clause 17, which provides for the payment of school fees, there was a short discussion raised by Mr. Dixon, who wished to admit all children free. Mr. Forster objected to the State undertaking a responsibility which belonged to the parents, except in cases where parents were unable to discharge it, and in the end Mr. Dixon's proposal was rejected by 257 to 32.

Clause 22, which enables managers to transfer schools to school boards, was found much fault with, and ultimately Mr. Forster, at the suggestion of Mr. Disraeli, postponed the clause.

To clause 26, which enables the school boards to establish industrial schools, Sir C. B. Adderley moved an important addition, which would have had the effect of placing all the existing industrial schools under the management of the Education Department and the local boards. Mr. Forster admitted that the Industrial Schools Act required revision, but objected to doing it in this Bill. He could not state whether it would be advisable to adopt any portion of the amendment, but there might be an advantage in retaining the first part of it. He suggested that the mover should withdraw it, subject to the first part being considered after the other clauses of the Bill. This was agreed to by Sir C. B. Adderley.

The Committee resumed on the 4th inst., commencing with clause 27, which defines the mode of electing the school boards.

Sir C. Dilke proposed that the ratepayers in each district shall be the constituency, instead of the town council in boroughs, and vestries in parishes, and was supported by Lord Robert Montagu, Sir Stafford Northcote, Mr. M'Laren, and Lord F. Cavendish; while Sir J. Pakington, Mr. Beresford Hope, Mr. Cawley, and Mr. Dixon spoke in favour of the constituent body fixed by the Bill. Mr. Forster was not unwilling to be guided in the matter by the opinion of the House, though he preferred the Bill to the amendment. On a division, Sir C. Dilke was beaten by a small majority, 150 to 145. Subsequently, however, on the suggestion of Mr. Hibbert, the ratepayers were substituted for the vestry in parishes. Mr. Cowper-Temple moved that after the payment of a school grant, the Education Department shall have the power of nominating one-third of the school board, one-third of this third being parents of children attending the school. Mr. Cross, who was endorsed by Mr. Forster, objected to the proposal, as a stretch of centralisation which it would be found impossible to work.

Mr. Hibbert carried an amendment, with the assent of Mr. Forster, by which not less than one-third of the board shall consist of members outside the council; and it was further provided, at the suggestion of Mr. M'Cullagh Torrens, that in the metropolis the electors shall be the parishioners of each parish.

Lord F. Cavendish next proposed that the elections to the school boards be conducted by cumulative voting. Mr. Forster having invited the Committee to express its opinion on the point, Mr. W. H. Smith, Mr. Buxton, Mr. Melly, Mr. Lowther, Dr. Brewer, Mr. Fawcett,

Lord R. Montagu, and Mr. Winterbotham spoke in favour of it, while, on the other hand, Mr. Cross, Mr. Harcourt, Colonel Barttelot, Mr. Jessel, and Sir C. B. Adderley opposed it; and Mr. Gladstone pronounced that the balance of advantage had been shown to be on the side of cumulative voting, applied to this particular case, and the government, therefore, would support Lord F. Cavendish. His amendment, therefore, was carried without a division. This and the next clause were then agreed to.

On the 5th inst., the Committee resumed the consideration of the clauses relating to the election and constitution of the Education Board. In clause 29, the minimum of the numbers of the Board was raised from 3 to 5, and the maximum from 12 to 15, the number to be fixed in the first instance by the Education Department. Mr. Forster also pointed out that retirement by rotation could not be carried out under the cumulative vote, and he therefore proposed that the whole Board should be re-elected triennially, and that the Education Department should have the power of dissolving a refractory or obstructive board.

Clauses 30, 31, and 32 were agreed to without any alteration of importance. In clause 32, Mr. Haviland-Burke proposed to prohibit school boards from applying denominational tests in the election of teachers; but Mr. Forster and others urged that it would be impossible to prevent them imposing a test, if they were so inclined, indirectly, if not directly. The amendment was not pressed.

On clause 33, which prescribes how the Department is to form united districts, there was a long conversation, started by Mr. Holt, on the expediency of dividing large and scattered rural parishes and boroughs of unwieldy size. Mr. Forster admitted that cases of practical inconvenience might occasionally occur, but he pointed out that for the purposes of rating it was indispensable to retain boroughs and parishes as units. The contributory districts clauses would probably meet most of the inconveniences. The amendment was negatived without a division. Mr. M'Arthur proposed to fix the minimum size of a district at 7,000 inhabitants, but Mr. Forster declined to accept this rule.

Clauses up to 46 were agreed to rapidly, but this, which is the first of the rating clauses, provoked a discussion, which lasted the rest of the sitting, and was not concluded.

Sir Massey Lopes, who was seconded by Lord Mahon, moved an amendment, fixing the maximum at one penny in the pound on the rateable value of the area included in the school districts. Mr. Liddell was in favour of fixing a maximum, but thought 3d. in the pound would be low enough.

Mr. W. E. Forster spoke against the amendment, and the Committee adjourned.

It may be mentioned, that on the 5th instant, the University Tests Bill was passed in the Commons, by 247 to 113, more than two to one. The reception of this Bill by the House of Lords will be watched with much interest.

PROPOSED SCIENCE COLLEGE FOR NORWICH AND THE COUNTY.

The following is taken from the *Norfolk Chronicle*:—

Most of our scientific readers are aware that considerable attention has been called to the defective state of technical and scientific education among the middle and lower classes of our country, as compared with the same classes on the Continent. Large meetings have been recently held for the discussion of the causes and remedies of this grievance in the principal towns of England —notably one was summoned, and very influentially attended, at the commencement of the present year, in the hall of the Society of Arts, in London. This venerable body, established more than a hundred years ago, for the encouragement of Arts, Commerce, and Manufactures, has always devoted its special efforts and resources to the promotion of education and artistic skill among the artificer class, and, of late years, has sent delegates to the International Exhibitions at home and abroad, to institute and report upon the comparisons they have drawn between English and foreign manufactures. The result of their efforts, and of kindred ones, has been a movement towards the establishment of science colleges in the principal cities of England. Last year, Manchester took the lead, by means of resolutions passed at a very important meeting, held in the Mayor's parlour, to the effect that certain funds arising from the property belonging to Owen's College should form the nucleus of a sum to be expended, in spreading science, by means of a properly organised college. The Rev. J. Bates, formerly Vice-Principal of the Chester College Science School, and one of the Examiners of the Society of Arts, was requested by the Secretary of that Society to introduce the question of a science college to the notice of the citizens of Norwich. Accordingly, with the co-operation of the Rev. J. Crompton, he invited several gentlemen interested in scientific matters to a meeting, held in the Norwich Museum, on Friday, June 24th, at 3 p.m. The attendance was more numerous than could have been naturally expected, and the proceedings were animated by feelings of hopeful and even enthusiastic interest. The worthy head-master of the Grammar School took the chair. Letters, expressing regret at unavoidable absence, were received from Sir Willoughby Jones, the Mayor, Canon Hinds Howell, Professor Sedgwick, Dr. Eade, and the Rev. J. M. Du Port; and verbal messages, expressive of more or less sympathy, were sent from Canon Heaviside, Canon Robinson, Gurney Buxton, Esq., Dr. Bateman, Dr. Copeman, and other gentlemen. It will be needless at this early, and, at the best, only promising stage of the proceedings, to go fully into the details of the scheme, which Mr. Bates, on the part of the Society of Arts, explained to the meeting. The ideas which ran through the whole of his remarks were, briefly, that no scheme which required costly buildings or educational appliances could be entertained by the city, on account both of its comparative poverty and the heavy municipal expenses to which it had been recently subjected; that it would be wise, therefore, to appoint an educational board which, under the name of a science college, should inspect, recognise, encourage, and extend the educational facilities already existing in the city; doing this, in cases where work was done and science was taught, by means of its own or publicly recognised examinations, certificates, and rewards; supplementing what was deficiently or ineffectually taught, or not taught at all, by means of classes, laboratories, educational museums, workshops, &c. It was apprehended by the speakers and those whom they addressed, that materials for the scientific instruction of the middle classes already existed, and only required the eye and mind of a central board to utilise and control the use of them. A few simple and generously contrived arrangements would open up the rooms and museums of Norwich for instruction to the young of both sexes in the day-time. To such a board would also belong the consideration of the great question, "How shall our artisans receive, in evening classes, a technical education?" and the answer would be found in the judicious use of what Norwich already possessed, supplemented by the measures which a science college would originate. It was further proposed that educational visitors or missionaries should statedly inspect the whole city, and encourage all those who needed teaching to put themselves, under some form or other, in connection with the science college. The young would thus be reached by such schools and classes as should be more or less in connection with the science college; the artizans and labourers by the evening classes, and the public generally by means of a carefully planned and attractive series of lectures. It had been

foretold that the whole scheme would begin brilliantly and then collapse; on the contrary, one of the speakers (Mr. Bates) expected half a dozen years at least of toil and comparative failure, and then—if patient and true-hearted men could be found—then success. A committee was immediately formed for the purpose of making the necessary arrangements for calling a large city meeting to consider this deeply interesting and important question.

EFFECT OF PHYSICAL AND MENTAL TRAINING ON THE HALF-TIME SYSTEM.

At this time, when the steady increase of pauperism strikes many minds as appalling and inexplicable, and an inference is raised of its being a necessary result of the increase of the population, and when there is a cry raised for relief by emigration, it appears to the Council that the facts set forth in a report by their colleague, Mr. Edward Tufnell, are of the highest public importance and interest, as showing what really is redundant and burthensome is ignorance, and bodily as well as mental inaptitude to enter into new conditions, new arts, and new modes of productive labour, and that the true and sure means of relief are new and proved methods of sound mental, and physical, and industrial training, imparting aptitudes for new service of every kind. It has been by such aptitudes that the better educated populations of New England have been distinguished, and that they have well weathered commercial and manufacturing distress, and have maintained their prosperity. It appears to be strange that the proofs of what is stated by Mr. Tufnell, displayed in the industrial schools members of the Council have visited, should have hitherto failed to excite due notice, and should have remained unexamined aud unapplied. The Council consider it a duty to prepare and submit for discussion, as early as practicable, measures to be pressed on public notice for their application.

Education of Pauper Children.—Report for the year 1868 *of E. C. Tufnell, Esq., on the Home District.*

9th April, 1869.

Sir,—The industrial training of boys brought up in the district or other schools belonging to parochial unions has always been a matter of much difficulty. As boys in this class of life must almost invariably gain their livelihood by the labour of their hands, if their muscles are not accustomed to physical exertion while at school, there is great danger of their becoming applicants for relief in after life, or living by dishonest means.

In an investigation, conducted by Mr. Chadwick, into the antecedents of juvenile criminals, it was ascertained that the cause of their forsaking honest labour generally was, that their muscles being unaccustomed to hard physical exertion, continuous labour was painful to them.

A frequent complaint by runaway apprentices and vagrant children was, that the labour to which they were first put was really extremely painful to them, and they were thus induced to resort to criminal courses, which are well known to consist chiefly of idleness, in order to escape the pain of labour. This is stated by Mr. Chadwick, in a letter to Mr. Senior, printed by order of the House of Lords in 1861.

Hence the question of labour in these schools is of paramount importance, and to what labour the boys shall be put is a difficulty of continual recurrence, in the solution of which nearly every trade that it was possible to introduce into a school has been tried.

It has been discovered that there is a considerable demand for boys who have been taught to play some musical instrument in the bands of regiments and the royal navy. Accordingly, all the large schools now reckon music among the chief industrial employments of the boys, and I append to this report a list giving the names of the boys, the instruments they have been taught, the regimental or naval bands in which they enlisted, and the schools whence enlisted during the year 1868. The result is, that 183 boys have been disposed of in this way during the past year, of whom 25 have enlisted as musicians in the Royal Navy, and 158 boys in regimental bands.

Inquiries have been continually made into the conduct of the boys thus provided for, and the invariable answer is, that they have given the utmost satisfaction; and some of them, owing to the musical talent they have displayed, have been selected to be trained as band-masters. From one school alone, that belonging to St. George's-in-the-East, 90 musicians have been enlisted into army bands during the past five years, and by an inquiry lately made, I find that every one has turned out well. This is a pleasing contrast with the old system of workhouse schools, whence of all the children launched into the world after their so-called education, two-thirds turned out badly.

I could wish that the appliances for forming sailors were more generally introduced into these schools, but Stepney continues to be the only school where boys are specially trained for sea service. However, many boys are sent from all the schools both to the royal and merchant service, but, owing to their not being specially trained for this business, as at Stepney, they get very inferior situations to what they otherwise would. It should never be forgotten that the main secret for destroying hereditary pauperism, which has been the bane and disgrace of former Poor-law administration, is to well educate the children apart from adult paupers, and then to send them into the world, as far removed as possible from their own miserable relations and parishes, where they have known nothing but vice and misery. This is the reason why the army, navy, and merchant service is so peculiarly adapted to this class of children. When thus disposed of, they almost invariably become elevated far beyond the pauper ranks, and to this end no means have been so effectual as the establishment of large schools on the district system.

There is one conclusion which my inspection of pauper schools has strongly impressed on my mind, and which, as it refers to a question now much before the public, I think it right to mention.

I have an entire disbelief in the common idea that there is in England any surplus population; on the contrary, it is my conviction that the demand for labour is beyond the supply, that this demand is yearly becoming greater, and the proportionate supply less, in short, that the country is suffering rather from a deficiency of the labouring population than a surplus.

I draw this conclusion from what I have everywhere observed in the condition of pauper schools, which seems to me quite irreconcilable with the idea of a redundancy of population. It was different 25 years ago, when there may have been a surplus of labourers, but I am enabled to make a comparison between the state of things in this respect as it was then and the present time.

In a volume published by the Poor-law Commissioners, in 1841, there is a report from myself, in which I quote some complaints made by Boards of Guardians respecting the difficulty of disposing of their pauper children. The Tenterden Board writes thus to the Commissioners:—"The attention of the Board has been painfully directed for some time past to their total inability to dispose satisfactorily of their great boys, orphans. They have become unfit for the school, and when removed to the able men's ward, evince no particular desire to leave the workhouse. The Board of Guardians have sent to their parishes from time to time lists of the boys fit for service, and requested the parish officers to endeavour to find service for them, but they have not succeeded. What is to be done with great boys is a common question, not only at the Board, but out of doors, and it is a question which the Board most respectfully ask of the Poor-law Commissioners." At that time there were 79 boys in the workhouse. I have visited the Tenterden school in the last month, when I found 23 boys in it, only one of

whom was at all fit for service, and he has since found a situation. The girls, too, had diminished from 88 to 30, and here, as elsewhere, the demand for them was beyond the supply. Yet, between these two periods, the population of the Union had increased from 10,478 to 10,947.

The Rye Board made a similar complaint to the Commissioners about the difficulty of disposing of their pauper boys. There were then 58 boys in the workhouse. Last month I found 13 in it, of whom one boy only was as old as 12, and he was not strong enough for service; at the same time the girls had decreased from 101 (infants included) to 23, while the population of the Union had increased from 11,456 to 11,927 by the census of 1861.

The same report contains a third similar petition from the Eastry Board, who say:—"The attention of the Board of Guardians having been requested by the governor, at the weekly meeting held yesterday, to the number of boys in the workhouse who are fit for service, and willing to be engaged in any employment which can be offered for them, with the probability of maintaining themselves without further charge to the Union, submitting at the same time a list of names of boys whose ages are from 13 to 16 years, the Guardians being also satisfied that the subject is one of very grave importance, and seeing that no present opportunity offers for obtaining that employment, which is so desirable to prevent an habitual taste for the workhouse, and to subdue a disposition for pauperism, it was unanimously determined that the Commissioners be requested to advise the Guardians as to the best means to be adopted for obtaining services for about 12 or 14 very promising boys."

At that time there were 62 boys in the school, while last month, which it should be remembered is nearly the worst month in the year for pauperism, there were only 43 boys in the schools, and not more than one of these was fit for service. Yet here the population had increased from 23,870 to 25,900; consequently, as in the two former instances, the decrease of children cannot be ascribed to decrease of population.

I have made special inquiry with reference to the disposal of the children in every pauper school in my district, which comprises Middlesex, Kent, Sussex, Surrey, Hampshire, Berkshire, Hertfordshire, and part of Essex and Bucks, and the universal answer is, that there is no difficulty whatever in finding situations for the children, and that, for the girls especially, the demand is often for four times as many as can be supplied. Such facts as the above seem to me wholly irreconcilable with the idea of a surplus population.

But the condition of the metropolitan schools is more remarkable still, though it varies from that of the country schools. The number of children, amounting now to upwards of 8,000, has not diminished from what it used to be, but, instead of the schools being crowded with large boys and girls, fit for service but unable to obtain it, there are really none whatever of this description in the schools. I have continually asked the question from the superintendents of these schools, whether there is any difficulty in obtaining situations for the children, and the universal answer is, that they cannot supply the demand. For domestic servants especially the demand is so pressing, that in one of the large district schools I was informed that there were six applicants for every girl that could be recommended for service. The applications come from all parts of England, and even from Scotland.

We hear much of the destitution and poverty in the east of London, yet here there seems to be as little difficulty as elsewhere in providing situations for the pauper children from the schools. There are undoubtedly many labouring people out of work, the streets are crowded with children, who have obviously nothing to do, and in many of the country workhouses I found that, last March, there were many able-bodied men driven to the workhouse from inability to get work, and who sometimes even exceeded in number the children who were daily sought for by employers.

This is an anomalous state of things. It may appear incredible that a great demand for labourers can exist simultaneously with a multitude of people seeking employment and unable to obtain it, but I think I can give an adequate explanation. The real demand is not simply for labour, but trained labour, efficient labour, intelligent labour; a shopman who wants an errand boy will not take a boy from the streets who is dirty in his habits, unable to read the direction of a parcel, has never heard of the eighth commandment, and is unconscious of any moral or religious feeling; but he will readily engage a boy trained in one of these district schools, as he is tolerably sure of getting thence an intelligent and well-behaved lad. Nothing can be better than the training of the children in these large establishments. I am aware it is costly, but it is cheaper than allowing them to become thieves, or paupers, or prostitutes, as was the case formerly. When I see these shoeless, half-starved Arabs turning somersaults in the streets, I long to send them to the district school, whence I could warrant to turn them out, in two years, worth at least 6s. or 7s. a week. The girls in these schools are all taught to wash, to sew, to cook, to clean, in short, to do all that is usually required of a maid servant; the boys are accustomed to labour, and their intellectual instruction alone is sufficient to enable them to write good hands, to keep accounts with accuracy, and thus they often become clerks, telegraph assistants, and many are turned out as musicians into the army and navy, as previously observed.

I have continually made inquiry from the masters of workhouses respecting the character of the able-bodied inmates, and the almost invariable answer is, that they are the idlest and most disreputable characters in their parishes. In other words, they cannot get employment, not because there is no employment to be had, but because they cannot furnish intelligent, efficient labour. Some years ago, I inquired into the educational condition of all the adult paupers in the 12 East Kent Union Workhouses. Their number was 1,050, of whom only 4 could read and write well; 297 could both read and write either decently or imperfectly; and 474 could neither read nor write.

Sir J. Kay Shuttleworth made a similar inquiry into the intellectual condition of the 1,675 adults who were then in the 27 unions of Norfolk and Suffolk, when it came out that only 10 could read and write well; 281 could both read and write either decently or imperfectly; and 928 could neither read nor write.

With such facts before us, I think it impossible to doubt that the real cause of the destitution and forced idleness which we see around us is not the absence of work, but the absence of the training, the intelligence, the ability, and will to work, which all employers require in those they engage; and this conclusion is confirmed by incidental facts that often come under my notice.

When boys or girls 12 or 13 years of age, who have been running wild in the streets, come into the pauper schools, there is always great difficulty in disposing of them. It is well established, that it is one of the hardest of labours to train and educate a child of that age, who has never been previously subjected to any sort of discipline; and when I have made inquiries respecting children who, having been a year or less in a good pauper school, have subsequently fallen into vice or crime, I have generally found that they have entered the school at 12 or 13 thoroughly demoralised, and the ordinary routine of such a school has not been sufficient to train and moralise them.

Such children ought to be sent to a reformatory, when the discipline of what is termed the "family system" might be applied to them. The management of pauper schools is not adapted for criminal children of

an advanced age, though when they are received under 10 years of age there is a tolerable certainty that they will be converted into honest, hard-working members of society.

In saying that the country is suffering rather from a deficiency of workpeople than a surplus, and that that deficiency is yearly becoming greater, I quite recognise the truth of the statement of the Registrar-General in his last report, that "the English race is multiplying with unabated velocity." But the demand on the race increases with a still greater velocity. In 1840, the import and export trade of the country fell short of 100 millions in value; last year it exceeded 450 millions, and the internal trade has doubtless increased in at least an equal ratio. It may be doubted whether the surplus population, which was so much complained of some years ago, was not in great measure fictitious; but at any rate now, when every well-trained pauper child so readily obtains employment, I cannot doubt that what is really wanted is not employment or emigration, but a more general system of education.

I have, &c.,

E. Carleton Tufnell,

H.M. Inspector of Schools.

To the President of the Poor-law Board.

THE CAUSES OF RAILWAY AXLE FRACTURE, AND THE REMEDY.

By W. Bridges Adams.

The fatal accident which has slain so many persons, and maimed so many more, perhaps for life, and the impossibility of ascribing blame for its occurrence to any individual or corporate body, leads us to the inquiry as to the possibility of future precaution. The contingency of one train damaging another at the moment of passing each other on two lines of rails seems, at first, a remote one, but of course the chances in favour of it will be on the increase with the increase of traffic, and it is therefore worth analysis.

That the breakage of the axle was caused by a gradual deterioration of material, may be assumed *à priori*, for the wagon, so far as we know, was one long in use, originally constructed to carry six tons, and loaded with less than that amount when the axle suddenly broke.

Wheels and Axles.

In discussing the question of wheels and axles, we must first define them, for there are wheels proper, and wheels so-called, which are not wheels at all, but only rollers. In its principle, what is called in railway parlance an axle and pair of wheels is, in truth, only a garden roller with the centre portion cut away. If any one tries to pull a garden roller round in a small circle, he will soon find himself in the difficulty that it is a sledge, and not a rolling body, that he is working at. The garden roller is a revolving axle, with the wheel fixed fast on it, and so is the railway axle. Some long time back, an agricultural machine maker patented and made what he called a clod-crusher. It was a revolving harrow, some seven feet in length, set all over with spikes. But no power of horses could draw it, save in a straight line. To change its course was impracticable, because both ends would persist in travelling at the same rate of speed, a practice strictly in conformity with geometry. So our would-be clod-compeller was compelled by the clods to change his practice. He divided his roller into two separate wheels, each being enabled to revolve separately on the axle. Still, each wheel was so broad that he gained little advantage. He then subdivided it into four wheels, and it was much more easily managed, and he carried on the subdivision till he had reduced his rollers to the width of ordinary wheels, all strung on one axle together. In fact, he had gone through once more all the original contrivances which had in past ages developed wheels out of a roller, and this is precisely the process to which railway mechanicans must, sooner or later, address themselves. They must take to wheels proper, and eschew garden rollers, however cunningly they may cut and carve them into fanciful forms, conical or other, for it is a law of nature that, to avoid friction, wheels must travel at differing rates of speed along pathways of differing lengths.

It is recorded that when Donald Macdonald first descended from the Highlands, and beheld a four-wheel carriage travelling along with a Lowland Earl, he first stared with astonishment, and then burst into a fit of laughter, exclaiming, "We'el rinnit, wee wheel, big ane canna catch ye," not realising the fact that the big wheel made fewer revolutions.

It is quite true that by making, in railway practice, each half of the garden-roller the frustrum of a cone, it is possible so to vary the diameters as to be the equivalent to separate wheels, provided sufficient end-long movement of the axle be arranged. But this only holds good as regards a single axle, and vehicles with a single axle are not prevalent on railways; they have never less than two, and sometimes more. The frames to which these axles are attached are oblong, and the axles are supposed to be rectangular to the frame, and parallel with each other, the line of traction being parallel with the planes of the so-called wheels. So arranged, they are adapted to run truly on straight lines of rails. But such straight lines are purely imaginary. Rails are a succession of large and small curves and zigzags, on which the coned rollers incessantly vary their tread, and oscillate from side to side, on sinuous courses, like so many snakes, but not so gracefully. In this oscillating movement the rollers are seeking the path of least friction; and so well is this understood by the engine-drivers that the trains of wagons are coupled only by loose chains or links, for the simple reason that, were they close coupled together, the friction of the treads and flanges against the rails would be so great that it would be impossible to haul them along. With passenger trains this sinuous motion is so annoying that, perforce, the train is coupled close together to check it, and the wheels or rollers tell the story of the additional friction they thus have to encounter, by the amount of frictional vibration and retardation thence ensuing. And frequently at stations the driver will take the opportunity to loosen the couplings, in order to ease his engine.

Longitudinal Shocks.

Longitudinal shocks, of more or less intensity, occur in all trains, whether in drawing or propelling, and if the traction and buffing-springs be insufficient in elastic power, the frames, especially on curves, are apt to get a diagonal set. In wagons without traction-springs or buffing-springs the haulage by loose couplings is a succession of violent jerks, frequently breaking the couplings, and causing accidents. And again, when the buffers on one side get violent blows on curves, the oblong frame becomes rhomboidal, and though the axles retain their parallelism with each other, they cease to be rectangular to the line of traction, and the wheels remain at a permanent tangent with the rails. In this position the strain upon the axle, by the pressure of the wheel-flanges against the rails, becomes enormous, and the longer the wheel base the more mischievous it is.

Haulage Resistance.

It may be taken as an axiom that resistance to haulage —apart from gravitation on inclines—is the measure of axle strain in torsion. The normal resistance is assumed to be eight pounds per ton of load on the axles, on the level. If, then, we find, as sometimes occurs, that trains of wagons will not run down inclines of 1 in 72 without haulage, we may be sure that there is something vicious in the structure, whether original or induced by violence. Curves and bad permanent way will quadruple the resistance to traction, and practically the resistance in

being obliged to shunt a train into a sharp-curved siding will reduce the train by one-third to one-half of what the engine is able to deal with on a straight line.

Axle Torsion.

Under these circumstances, the railway axle is exposed to great torsional strain, with a condition more trying than that of the fixed axles on the common road. The common road axle being a fixture, if it be weak for its load, any bending is only in one direction, viz., upwards at the ends. If the revolving axle bends under the load, it bends in every direction radial to the centre in a constant succession of changes. The bending of course takes place in the weakest part, where it is reduced for the bearing, or for the boss of the wheel. If it bends at all under the load, aggravated by excentricity of movement, the final breakage is only a question of time. The commencement is by a fine circular line round the weak part, so fine as to be undiscernable by the naked eye. This line gradually deepens to a sixteenth of an inch, half an inch, and so on till the central portion becomes too weak to hold it together, and it drops apart. Breakage of axles in this mode is not uncommon, and those who have locomotive engines in charge, with cranked axles, maintain that the access of oil in the opening crack acts as a wedge to quicken the fracture, and the question of duration is a known quantity. In truth, the crank axle of an engine is a very weak axle. Its diameter is usually the same as that of straight axles, while its length, if straightened out in the cranks, will be found to be double that of the straight axle.

Breaking Strain.

It will be seen then, that the cause of the breakage of railway axles is to be found in the fact that they are strained beyond their powers, not by the load, but by imperfect structure of the vehicle they are attached to, imperfect, possibly, originally, but commonly by violence in use. The running is "wringing the neck of the axle."

With a view to lessen lateral friction of the wheel flanges as much as possible, it has been customary to keep the axles as near as possible together. This, if the bodies be long, involves "hogging," and oscillation, with a bad distribution of the load. Other things being equal, the nearer the axles are to the wagon end, the steadier they will be; but then flange friction increases with the length of wheel base, and a remedy must be provided for this.

Supposing that a train of wagons were built perfectly true at the outset for a straight line, the multitude of longitudinal shocks would soon set the wheels out of truth, and so the question arises whether it be possible so to construct them that diagonal shocks to the frame, giving a permanent set, shall not affect the true running of the wheels; and next, whether wagons may not be so constructed as to dispense with the loose coupling, which is a material source of breakage to couplings, and displacement of the wagon frames. We think it is. Desirable as it is to point out the causes of the defects, it is still more useful to point out the remedy.

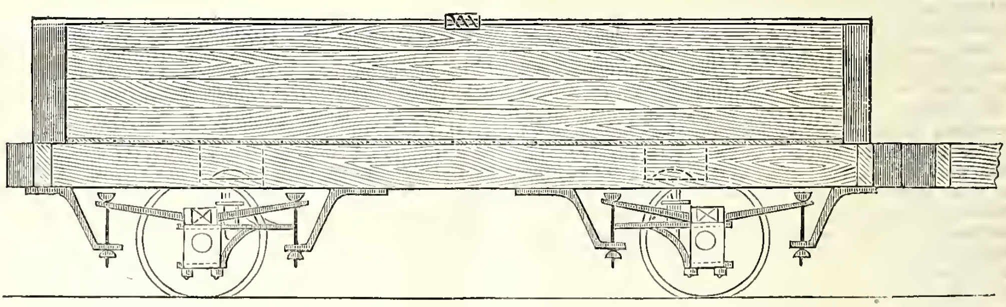
Existing Structure of Vehicles.

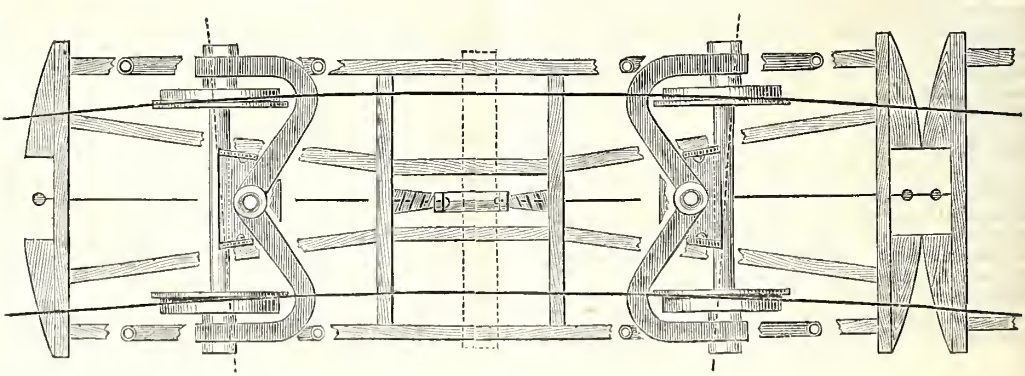
The existing mode of construction is, to fix to the sides or sole bars of the wagon four iron forks called horn-plates, up and down which the axle boxes slide vertically with the movement of the bearing springs, similar to the rowlocks of a boat which hold the oars. The fit of these horn-plates in the grooves of the boxes must, of course, be a loose one, or they could not work equally. Consequently, every blow which disturbs the frame carries the horn-plates with it, and sets the wheels and axles askew.

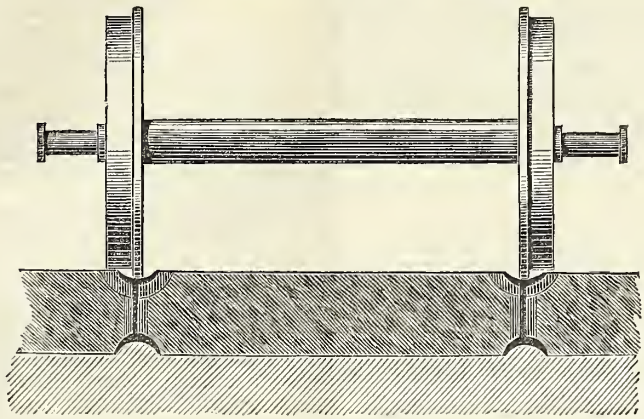
Improved Structure.

The diagrams show an improved wagon in side

Radial Wagon, for Curves of One Chain Radius.







Railway Wheels, Flange Running on Channel Rails.

elevation and plan. The horn-plates are dispensed with, and instead of them, axle-guards are made to clip the two axle-boxes firmly, and bend round the wheels horizontally, and form a central pivot-hole seven inches within each axle. A strong pivot is forged on a plate turning up at the ends, and bolted between the two diagonal timbers of the wagon frame at each end. The axle guard frame thus forms a caster pivot, which carries no load, but merely acts as a guide or excentric centre for the wheels. The bearing springs are fixed on the axle boxes above the axle guards, and carry the load by long pendant round rods, with ball and socket heads and nuts passing through strong iron brackets fixed to the sole bars. Thus there is perfect free movement for the axles to move laterally and radially on irregular rails, or when the wheel flanges press against the outer rails on a curve—when the axles take a true radial position pointing to the centre of the curve, each independently of the other. If any distortion happens to the frame by a blow, making it rhomboidal, it does not affect the relative position of the two pivots, and the wheels will run as true with a distorted rhomboidal frame as with a true oblong; and on a straight line the gravitation of the spring shackles ensures a rectangular position.

And this free movement of the wheels from side to side, while preventing all jamming of the flanges, will permit the close coupling of the trains without affecting the wheel action, and thus reduce the longitudinal shocks to the minimum. Thus the wagon bodies may form a series of tangents on a curve, free from oscillation. The buffers are curvilinear to give free action. It will be seen that the short distance between the axle centre and the axle guard centre, while keeping the wheels true on curves, also keeps the wheels true to the guage, and free from oscillation. The wagon is adapted to carry ten tons of coals or minerals quite steadily at any speed. The spring-plates are six inches broad, and thoroughly elastic. The cubic contents are 381 feet, and sliding iron bars are made to clip the upper edges, permitting loading without trouble, and holding the light top sides together.

Coal Wagons direct from the Pit's Mouth to the Consumers' Premises without Change.

On this system, the cones of the wheels or rollers may be brought into effectual play, widening the guage of the rails where the curves are very sharp, thus enabling coal-wagons of 12 feet wheel base and 20 feet length to go direct to the pit's mouth round curves of one chain radius. Such wagons also will permit the delivery of coal direct from the pit's mouth on to the consumers' premises, such as large gas-works, running on the wheel flanges, on channel rails laid on the streets and roads as tramways, as shown on the diagram. It is true that very sharp curves would involve tread friction, as may be any day seen in street-tramway working, but this can be very easily provided for, and then the movement becomes perfect, and the friction on the channel rails would be less than that on the railway proper, as the flanges would cease to rub.

It is thus possible to get rid of the contingency of railway axles breaking by unfair wear, when otherwise faultless. And when we get to the proper process of forming hollow axles, we shall have far less chance of flaws. And if coal and goods wagons be thus constructed, they may run at as great speed, and with more safety, than existing passenger trains. The cost and consumption of fuel is mainly governed by the resistance to haulage.

Evidence on Inquest.

The intelligent evidence given by Mr. Saeré and Captain Tyler made the matter very clear:—"The wagon was estimated to carry a load of six tons, and the dead-weight of the wagon, unloaded, was two tons five hundredweight, and it had been in use eighteen years." This was a satisfactory and economical proportion, of ample weight for strength, without the surplus dead-weight we have heard so much of lately. Captain Tyler said, "the flaw was round the whole circumference of the axle-tree. The flaw was not due to the quality of the iron, but arose from wear and tear. A large portion of the section of the axle had been defective, and it was only a moderate sized piece in the middle that held on. As the truck worked, the sound portion got smaller, and at last it got so small that it failed altogether."

This is precisely the process of breakage in all railway axles subjected to a bending strain, either by overloading, or by torsion on sharp curves, or by vicious or damaged structure.

In the running of ordinary trains, the tendency is for the leading wheels to hug the outer rail with their flanges where the lines are curved, and the result of this is to throw the trailing-wheels against the inner rail, placing the vehicle in a partly diagonal position, with an incessant sledging, frictional grind, inducing the "wear and tear" to which Captain Tyler alludes. If the wheels were free, instead of being held fast laterally to the frame, they would find out for themselves the path of least friction; the torsion of the axles would cease, and oscillation of the bodies would disappear also. And be it remembered that the tendency to hug the rail with the wheel flange by rigid pressure is the main cause of "getting off the line."

Mr. Patrick Stirling, the engineer of the Great Northern Railway, and than whom no more competent engineer exists, said, "It is quite possible the flaw in the broken axle might have been an incipient one at the time of its original construction, but not perceptible to the eye. A concussion with another wagon might have completed the break of the axle in question. There is a considerable curve in the locality of the accident. A curve always brings a greater strain on the axle than a straight line."

Cranked Axles.

In February, 1869, a paper was read on the Mauritius Railway, at the Institution of Civil Engineers, and, in the course of the discussion on locomotive engines, Mr. Harrison, the engineer of the North-Eastern Company, made the following remarks:—"Mr. Adams had stated that he could make an engine which would pass round curves of three chains radius. He knew that gentleman's radial motion had been successfully applied to engines and carriages, and he had no doubt that Mr. Adams was going in the right direction in designing stock for traversing sharp curves, but still he thought it would be much better, if possible, to avoid sharp curves, and thus remove the necessity for adopting these means of working. It was only when the curves were exceedingly sharp that it was necessary to resort to these expedients. There was no stronger argument against very sharp curves than the comparative wear of crank axles on curves and on straight lines, and he could state from experience that a crank axle in an engine working on straight lines would last at least six times longer than the crank axle of an engine working over exceedingly sharp curves."

Jeremy Bentham was accustomed to remark that "it would be a great mechanical convenience if the surface of the world were all down-hill; but that as it was not so, he must put up with it." And even so we must deal with our railways. Let us by all means get straight lines when we can; and it would be better, on the whole, to make straight lines in given lengths, connected by sharp curves at intervals, than to form them in general curves; only, in such case, we must take care that our moving stock be adapted to work the curves; and, in any case, our wheels and axles should be so constructed as to have free rolling movement under all circumstances, and never be subjected to other strains than that of the direct load borne upon them. With regard to crank axles, there is no apparent reason wh ythey should exist at all, other than a superstition. Straightened out in the cranks, they measure twice the length between the wheels that straight axles do, and yet, strange to say, they have no increase in diameter. The steadiest, fastest, and most powerful locomotive engine now existing on any English line has been produced by Mr. Stirling, and it has a straight driving axle and outside cylinders. It could scarcely exist at all for any useful purpose with a crank axle; and, with requisite appliances, it could, no doubt, work with coupled drivers and increased power.

Summary.

The faults and accidents are not in individuals, but in the system of all large establishments, whether government or other, that sticks to red tape and eschews progress, that would build every locomotive and wagon to an antique pattern, in order to save trouble in reorganisation, as though the works of man were as perfect in their beginning as the works of the Creator; as though there were not construction, destruction, and reconstruction in nature itself. But for the competition of individuals, we should still be travelling in stage-coaches drawn by horses, and building wooden war-ships, till the world were denuded of its forests. Not for this were our iron and coal stored in the underground cellars of nature!

CORRESPONDENCE.

PUBLIC AFFAIRS IN INDIA.

Sir,—Will you find space for the accompanying letter from Sir Arthur Cotton, which has arisen out of a correspondence that has lately taken place, in one of the Manchester papers, on the memorial presented to the Secretary of State for India by the Cotton Supply Association.—Yours, &c., T. Briggs.

Homestead, Richmond, 4th June, 1870.

My Dear Sir,—I am much obliged to you for your letters. Your friend is an old Indian, and of the Brahmin caste; but a great deal of what he says is quite true.

Many of the collectors are really what he describes them to be, and highly respected by the natives, in spite of the habit they have of putting their hands into the pockets of the natives, or rather their cummerbunds, as they are not so vulgar as to wear trousers. But this is far from being the case with all the collectors.

I have no doubt that some of the people at Manchester are as dull as your friend, and, what is more, don't wish to be taught; but this is, as you say, the very reason for trying to teach them. If they believed in water-carriage, there would be no occasion to lecture them. Manufacturers must be dull indeed who cannot understand that it must be better for them to have the cotton carried from Delhi to Calcutta, for instance, for 10s. a ton than for £10 or £15, and that those who grew the ton of cotton should have the ten tons of food, clothing, building materials, &c., they require brought by water at one-tenth of a penny a mile, rather than by land at twenty or thirty times that cost. Yet there are many such in Manchester, and in Calcutta, too; and some of the Cotton Supply Association belong to this class. Some, I find, are beginning to understand this difficult point. However, many thousand miles of steamboat-canal are already constructed, and many thousand more are under execution; and they will get cotton cheap in spite of themselves, by means of internal water-carriage, just as they are now getting it by the Suez Canal, cheaply and quickly, in spite of the efforts of all England against it; and as they are now getting five quarters of a year's supply by this canal this year, without their thinking of such a thing, 100,000,000 lbs. this year more than they would otherwise have received will make such a difference in the cotton business as it is not easy to estimate, and it will not be followed by any diminution in following years. I should like to give them another lecture at Manchester if I could.

I am very glad you are urging the steam-boat canal to Manchester. I feel sure that if it is once made nothing can stop it till it gets to London. Why should not Manchester and Birmingham have the incalculable benefit of a ship canal as well as Gloucester? How strange it seems that such great centres of business as those should be content to remain cut off by railway carriage from all the world, when there is not one reason for it.

I think in your letter to the *Courier* you are right in saying "the collectors, as a rule, &c." The names your Brahmin friend gives are the exceptions. The collectors, who try to do their duty to the million or two subject to them, are overwhelmed with work of other kinds.

The main reason why the natives did not take shares in the railways is, that they are much too acute to be taken in by such rubbish. They knew well enough they would not pay. If they had been asked to take shares in irrigation works, with a portion of the profits, millions would have been received, for they perfectly understand the value of water. I have lately seen an official from the Godavery Delta, and he gave me the following statistics:—

Receipt from the Works.

Water-rate on 450,000 acres of rice, at 4 rupees	£180,000
Water-rate on 250,000 acres of dry grain, at $2\frac{1}{2}$ rupees	62,000
	£242,000

The capital invested being £480,000, and the cost of repairs, &c., being £20,000, this gives a net return of £220,000 on £480,000, or of 46 per cent., to government. Not a word is said about these results of irrigation in all the finance discussions, though one would suppose it had something to do with the question of how to balance the finances.

I quite agree with you about the income-tax. I am very glad of it, because it forces the rich natives and Europeans to rouse themselves and make a stir; but in itself it is a sound and just tax; and, much as it irritates the upper class of the natives, it is more politic than the salt tax, which irritates the great mass of the people, and most justly too.

Nothing can show more clearly the strange misapprehension of the memorialists than their urging the prosecution of the railways. They are the very things that have upset the finanees; if it were not for the three millions that they are really costing the country, paid out of taxes to the shareholders, there would be no deficit, even according to the present absurd way of making out the accounts. What can be the use of asserting, as the financiers do, that they have greatly improved the revenue, in the face of the fact that there is no such great increase in any of the items of revenue. There is not a show of proof that the railways have increased the revenue. Where is the railway district that has increased in revenue 50 per eent. as the irrigation districts have?

As to the opium revenue, both sides equally failed in the late discussion, because they were both trying to settle this point, What are we to do with the opium revenue? There is no such point to discuss. The sole point now is, What are we to do without it? Happily the matter is taken out of our hands now; the opium revenue is gone, and nothing can prevent it. The question now is, with a railway charge, nominally of $1\frac{1}{2}$ millions, really much more, and rapidly increasing as the more unproductive lines are opened, and without the opium revenue of 8 millions, in four or five years, what are we to do to meet our difficulties? It is of no use ignoring these things; we have nothing for it but to look the facts in the face, and meet them like men.

What I consider is wanted in the Council is, not so much mercantile men, as simply non-official men, and younger men; the mischief now is that all the members are Indianised men, all old, and all men who have got into the official rut.

About the land; in some parts it is very lightly assessed, and it is true that the ryots are sub-let at a good rent; but this is by no means generally the ease, though very much has been done of late years to lighten the land-tax. In all the irrigated districts the land is very valuable, after paying land-tax and water-rate.

When your friend says, "If any injustice is done to the cultivators, they have the Queen and Parliament to appeal to," he talks something so like nonsense that it is difficult to distinguish it from it. They have no resouree whatever; practically, the great body of the ryots are entirely at the mercy of government. In the tract of country of late years transferred from Hyderabad to us, on the north bank of the Godavery, a large portion of the people have abandoned their homes and lands, and immigrated to the native states adjoining, of course because they had no other resource from the oppression they experienced. This is a fact, and it is stated in official papers. I would send you a quotation, if I had the papers with me. Nothing can be further from the truth than to say that the ryots are an independent, thriving set of people generally; they are so in some tracts, but the great proportion are the most abject serfs, in the lowest state of poverty. What is the defence of the promoters of the salt tax? It is expressly stated by them that there is no other way of getting revenue from the great mass of the people. What is this but saying that they are in such a state of poverty that the only way to tax them involves the depriving them of some of the absolute necessaries of life; for, in consequence of the enormous salt-tax, the average consumption of all India is much less than that of half of some tracts, and men never eat salt to excess.

That this state of things is rapidly improving is certain, but it is by the increased value of cotton and other products, by the extension of irrigation and water-carriage, and of common roads.

In urging the Manchester ship-canal, we should use this argument. These awful railway accidents are, almost without exception, owing to their attempting to carry passengers and masses of heavy goods on the same line; they can never be stopped till steamboat canals take the heavy traffic off the railways. Speed and safety together for passenger traffic are absolutely incompatible with heavy goods traffic.—I am, &c., A. Cotton.

Worthing, June 28, 1870.

MEAT PRESERVING.

Sir,—I should very much like to know how it happens that the simple mode of drying raw meat by hanging in a close chamber, with a basket of quick lime suspended therein, is not adopted for some portion, at least, of Australian and South American beef, for the process has long been known and practised. When thoroughly dried by these means, if preserved from the ravages of insects, it will keep for any length of time, and in any climate, like so many junks of oak timber. All nutritious chemical matters are retained in meat so dried, and it is said to resume the character of fresh beef by sufficient soaking in cold water. But the best method of utilising this product would be to grind or grate the dry lumps into coarse powder, which, mixed with wheaten flour, would make up very palatable and nourishing biscuits, well fitted for the occasional food of a working man.

Meat biscuits, so-called, can be obtained everywhere; but they are made with Liebig's *Extractum carnis*, which, besides being very costly, has lost much nutritive matter in the process of concoction, and is only a fit nominal food for invalids who have lost their natural power of digestion, and not for the working man, who must be supplied with the *caro*, not the *extractum*, which is utterly useless to him.

Meat biscuits, if honestly made, would, upon occasion, enable a man to do a hard day's work; but sueh biscuits in combination with vegetables, &c., would make a strong, palatable, and nourishing soup, fit almost for any table.—I am, &c., Henry W. Reveley.

Reading.

INTERNATIONAL COINAGE AND MONEY OF ACCOUNT.

Sir,—Will you allow me a brief space in your columns to correct a misapprehension under which your correspondent, Mr. Frederick Hendriks, labours, in representing a report, to which he refers in his letter to you, as being that of the Associated Chambers of Commerce of the United Kingdom. The report in question was that of the gentlemen who signed it. It was not adopted, but only (as a matter of courtesy) received by the Association, at its annual meeting, in February last, as you will see by referring to pages 47 and 56 of its official report, a copy of which I send you herewith.

The discussion on the subject, and the resolutions which were passed on that occasion, will be found at pages 77 to 86 of the same report. If you can afford the space, I think it very desirable that you should reprint

the resolutions from page 86, in order to correct or prevent misapprehensions. Without desiring to enter on a discussion in your columns, I may venture to say that not one of the gentlemen referred to by Mr. Hendriks attempted to propose a resolution in favour of the 25-franc piece at that meeting.—I am, &c.,

Leonard Bruton, one of the Honorary Secretaries of the Association.

Bristol, 4th July, 1870.

SHIPS' LIFEBOATS.

Sir,—I have read with much interest the practical suggestions contained in Mr. Acheson's able letter on the subject of rendering all ships' boats lifeboats.

As an owner of both steam and sailing ships, and having been unfortunate enough to lose three of the former, one with all hands, it has always been a matter of regret to me that a better system with regard to the boats they carry, and the means of launching them on an emergency, could not be adopted.

It has been a subject of general remark that, when ships come into collision, one so frequently strikes the other in the weakest part, and carries away her lifeboat. This was the case with the *Normandy*, the *St. Bede*, and the *Lady Elgin*. The loss of the last-mentioned only occurred a short time ago, and resulted in the loss of eight lives; and the graphic description of the scene of confusion which ensued, as told in the words of a survivor, eloquently supplements Mr. Acheson's remarks.

The record of all these frightful casualties show how callous and unprepared the masters and crew always seem to be for what may happen to them at any moment. We find in practice that the boats are never attended to as they ought to be, and with the knocking about which they get in and out of the water, and the manner the wood warps and shrinks in hot weather when they are hung on the davits, they soon get leaky, and it would be a very difficult matter to keep the compartments of one, built as Mr. Acheson proposes, water-tight.

I should suggest that the spaces at each end, and under the thwarts, should be filled with air-tight tin cases, which might be so divided that injury to one would not affect the whole, and which would be both durable and cheap.

I would also suggest that the ends of all boats be higher than the midships, or, as sailors would say, with plenty of sheer.—I am, &c., F. D. L.

WHAT A MILLION IS.

Sir,—Some time ago, in the *Journal of the Society of Arts*, I saw a statement of the number of the Society's prize colour-boxes which had been sold, that recalled to me that there are not unfrequent errors made as to the figure of a million. Astronomy familiarises us with numbers of vast magnitude. We read that the sun is distant from this earth between 94 and 95 millions of miles, but that, nevertheless, light travels to us from our central luminary in eight minutes. But, within our terrestrial limits, a million is a mighty number. It is true wo hear occasionally of millionaires, but still we scarcely realise the number of coins that it would take to represent such wealth. To illustrate the magnitude of this number, we may well put it in contrast with the duration of human life. A man who lives a hundred years does not live a million hours! To attain a life of a million hours, it must extend to one hundred and eleven years, forty-one days, and sixteen hours. While, on tho other hand, ono that extends to a hundred years exactly, and no more, only gives a period of eight hundred and seventy-six thousand hours, or one hundred and twenty-four thousand short of one million hours. Thus a million is a homily in itself!

I am, &c., Epsilon.

NEW BOOKS.

Field Flowers. By Shirley Hibberd, F.R.H.S. Price 3s. 6d. (Groombridge and Sons.)

The Lakes in Sunshine, being photographic and other pictures of the lake district of Cumberland, with descriptive letterpress by James Payn. Vol. II. Price 21s. (Simpkin, Marshall, and Co.)

A Manual of Modern Geography—Mathematical, Physical, and Political; embracing a complete development of the River Systems of the Globe. By Rev. Alex. Mackay, LL.D., F.R.G.S. Part I. Price 4s. (Blackwood and Sons.)

In the Press.

Fine Art. A Course of Lectures delivered at the University of Cambridge, by Sir M. Digby Wyatt, M.A., Slade Professor of Fine Art. (Macmillan and Co.)

Elementary Lessons in Physics. By Balfour Stewart, F.R.S. (Macmillan and Co.)

An Introductory Text-book of Zoology. By H. Alleyne Nicholson, M.D., D.Sc., F.R.S.E., F.G.S. (Blackwood and Sons.)

A Glance at some of the Principles of Comparative Philology. By the Hon. Lord Neaves. (Blackwood and Sons.)

MEETINGS.

Friendly Society Association.—The quarterly meeting of the Friendly Society Association was held at the Society of Arts, July 5th; the Earl of Romney in the chair. There were present, Lord Wynford, the Hon. Edward Stanhope, the Hon. and Rev. S. Best, J. Bonham Carter, Esq., M.P., W. W. Beach, Esq., M.P., W. Wells, Esq., M.P., W. S. Portal, Esq., W. H. Michael, Esq., and Mr. Birch. The Right Hon. W. Cowper-Temple, M.P., was elected as vice-president, and W. Balston, Esq., Springfield, Maidstone, treasurer. After some discussion, it was resolved not to move in the question of establishing standard tables, but to wait the result of the application to the government for a royal commission on friendly societies. It was further resolved that a general meeting of the Association should be held October 26th, at Maidstone, for the discussion of questions affecting friendly societies, and a committee was appointed to make the necessary arrangements. Thanks were voted to the Society of Arts for the use of their room, and to the Earl of Romney for his services in the chair.

The East India Association, by permission of the Council, held a meeting at the rooms of the Society of Arts, on Thursday, June 30th, to discuss the paper read by W. S. Fitzwilliam, Esq., on "The Present and Future Product of Cotton in India, compared with that of America and other Cotton-producing Countries." Sir Bartle Frere, G.C.S.I., K.C.B., presided.

EXHIBITIONS.

The Workman's Industrial Exhibition, 1870.—The workmen of foreign countries have been actively preparing to answer the invitation to send examples of the various industries in which they excel. In Italy particularly, the working classes aro taking the greatest pains to figure well in this exhibition. Choice specimens of the better known Italian industries will also be shown, such as Genoa laces, and gold and silver filigree works, Pompeian and Etruscan, Castillani's famous jewellery, Milan artistic furniture, Brescio's celebrated arms, Venetian beads and glass, as well as inimitable bronze and bell-metal works, Roman and Florentine mosaics, cameos, Carrara marbles and Volterra alabasters, and Naples corals. Central and local committees have been formed all over Italy, and in London, under the presidency of the late Italian Minister, the Marquis d'Azeglio, and Baron Robert Heath, the Italian Consul-General. The Italian Government has appointed

two Royal Commissioners, the Chevalier Giuseppe Guerzoni, a member of the Italian Parliament, and the Count Papadolpi, to co-operate with them in the selection, collection, transmission, and proper exhibition of the products of the national industry, and has granted also a free conveyance of the goods to London on board the royal steamer *Plebiscito.*

GENERAL NOTES.

Pompeii.—Some marvellous views of Pompeii, produced by Signor Giacomo Luzzati's system of photosculpture, are being exhibited in the Crystal Palace. In addition to the exactness which ordinary photography gives, the objects stand out in such bold relief that the spectator finds it difficult not to imagine that he is verily in the midst of the famous scenes which history, poetry, and painting have made familiar to us. In one of the side passages, near the tropical department, the visitor looks through fifty powerful magnifying glasses at these views, though no optical delusion is practised. Signor Luzzati's aim has been to show Pompeii as it was, in addition to Pompeii as it is. The relics of a city which, after 18 centuries of oblivion, have been gradually brought to light, are highly interesting to all classes of observers, and this exhibition demonstrates to the ocular senses the wonderful character of the excavations commenced in 1748. Photosculpture makes each view practically a model, and all the models are in a geometrically proportionate scale. In addition, there are four models pure and simple, which will greatly assist those who wish to obtain full information and ideas as to the buried city. The twenty-four scenes of the actual ruins are full of interest. Following these are a number of beautifully-coloured restoration scenes, taken from the plans of the localities, and interpreted according to existing architectural remains; and another set of scenes is illustrative of phases of Pompeian life, the eruption of Mount Vesuvius, and there is a fine panorama of the city. These scenes are in their natural size, and the costumes and dresses are taken from the paintings in the Royal Museum of Naples. Signor Luzzati received a gold medal from the King of Italy, and a grant of ground by the municipality of Naples, for his achievements, which tasked his study and energies for more than twelve years. He has been marvellously successful in his work, and the view of the eruption of Mount Vesuvius, as seen from the window of his house, near Virgil's Tomb, is a most wonderful specimen, and the beholder, on a closer view of the same eruption, seems to be standing on the edge of the ravine through which the torrent of molten lava is rolling.

Dualine.—*Nature* describes a new explosive, which has been invented by Mr. Noble, the inventor of the nitro-glycerine and dynamite, and which he calls dualine. It consists principally of nitrate of ammonia and very fine sawdust which has been acted on by nitro-sulphuric acid. It is said not to be decomposed by accidental contact with acid, and will not congeal or lose any of its properties during cold or hot weather. Its explosion does not produce any noxious gases, and it will burn in the open air without exploding.

Western Australia.—At the next session of the Legislative Council of Western Australia, the governor proposes to bring the question of an alteration of existing land regulations forward, it being his opinion that every possible inducement should be offered to *bonâ-fide* settlers willing to occupy and improve the lands which are lying waste in this colony. "It must, however, be remembered," he says in announcing the fact, "that, before the land can make a return, even if given for nothing, the immigrant must support himself and family, or be supported, and the colony of Western Australia is not at present rich enough to give that pecuniary assistance."

Royal School of Mines.—At a meeting of the Council of the Royal School of Mines, held on Saturday, June 2nd, the following awards were made:—Two Royal Scholarships of £15 each, for first year's students, to W. H. Greenwood and F. C. Milford; H.R.H. the Duke of Cornwall's Scholarship to P. C. Gillchrist; the Royal Scholarship of £25 to R. R. Atkinson; the De la Beche Medal and prize of books to W. Gowland; and the Directors' Medal and prize of books to P. C. Gillchrist. The Edward Forbes Medal and prize of books were not competed for this year.

Thames Embankment.—Mr. B. Hope asked, in the House of Commons on Monday, the First Lord of the Treasury what steps Her Majesty's government were taking to erect the new Natural History Museum on the Thames Embankment, as unanimously recommended by a select committee last session, on the suggestion of Mr. Layard, then First Commissioner of Works, and with the heads of the Natural History Department of the British Museum. The Chancellor of the Exchequer said the report could not be carried out without taking back from the tenants of the Crown the ground secured to them by the Embankment Act, and the Treasury was not prepared to recommend its purchase.

Tin-lined Lead Pipes.—Mr. Haines, of Liverpool, has obtained a patent for his tin-lined lead pipes, which is thus described:—Mr. Haines's patent may be simply described as a lead-encased block tin pipe, which it is found resists all corrosive influences. The process of manufacture, with one single and most important exception, is the same as that adopted in the production of the ordinary lead piping. The exception is in the casting of the ingot. The molten lead is first poured into a mould, in which, by the insertion of an iron bar, a space is left for the tin. When the lead has cooled the bar is removed, and a mandril of the exact width which the pipe is to take is inserted. Around this, again, the molten tin is poured, and when the mass has cooled it goes through the usual process until it emerges in the form of a pipe. The engineer to the Glasgow Corporation works has tested the piping, with reference to its cohesive strength, double that of the ordinary lead pipe. The results of the experiments at the Liverpool waterworks, on the 5th of May last, were even more encouraging. Three thicknesses of the ordinary lead piping tested had an average cohesive strength of 2,840 lbs., while the lead-encased tin pipe showed an average cohesive strength of 6,481 lbs.

A New Application of Steam.—The *Scotsman*, in referring to an experiment made on Friday last at the Easter-road Barracks, by the Edinburgh Militia Artillery, says "it is noteworthy as probably the first time that heavy guns of position have been handled with ease and rapidity, without horses, bullocks, or elephants. By means of Thomson's road-steamer, two guns of 50 cwt. were moved at six miles an hour, and wheeled while moving at that rate in a space eight yards in breadth. They were placed in a position with a precision and rapidity that could scarcely be attained by any other means with guns of equal weight. This, it may be remarked, is the first time that Thomson's road-steamers have been actually applied to heavy artillery. It is extremely probable that they will be largely used in future military operations. We understand that a number of these engines is being made for the British and Indian Governments, and that they will in future probably be in constant use by all civilised armies. Friday's work will, therefore, be quoted in future as the commencement of a new and important application of steam to warlike purposes. We understand that Mr. Thomson has offered the loan of engines to transport the guns in charge of our Militia Artillery to Dalkeith. The value of the appliance can be judged when we state that these heavy guns could be brought into action at Dalkeith, which is six miles from Edinburgh, within an hour and a half after the order was received to march from Edinburgh."

Free Coinage.—This question is likely to be tried shortly in the Court of Queen's Bench. Colonel Tomlin, M.P., has brought an action against the Chancellor of the Exchequer, in his capacity of Master of the Mint, for refusing to coin his standard gold and silver. The question is an interesting one to the public at large, since, if the hon. member for Grimsby succeeds in his action, the right of free coinage will be settled, and thus every person will be entitled to have his gold or silver bullion coined free of impost, precisely as in the earlier times of English coinage. It is to be hoped the government will contest the point in an open and candid spirit, rather than upon technical grounds, and thus enable the judges to decide the existing state of the law in a manner intelligible to Parliament and the country.

Science for the People. — The "Memorandum on Science for the People," lately addressed to the Chairman of the Council of the Society, by Mr. Thomas Twining, one of the Vice-Presidents, and printed chiefly for distribution, has been received in a flattering manner by distinguished educationalists and men of science, and has fonnd favour in several parts of the Continent. The following is translated from an article in the June number of the *Revue Britannique*:—"Mr. Thomas Twining, Vice-President of the Society of Arts, has just published, under the title of 'Science for the People,' a small volume, interesting to all those who are occupied in the physical and social amelioration of the people. He throws quite a new light upon the necessity and the possibility of propagating, among the working classes, scientific and practical knowledge. Mr. Twining has classed, with a minute care, all the ideas relating to popular education in such a manner, as to make of these numerous articles a true course of social economy, which associates, very happily, the questions of art, morality, and industry."

The Size of Atoms.—Sir William Thomson contributes a paper "On the Size of Atoms" to *Nature*, and thus sums up:—"The four lines of argument which I have now indicated lead all to substantially the same estimate of the dimensions of molecular structure. Jointly they establish, with what we cannot but regard as a very high degree of probability, the conclusion that, in any ordinary liquid, transparent solid, or seemingly opaque solid, the mean distance between the centres of contiguous molecules is less than the hundred-millionth, and greater than the two thousand-millionth of a centimetre. To form some conception of the degree of coarse-grainedness indicated by this conclusion, imagine a raindrop or a globe of glass as big as a pea to be magnified up to the size of the earth, each constituent molecule to be magnified in the same proportion. The magnified structure would be coarser-grained than a heap of small shot, but probably less coarse-grained than a heap of cricket-balls." The importance of this conclusion can hardly be over-estimated.

Postal Cards for North Germany.—On the 1st July, "correspondence-cards" were admitted through the post, one side of which contains a blank printed form for the insertion of the address, the whole of the surface of the other side being available for the written communication. Address and communication can be written with ink, or black or red pencil, but the writing must be durable and legible. The back may also be filled with letter-press or lithographic matter, in which case insertions in writing are allowable. The sender need not sign his name. The cards are obtainable from all post-offices, or from town and country letter-carriers, ready provided with an adhesive stamp, of the value of three kreutzers or more, according as they shall be required for delivery in town or country, or in neighbouring States. The cards are sold for the price of the stamp affixed, and delivered without further expense. They may be had unstamped, if required, in quantities of not less than a hundred, at cost price. They cannot be used for post-office orders. Stamped cards, when soiled, or otherwise rendered useless, can be changed for new ones without expense.

The Petroleum Trade.—On the 4th of June, seven ships laden with crude and refined petroleum cleared at Philadelphia for Europe, carrying 1,168,000 gallons. The total shipments for Philadelphia are 5,000,000 gallons this year in excess of the exports of the same date last year. But this does not tell all the facts. The oil ships already chartered in New York and Philadelphia will take out of the country, between this date and the middle of July, the enormous quantity of 10,000,000 gallons of refined oil. This shipment will constitute, by two or three millions of gallons, the largest export of petroleum within the first seven months of any year since terrene oil became an article of commerce. One thousand barrels per day were added to the production of crude oil during May, and some parties maintain that the yield has increased 1,500 barrels per day; yet the vast shipments abroad seem to balance the large increase of production.—*New York Daily Bulletin.*

The Sea Illuminated.—A correspondent of the *Cologne Gazette*, writing from the Gulf of Siam, gives the following account of a remarkable illumination of the sea, of which he was a witness:—"The air was quite still, as the wind had two hours before veered round from the south to the north-east, in consequence of a storm which passed by on the horizon. It still lightened very vividly on the western horizon, the heaven was covered with light clouds, through which the moon shone with some brilliancy. We made the sail fast, as the engine was to be set in motion immediately. I then noticed large bright flashes in the water, which I at first took to be the reflection of the moon. These appeared to be about a fathom in diameter, of uncertain shape, like an object seen in a great depth of water. The surface of the sea was gently heaving up and down, while the white patches swam not far from the ship, without perceptibly brightening that part of the marine mirror which lay in the light of the moon. We then steamed forward at the rate of six or seven knots an hour, and a wonderful spectacle now presented itself. Athwart the vessel long white waves of light were seen rushing towards it, ever brighter and in swifter motion, till they seemed to flow together, and at length nothing could be seen on the water but a whirling white light. Looking steadfastly at it, the water, the air, and the horizon seemed blended in one; thick streamers of mist seemed to float by both sides of the ship with frantic speed. The appearances of colour resemble those which arise when one turns a black and white striped ball so quickly that the white stripes seem to run together. The spectacle lasted about five minutes, and was repeated once again for two minutes. No doubt it was caused by shoals of minute animalculæ in the water, and these waves originated in the white flakes first described. The usual luminous appearance of the sea which shows itself when the water ripples in the wake of a ship, or the waves break against the rudder, is not to be compared with this. The light is then brilliant, bright green or blue like phosphorus, often most beautiful in deep clear water, mixed with reddish-white foam. We saw a very pretty specimen of this sort one night in perfectly smooth water in a little lonely bay. It was pitch-dark and quite still, when there fell a heavy shower of rain, consisting of large drops, not falling very close together. Everp drop that fell into the water lighted up, flaming drops sprang into the air, and a small luminous circle was formed where the raindrop met the sea. The whole bay seemed covered with fiery stars, but a rising current of the air soon destroyed the picture."

MEETINGS FOR THE ENSUING WEEK.

Mon......London Inst., 4.
Wed ...R. Literary Fund, 3.
East India Assoc., 3. (AT THE HOUSE OF THE SOCIETY OF ARTS.)
Aëronautical Society, 8. (AT THE HOUSE OF THE SOCIETY OF ARTS.)

Journal of the Society of Arts.

FRIDAY, JULY 15, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

COUNCIL MEETING.

At the first meeting of the Council after their election, Lord Henry G. Lennox, M.P., was unanimously re-elected Chairman for the ensuing year.

The following Committees were re-appointed:

Musical Education.	Free Libraries.
Memorial Tablets.	Telegraphs.
Food.	Cab Indicators.
Government and Inventors.	Public Works and Buildings.
Railway Improvements.	Education.
Drill.	Library.
Drill Review Arrangements.	India.
Ships' Life-boats.	Postago.

ALBERT MEDAL.

A meeting of the Council was held at Marlborough House, on Friday, July 8th. Present—His Royal Highness the Prince of Wales, K.G., President of the Society, in the chair; Lord Henry G. Lennox (Chairman of Council); Sir Wm. Bodkin, Mr. Cassels, Mr. H. Cole, C.B., Mr. E. Chadwick, C.B., Mr. Hyde Clarke, Captain Donnelly, R.E., Major-General Eardley-Wilmot, Mr. J. A. Franklin, Mr. Douglas Galton, C.B., Mr. W. Hawes, Mr. C. Wren Hoskyns, M.P., Lord de L'Isle and Dudley, Sir John Lubbock, Bart., M.P., Rear-Admiral Ommanney, C.B., The Right Hon. Sir John Pakington, Bart., M.P., Mr. S. Redgrave, Rev. W. Rogers, Mr. B. Samuelson, M.P., Mr. G. A. Spottiswoode, Mr. Seymour Teulon, and Mr. H. Vaughan. The Council were attended by the officers of the Society, Mr. P. Le Neve Foster, Mr. S. T. Davenport, Mr. C. Critchett, and Mr. W. G. Larkins.

Lord Henry Lennox introduced M. de Lesseps, who received from his Royal Highness the Albert Gold Medal, for "services rendered to Arts, Manufactures, and Commerce, by the realisation of the Suez Canal."

The Prince addressed M. de Lesseps in a French speech, of which the following is a translation:—

"It is with sincere gratification that, as President of the Society for the Encouragement of Arts, Manufactures, and Commerce, I have the honour of presenting to you to-day the gold medal which was founded after the death of my beloved father, and which bears his name. This medal is presented every year to the person who has distinguished himself most remarkably in advancing the interests of the objects for which the Society was founded; and I am fully convinced that no recipient has ever been more worthy than yourself of this honourable distinction. In presenting it, I need scarcely say that the award was unanimous; and I may perhaps be permitted to add that I stipulated for the pleasure of placing the medal myself in your hands. England will never forget that to you was due the success of that great enterprise which is so much calculated to develop the commercial interests subsisting between herself and her Eastern empire; and I trust that, since your sojourn amongst us, the English people have evinced to you their appreciation of the benefits which your great work has conferred upon this country. Allow me once more to congratulate you upon your grand achievement, and to express my sincere hope, as it is my belief, that it will fully realise the brilliant anticipations which you have from the first entertained respecting it. In conclusion, I must assure you of the pleasure I feel in presenting this medal to you, not only as President of this Society, but as a personal friend, who has moreover enjoyed the inestimable advantage of an inspection of the canal under your guidance."

M. de Lesseps replied as follows:—

"Monseigneur,—I am happy in receiving from the hands of your Royal Highness the medal which has been awarded to me by the Society of Arts and Manufactures. This medal, recalling the respected memory of your august father, has a double value in my eyes; for his Royal Highness Prince Albert, from the commencement of the enterprise of the Suez Canal, received me with that kindly feeling which was to him habitual, and which led him always to encourage everything which might be useful to social progress, to the discoveries of science, and to the development of commerce. He received me for the first time in 1858, in his private study, where he invited me to explain to him all the details relating to the construction of the canal, and he followed with close attention, upon the map and on the working plan, the course of the projected scheme as worked out by the engineers. Since that time he continued on several occasions to testify the interest which he felt in the enterprise, for which the period of commencing the works had arrived. I thank your Royal Highness and the Society of Arts for having added this important manifestation to all the evidences which I have had the good fortune to receive from the government of the Queen and from the people of Great Britain. The words of your Royal Highness will remain engraven on my heart. I have already had the good fortune of finding myself with you, Monseigneur, when travelling in the desert, and there, where a man, however highly he may be placed, shows himself as he is, I have been enabled to appreciate the noble character, the lofty mind, and the elevated sentiments of your Royal Highness, and I am happy to bear this testimony in the presence of the distinguished men who surround us. I shall ever be, as they are, the devoted partisan of your Royal Highness. I pray you to present to her Majesty the homage of my respect and of my gratitude, and to assure her that the company which I have the honour to direct will be ablo to maintain the Suez Canal in a condition which will satisfy all the requirements of the great commerce and of the navigation of Great Britain."

BOYS' MILITARY DRILL.

Field-Marshal Sir John F. Burgoyne has sent to the Council the following remarks on the Drill Review, which took place at the Crystal Palace, on the 21st June:—

It was impossible to witness 2,000 or 3,000 schoolboys collected at the Crystal Palace, in military array, on the 21st June, without reflecting on what might be the result of the introduction of this novel course of proceeding and occupation on the young mind and frame.

It is probable that it will be likely to have more effect, in many ways, than may have occurred to those who have originally promoted the system, and the more it is considered, the more valuable does it appear likely to provo in every particular.

The proposition is, to adopt very generally in schools and on system, a practice of the preliminary military exercises—what is technically called drill—exclusive of their application to the soldier's weapons for attack and defence. Physically and morally, this cannot but tend to the advantage of the individual and of the community. The bodily results of such exercises tend to open the chest, to produce an upright bearing and demeanour, a play to the muscles; and they put the human frame into a condition of giving the most free and advantageous action to all its joints.

It is asserted that this is so much the case, that, on actual trial, it has been proved that young men who had been drilled were capable of doing perceptibly more work than others who had not been subjected to the same exercise; while, morally, the practice inculcates imperceptibly a spirit of order, obedience, implicit attention to instructions, and a deference to superior authorities.

As an aid to the military institutions of the country, it will no doubt tend to infuse an amount of military propensities among the population, and a community of sentiment and occupation between the civil and military ingredients, which may be useful and advantageous. The matter, however, is so new, and on trial, that the principles on which it may be conducted to most advantage are well worthy of consideration. Among them it would seem to be very desirable to introduce and conduct it quite as a matter of recreation, in which the boys would take an interest and a pride as an athletic sport, rather than as an irksome task; if treated otherwise, there may be great doubts of success.

Another important principle would be to avoid all refinements leading to unnecessary expense. This, for instance, may be particularly acted upon in the item of dress. A uniform is decidedly of great advantage for such action, and, without much perceptible cause, really promotes the perfection of the exercise; but it is in the uniformity of the habit, and not in any refinements that its value consists.

The dress then selected may be, in jacket or frock, trousers, and cap, of patterns in materials and form entirely suited to the life and habitual occupations of the class of boys, but of a uniform colour and make; comfort and convenience being decidedly the first consideration, and appearance and ornament (which need never extend to any but the most trifling expense) quite secondary.

By this system, a uniform of respectable appearance will be adopted, while every item of it will be applicable to the ordinary purposes of life. Even the distinguishing marks of rank may be separate, and attached to the dress for the special occasions.

Bands of military music is a subject of interesting consideration. They are certainly worthy of encouragement; they add a life and spirit to all the proceedings, which, besides being really of use in promoting correct marching, will greatly tend to the popularity of the system, besides being the means of teaching a certain number an art on which they may subsequently thrive. The only objection to the establishment of a band is the expense, but, where that is really an object, it may in many ways be restricted to a very moderate amount.

London, 4th July, 1870.

THE ELEMENTARY EDUCATION BILL.—THE RATING COMMITTEE.

At the last meeting of the Council, the following report of the Education Committee was adopted, and ordered to be printed:—

The Council of the Society of Arts having, for the sake of secondary and art and science education, directed particular inquiries as to the means of obtaining time for it, by improving the quality and shortening the time occupied in primary education, as also in reducing its expense, have ascertained, as a clear principle, that the power of teaching and training is in time, in efficiency, and in economy, very much as the number that can be brought together for a division of skilled educational labour and simultaneous class teaching. From the reported discussions in Parliament, it appears to be of great importance that some of the ascertained results, demonstrative of this principle, should, with the least delay, be brought under the consideration of her Majesty's government and the members of the legislature. The common belief as to the necessary cost of primary elementary education may be taken as represented in the following statement, reported to have been made by Sir Massey Lopes, Bart., the member for South Devon:—"The Vice-President of the Council had said that the rate would not exceed 3d. in the £, but he would ask the right hon. gentleman to consider what would be the effect of this Bill on a parish with 300 inhabitants, 50 children who would go to school, and a rateable value of £2,000. The cost of the school, the schoolmaster's house, and the site would be £500, which he supposed might be borrowed for thirty years at six per cent. The expenses would be these:—The annual payment of principal and interest, £30; fifty children at 30s. each, £75; repairs, furniture, books, apparatus, &c., £10; total, £115. The receipts would be—from government 50 per cent. of the expenses of the children, £37 10s.; from fifty children, 2d. each for forty weeks, £17; rate, at 3d. in the £, on £2,000, £25; total, £79 10s.; which would leave a deficiency of £35 10s. Another rate, of 4½d. in the £, must be levied in order to make up the deficiency. Take a larger parish, with a rateable value of £4,000, a population of 600, and 100 children—the cost of a building could not be less than £750, the expenses would be as follows:—Annual payment on building account, £45; 100 children at 30s. each, £150; repairs, furniture, and apparatus, £20; making a total of £215. The receipts would be—the government grant, equal to half the cost of education, £75; the children's pence, £34; and a threepenny rate on £4,000, £50; making a total of £159. This left a deficiency of £56, or more than the amount of another threepenny rate. Thus in one case a rate of 7½d. was required, and in the other a rate of 6d. He trusted the right hon. gentleman would notice these figures, which were substantiated by his own experience, and he was connected with several schools, and had himself built two or three."

The answer to this statement is, that in such small school organization efficient teaching will require even higher rates, whilst on the principle of educational administration examined and demonstrated lower rates will be needed, and in some conditions rates may be altogether avoided.

In both of the given parishes the number of children for which accommodation would be required for efficient education is understated. Taking the limits of age at 4 and 14 inclusive, out of a population of 300, there would be 75. Space would therefore be required for 75 instead of 50 children. Even if we take the 11th year as the extreme limit, the number would still be 56·5; but, as in such small agricultural parishes, the half-time principle applicable to those districts would generally prevail, the number under treatment would be carried up to the 14th year, and accommodation for not less than 70 would be required. Efficient trained teaching could not be got for much less than £2, or, strictly, about £1 17s., instead of 30s., that is to say, for a quality of education that really pays by all the children being trained up to the government standard, instead of, as now, only from 45 to 50 per cent. of the scholars. It is admitted that by no possibility could all the children be brought up to the government standard in the single-chambered school, where the master has to teach the several classes separately; in less than six-and-a-half years, which, according to Sir Massey Lopes's own estimate, would make the total cost of teaching each child the three R's £9 15s. The

actual annual cost, however, in such small schools is £1 17s. per head, or for the whole course of six-and-a-half years, £12 0s. 6d. This would bring the total yearly cost in the smaller schools to £129 10s., or, including the aid of a sewing mistress, which Sir Massey Lopes has altogether omitted, to at least £145. With respect to the second school of 100 children, there would really be 150, or, taking the ages at 5 and 12 inclusive, 108; — but on all sound grounds of educational requirements, the larger number must be adopted as the true one. In this school the yearly cost is stated at £215; — but with the increase of numbers, a considerable reduction in the cost per head would follow, and for 150 the cost would not exceed £225, notwithstanding an improved quality of teaching-power obtainable on the larger scale. But it should be known that if the numbers of these two supposed schools were united by educational administration, the expense of teaching power would be reduced to £1 4s. per head, and the time of imparting the three R's would be diminished by two years, bringing the cost down to £5 8s. per head, or, allowing for a sewing mistress, to £5 10s. If we advance still further, and enlarge our aggregation to 300, we should be enabled, as is proved by experience in "graded schools"* in America, by the effective teaching efficient district schools in England, with an assistant master and pupil teachers, further to reduce the cost to about £1 2s. per head. If, again, we were to raise the number to 400, the cost would be reduced to £1 per head, while the time required for getting through the three R's effectively would be only four years. Thus, the total cost per head (in contrast with the £9 15s. in Sir Massey Lopes' small village schools) would stand at £4, or less than one-half his charge.

In this case, of the aggregate of 300—assuming Sir Massey Lopes' unit of population—the sum obtained by rates would be £100, the government grant would be £225, and the school pence £100, or as nearly as possible £100 in excess of the requirements—so that by combination, we may either relieve the landlord of the rates or the parents the necessity of paying the pence. These would be the results on the principle of consolidation, which only a competent local examination and report would serve to display to the people.

According to the experience of the highest scales of school teaching, say to 600, the common number of the district half-time schools, the time will be reduced to little more than three years, and 800 will accomplish the work in less than three years well. In some of the best district schools it is done in this time at from 16s. to £1 per head per annum.

In a subsequent debate Colonel Barttelot re-enforced the position taken by Sir M. Lopes, by the following statement:—" With regard to rate-founded schools, objection had been taken to some statements that were made by the hon. member for South Devon, and since then he had ascertained what the management of schools cost in a district with which he was acquainted. He took a parish of 6,610 acres, with a rateable value of £9,000, a population of 1,900, and 260 children attending school. In that parish there were three schools, the cost of which was £2,028; the managers now received from the government grant, £113; from the school pence, £54; and from other sources, £95 19s. 4d. The expenses were: — A schoolmaster, £84; two schoolmistresses, £38 and £35; sewing-mistress, pupil-teachers, monitors, books, &c., £105 18s. 8d; total, £262 19s. 4d. If they had to pay 6 per cent. on the outlay for school premises, that would be £121 10s., and that parish would have to pay a rate of 5¾d. in the £. He asked whether it was right to increase by such an amount the present burdens of the ratepayers in that parish, who now paid two 20d. poor-rates, a 10d. highway-rate, and a 2d. voluntary church-rate; they also paid a sewers-rate in a certain portion of the parish, and on one farm which produced a rental of £200 per annum he paid £16 land-tax. (Hear, hear.) The present burdens of local taxation were enormous, and if this Bill added to them it would create a feeling against the educational movement, and do more mischief than could be easily imagined."

The answer to this statement is still, that for efficient education in the three schools the charges and rates will, with efficient teaching, be yet higher, whilst with proper organisation for a division of educational labour, they will be yet lower. On the small separate school plan, in the case last stated, the cost will be about £8 4s. 9d. per head, whilst, by combination, it will be reduced to about £4 16s. 8d. per head An improved school organisation, with trained masters, competent to give the children physical training, by the military drill and gymnastic exercises, such as were displayed at the school drill review at the Crystal Palace, the efficiency of five, it is proved, may be given to three for all purposes of ordinary labour; and it is an axiom, *tant vaut l'homme tant vaut la terre.* Instead of increasing rates, an efficient system of half-time education and training made general will lower poor rates, and also police rates, and the charges of penal administration, and will augment rents, as shown by the difference of rents accompanying differences in the intelligent efficiency of labour, in the northern and southern counties.

The principle in question may be further illustrated in this way:— Take six schools, of 50 scholars each, with a maximum of £75 for a trained master, total £450, with £10 each expenses, and £20 for interest on building account; final total of £530. The average cost per head of teaching power is £1 15s. 4d., without any allowance for monitorial assistance, or the total expense of six-and-a-half years of tuition of these 300 children, £3,445. In the single school we give still six teachers, viz., one at £150, a second at £80, and four pupil teachers at £15 each; total, £290. Add to this £45 for expenses, and £30 for interest on building account, and the result, £365, represents the total annual expense. This is £1 4s. 4d. per head. For the six-and-

* The Rev. Mr. Barham Zincke, Chaplain in Ordinary to the Queen, gives the following account of the teaching by a division of educational labour, known as the system of graded schools, in Massachusetts, U S.:—One main object of his visit to the United States was to enable him to form an independent judgment on their common school system. He had examined schools from Boston and New York to the Rocky Mountains, and from the Great Lakes to the Gulf of Mexico. In the large northern and western cities he found the system of graded schools established. He would describe the Poplar-street School at Boston. It contained 300 children. These were divided into six grades. Each grade had a distinct school-room, and separate mistress. Each mistress taught but one grade or step. The fifty children who came into the school at Christmas formed the lowest grade. By Midsummer they had had the first step thoroughly worked into them. They were then passed on to the next room, and the next teacher who taught the second grade; and thus, in three years, they emerged from the top of the school, having passed through the six grades, and the hands of the six teachers Each teacher had taught but one point; but as she had six months for teaching it, and as the whole of the school time from the first minute to the last had been devoted to it, there had been time for working it into the mind of the pupil. In this way, reading, writing, and elementary arithmetic are so taught in America as not to be afterwards forgotten. They become a part of the mind of the children. In this country it too often happens that what is learnt at school is forgotten; it is not so in America. The system is the division of labour in school teaching carried to the extremest point. Each teacher has to teach but one point. There is great economy as well as efficiency in this, because it is easy to procure teachers who can teach, or acquire the capacity for teaching, this one step. In these schools there is no drowsiness, or whispering, or poring over books, or pretending to be poring over them. The master or mistress stands up in front of the class, and teaches Every eye and ear is on the alert From the day a child comes to school till the day it leaves school there has never been an unoccupied five minutes. This makes habits of attention natural. It is not, as with us, where while the master is teaching one class, the other may be doing much as they please. As to economy in time, reading, writing, and arithmetic are taught in three years, and the child is then passed on to the grammar school, if such is the wish of the parents. And as to economy of money, these three years do not cost £3. So that for £3, or less, the primary education of a child is completed. In the great State of Illinois, 600,000 children are taught in 10,000 schools by 20,000 teachers, at a not greater cost than the two schools of Eton and Harrow cost the parents of the children educated in them.

a-half years, the total amount would be £2,372 10s., as against £3,445 on the segregate plan. But, instead of six-and-a-half years, the combination of numbers will enable us to reduce the time to about four-and-a-half years—a dimination of two years in the time, and of £730 in the total expense. The contrast, therefore, will really be as between £1,642 10s. on the larger scale, and £3,445 on the separate small scale. But a further increase of numbers, and a consequent union of teaching power, will reduce the expense under £1 per head, or even so low as 16s. In fact, if the government would give one or two sbillings more, this would provide an education for the whole population without any further trouble or agony as to rates. The contrast stands thus:—

Six separate schools of 50 children each, with one master to each, receiving a maximum payment of £75	£450	Against this, in the combined school of 300 scholars, there would be allowed for—	
		Head master	£150
		Assistant	80
With £10 each for expenses £60		4 pupil-teachers at £15 each	60
Interest on building ... 20		Total	£290
	80	For expenses £45	
		Interest on building ... 30	75
Total	£530	Grand annual total	£365
Total cost for 6½ years, £3,445.		Total cost for 6½ years, £2,372 10s.	
Annual cost per head, £1 15s. 4d.		Annual cost per head, £1 4s. 4d.	
This does not include any allowance for monitors or sewing mistresses, both of which would be necessary, and which would bring the cost per head up to £1 17s.		To this there would be an addition of 2s. 6d. per head for a sewing mistress. But the combination reduces the time by 2 years, and the total expense by £730.	

These figures do not represent the whole of the gain by combination. "As is the master so is the school," and the gain of teaching power from a superior head-master cannot be estimated in immediate money results.

These facts when examined, as they do not yet appear to have been, go to prove that the question of rating, and those which relate to the new sources of income required, will depend on whether the schools are or are not kept at the existing scales of numbers.

It is to be observed here, that—in either example stated in the House of Commons—the total cost of the single-chambered parish school of imparting the three R's will, as we have shown, be at the best £9 15s. (with proper teaching power, securing the success of every scholar, instead of only 45 or 50 per cent. of the school, it would be £12 0s. 6d.), of which the government will pay £5 in the shape of grants. By combination, extravagant as the statement may appear to many who have not examined the subject, the whole education may be extensively imparted for that £5 per head, without rates and without pence. Competent educationists, practical men, arguing wholly as to what may be done from what has been done and is doing, will support this conclusion in its application to all but very thinly and sparsely populated districts, as in the Welsh mountain districts—unless, however, the children be collected by an omnibus, which is being done in some thinly-populated districts in France. The experience of the Faversham School Union in Kent, comprising about 6,000 of population, and of mixed parochial schools in Scotland, as also the instances of Richmond, Surrey, Brentford, and others, examined at the instance of the Council, show that parishes within a radius of three miles may be brought into school union. In some instances, infant or nursery schools would be placed at the extremities, whilst elder children might go from long distances to primary or secondary schools in the centre. The extent of consolidation needful for efficiency and economy is indicated by this, that the minimum school district, to provide a school with a proper division of educational labour and with the power of economical results, in time as well as in quality (*i.e.*, a school of 300), would require a population of at least 1,200. But from a late return, there were between 700 and 800 parishes (say for simplicity 750) whose population did not exceed 50 persons, 1,900 which did not exceed 100, 6,681 which did not exceed 300, and 5,353 which varied between 300 and 800. It is proper to state that the information received by the Council tends to show that the areas for efficient and economical educational administration commonly differ very widely from the areas for other administrative purposes, and are in practice totally independent of them.

The other day the Council had a review, in which about 2,000 half-timers took part, at the Crystal Palace. The cost of teaching power in these instances, where children who had been in an infant school were got through the three R.'s before the eleventh year, was within the £5 per head.

Further reference may be made to illustrative instances and practical demonstrations of the principle, that have been elicited by inquiries made, under the instructions of the Council, into different modes of instruction, such as that of one trained certificated master,* who shows that in two schools, of about fifty scholars each, he could not impart the usual elementary instruction in much less than seven years, at a total cost £11 per head; whilst in a school of 315, and by a division of educational labour, he better attains the same standards, and with military drill included, in almost half that time, and at less than half the total cost.

The testimony obtained in respect to the great Jews' Free School of Bell-lane, Spitalfields, is in itself a study of what may be done in giving secondary as well as primary education, and that is nearly half the time and cost of common methods. The most important example of the saving of time and expense, and the improvement of the quality of instruction by a division of educational labour, obtained by union, is that of the Faversham School Union, with its school board comprising the clergy of the Church of England, dissenting ministers, and representatives of the laity, where the time is reduced to one half, and the total cost to about £5 per annum, and the children of the wage classes are enabled to leave with a complete primary education before the eleventh year, whilst the children of the advanced artisans, farmers' sons, and shopkeepers' sons, who can be allowed to remain until their thirteenth or fourteenth year, receive the art or science and technical education, for which it is one great object of the Society to labour.

But it is important to bear in mind, in respect to the whole class of small single-chamber and single-mastered schools, being long-time schools, since parents of the wage classes must have their children away by about their 11th year, they are usually taken away half-taught. Being long-time schools, of five or six hours of daily teaching, they obstruct the application of the balf-time principle, which is incompatible with more than three hours of good daily book instruction, and they prevent earning being carried on with learning, to the extent to which it may and should be, for the interest of all. The small school teaching also prevents industrial aptitudes being imparted by the early exercises of the Kinder-garten in the infant-school stages, and by the exercises of the hands, arms, and legs by military drill and gymnastics, to the extent stated. Such small schools are, therefore comparatively detrimental—bodily as well as mentally—to the rising generation, and from whatsoever motives of voluntary effort they are maintained, State aid or rate aid extended to them as against systematised teaching and training, is demonstratively worse than waste. The expense then incurred for educational conditions that are often positively and always relatively inferior and bad, is commonly double that required for conditions positively good and superior, and for which the amount required as State aid would of itself nearly suffice.

* Mr. Thomas Longford, Forest-gate District Half-time School.

The manner in which the results of the out-door investigations, and house to house inquiries, conducted under the Council's instructions were quoted by the Vice-President of the Privy Council, and by members of Parliament, and were received in the House of Commons, and served to obviate the religious difficulty —repays the labour bestowed on the subject. It is satisfactory also to observe that her Majesty's government have adopted provisions for the avoidance of the dangers represented to them, of giving local majorities power to deal with and determine the religious instruction of the children of minorities; as also that the power of departmental initiation has been extended, and the duty of initiation by parish vestries reduced, in compliance with general public opinion.

It is from a sense of duty the Council solicit the special consideration of the information now submitted for the alteration of the remaining provisions of the bill, and for administration of the powers already obtained—showing that the economy of any State aid, or of any rate aid, of voluntary local effort, and the efficiency of educational administration, whether local or general, is dependent on the number of children brought together for divisions of trained educational labour, and organisations commonly only determinable by skilled official and independent local examination.

POSTAGE RATES.

The following memorial has been addressed by the Council to the Postmaster-General:—

To the Most Honourable the Marquess of Hartington, Her Majesty's Postmaster-General.

The Memorial of the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce,

Respectfully Sheweth,

That the definitions of a newspaper, given in the Post-office Bill now before Parliament, do not adequately provide for the wants of the periodical press of the country.

That it contains minute and inconsistent definitions; and, amongst others, states that a newspaper shall "not be stitched."

The Council beg to state that the *Journal of the Society of Arts*, published weekly, is stitched as a measure of improvement, to enable it to be issued cut, and thus be more easy for consultation, and that other journals adopt a like course; but this improvement will cease to be practicable under the new Bill.

The Council represent that a good and simple definition of a newspaper will be obtained by the simple condition that it shall be published at an interval not exceeding seven days.

The Council submit that the correct course, and the one consistent with commercial and public convenience, is to make the rate of six ounces for one halfpenny available for all printed matter, and that it will not meet the public requirements to allow, as proposed by the Bill, a weight of two ounces only for the halfpenny rate.

The Council further represent that it is desirable that the regulations for the transmission of newspapers to the colonies abroad shall restore the practice of a uniform weight postage for printed matter, and thus redress the grievances of which our commercial and colonial interests now complain.

The Council of the Society of Arts make these requests on the recommendation of their Postal Committee, which largely represents the periodical press of England, Ireland, and Scotland, as well as the mercantile communities, and with a deep conviction of the necessity of Her Majesty's Government complying with these requirements.

And your memorialists will ever pray, &c.,

P. Le Neve Foster, *Secretary.*

COMMITTEE TO CONSIDER THE RELATIONS BETWEEN THE GOVERNMENT AND INVENTORS.

The Council have appointed a Committee to report "whether there is good foundation for the statement that reasonable dissatisfaction exists respecting the manner in which inventions are examined and dealt with by the government, and, if such be the case, whether any practical remedy can be suggested." The following gentlemen have consented to serve on the Committee:—

F. J. Bramwell, C.E.; Hyde Clarke; Henry Cole, C.B.; Warren de la Rue, F.R.S; Major Dyer, R.A.; Captain Donnelly, R.E.; John Fowler, late President of the Institution of Civil Engineers; Lord Richard Grosvenor, M.P.; Admiral Halstead; Thomas Hawksley, C.E.; Admiral Sir J. D. Hay, Bart., M.P.; C. W. Merrifield, C.E., F.R.S.; John Penn, C.E., late President of the Institution of Mechanical Engineers; J. Ramsbottom, President of the Institution of Mechanical Engineers; Alderman Sir W. Rose; Admiral Ryder; Captain Scott, R.N.; C. W. Siemens, F.R.S.; Captain Tyler; Thomas Webster, Q.C., F.R.S.; Sir Joseph Whitworth, Bart., C.E., F.R.S., late President of the Institution of Mechanical Engineers.

The following questions have been prepared by the Committee and addressed to those inventors and others who may possess information, and are interested in the subject:—

1. Name and profession of person filling up this form.
2. Address.
3. State the nature of the invention or inventions (if any) which you have submitted to the government. Were they, or any and which of them, protected by patent or otherwise?
4. To what department of government have such invention or inventions been submitted?
5. What was the tribunal which judged the invention or inventions? And, if you see fit, give the names of the persons composing such tribunal.
6. Give the date when the invention or inventions were submitted, and the dates and nature of the answers (if any) you received.
7. Is it your opinion that such tribunal was impartial, and competent to judge correctly of the invention, and, if not, why not?
8. Had you sufficient opportunity of appearing before such tribunal, and of giving the necessary explanations?
9. Was such tribunal one whose sole duty it was to judge of inventions, or was it likewise engaged, either as a body or individually, in inventing or in perfecting inventions?
10. Was any indvidual on that tribunal interested in inventions kindred to those which which you brought before it?
11. Have the inventions of the tribunal, or of any of the individuals composing it, embraced any portion of your own proposals since you first submitted the invention or inventions?
12. Was any trial made of your invention or inventions, or any of them; and was any official report made of the results of the trial, and when was that report communicated to you? If delayed or refused, on what grounds?
13. Were any, and what, objections raised to the trial of the invention or inventions?
14. Were the invention or inventions wholly or partially adopted or rejected; and if adopted, were any and what steps taken to remunerate you?
15. Have any and which of the inventions since been tried, wholly or partially, and, if so, by whom and at

whose expense; and has any remuneration been granted to you or to others for the same?

16. Can you briefly give this Committee any proofs in writing of the correctness of your views, and of the value of your invention or inventions?

17. Please make any observations bearing on the subject not invited by the foregoing questions?

The answers should be returned to the Secretary of the Society of Arts, John-street, Adelphi, London, W.C., as early as convenient, and in no case later than 1st of November, 1870.

By order,

P. Le Neve Foster, *Secretary.*

*** Copies of these questions can be obtained on application at the Society's House.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

APPOINTMENT OF JUDGES IN ART.

The Royal Academy has named the following gentlemen to act as judges for admitting works of art at the International Exhibition of 1871:—Mr. Elmore for painting, Mr. Calder Marshall for sculpture, and Mr. E. M. Barry for architecture. The Society of Painters in Water Colours has named Mr. Alfred W. Hunt; and the Society of British Artists, Mr. Clint. Other nominations have to be made.

CLASS X.—EDUCATIONAL WORKS AND APPLIANCES.

A meeting of the committee for Section B. (Maps, Globes, Instruments, &c.) was held at the Society of Arts on Thursday, the 30th June, at 5 p.m. Present—the Rev. Muirhead Mitchell in the chair; the Rev. Richard Whittington; and Messrs. Thomas Murby, Ellis A. Davidson, William Hughes, and Hyde Clarke.

The Secretary to the General Committee reported to the Section, that circulars relating to the Exhibition had been forwarded to all the exhibitors in the Educational and allied classes at the International Exhibition of 1862, and the Paris Universal Exhibition of 1867.

The Committee gave instructions that communications be addressed to various other persons, whom they specified, likely to be exhibitors.

A meeting of the committee for Section D (Specimens and Illustrations of Modes of Teaching Fine Art, Music, Natural History, and Physical Science), was held on Tuesday, the 5th inst. Present—Lieut.-Col. Strange in the chair; Major-General F. Eardley-Wilmot, the Revs. J. G. Fussell, J. F. Twisden, A. Rigg, Dr. Woolley, Messrs. C. W. Merrifield, John Anderson, Charles Brooke, F. S. Cary, J. F. Iselin, H. A. Bowler, W. Matchwick, W. F. Barrett, Hyde Clarke, Arthur S. Sullivan, G. A. Macfarren, Professors Willis, W. H. Flower, Dr. Armitage, Dr. Wylde, and Sir Michael Costa.

It was resolved that the committee be divided as follows, and that one of the secretaries assigned to each sub-section be empowered to convene a meeting of his sub-section when necessary:—

Sub-Section Fine Art.

Bell, John
Boehm, E. J.
Bowler, H. A.
Cary, F. S.
Gerstenberg, I.
Hart, Solomon, R.A.
Leighton, F., R.A.
Lindsay, Sir Coutts, Bart.
Millais, J. E., R.A.
Redgrave, R., R.A.
The President of the Royal Academy (Sir Francis Grant)
Wyatt, Sir M. Digby
York, Archbishop of

Secretaries.

Bowler, H. A.
Redgrave, R., R.A.

Sub-Section Music.

Armitage, T. R., M.D.
Benedict, Jules
Bennett, Prof. W. Sterndale, Mus. D.
Cole, A. S.
Costa, Sir Michael
Curwen, Rev. John (Tonic Sol-Fa Association)
Goldschmidt, Otto
Hullah, John
Johnson, Edmd. Chas., M.D.
Macfarren, G.A.
Sullivan, Arthur S.
The President of the Royal Academy of Music (Earl of Dudley)
Wylde, Professor, Mus. Doc.

Secretaries.

Cole, A. S.
Hullah, John

Sub-Section Natural History.

Ansted, Professor D. T., F.R.S.
Clarke, Hyde
Flower, Professor W. H. (Royal College of Surgeons)
Foster, Dr. Michael
Harrowby, Earl of
Hogg, Robert. LL.D.
Hoskyns, C. Wren, M.P.
Huxley, Professor, F.R.S. (Royal School of Mines)
Iselin, J. F., M.A. (Inspector of Science and Art Schools, Science and Art Department)
Lubbock, Sir John, Bart., M.P.
Matchwick, W., F.L.S. (South Kensington Museum)
Moore, Thos.
Mundella, A. J., M.P.
Ramsay, Professor A.C., F.R.S.
Thomson, T., M.D., F.R.S.

Secretaries.

Foster, Dr. Michael
Huxley, Prof., F.R.S.
Iselin, J. F., M.A.

Sub-Section Physical Science.

Abel, F. A., F.R.S.
Anderson, John, C.E.
Barrett, W. F., F.C.S.
Brooke, Charles, M.A., F.R.S.
De La Rue, Warren, F.R.S.
Donnelly, Captain, R.E.
Eardley-Wilmot, Major-Gen. F., R.A., F.R.S.
Frankland, Prof., F.R.S. (Royal College of Chemistry)
Fuller, Professor G., C.E.
Goodeve, Professor T. M. (Royal School of Mines)
Guthrie, Professor, Ph.D.
Hawes, William, F.G.S.
Her Majesty's Inspectors of Schools:—
Capel, Rev. H. M.
Fussell, Rev. J. G.
Wilkinson, Rev. F.
Merrifield, C. W., F.R.S. (Royal School of Naval Architecture)
Moseley, Rev. Canon
Pakington, Right Hon. Sir J. S., Bart, M.P.
Percy, Professor John M.D., F.R.S. (Royal School of Mines)
Phillips, J. A.
Playfair, Dr. Lyon, C.B., M.P.
Price, Rev. Bartholomew, M.A., F.R.S.
Reed, E. J., C.B.
Rigg, Rev. Arthur, M.A.
Samuelson, B., M.P.
Smyth, W. W., F.R.S. (Royal School of Mines)
Sopwith, Thomas, F.R.S.
Strange, Lieut.-Col. Alex., F.R.S.
Sidney, F. J., LL.D. (Royal College of Science, Dublin)
Twining, Thos.
Twisden, Rev. J. F., M.A. (Royal Military College, Sandhurst)
Whitworth, Sir Joseph, Bart., LL.D., F.R.S.
Williamson, Professor A. W., F.R.S., (University College)
Willis, Professor, F.R.S.
Woolley, Rev. Dr. (Royal School of Naval Architecture)

Secretaries.

Donnelly, Capt. R.E.
Frankland, Prof., F.R.S.
Guthrie, Professor, Ph.D.
Rigg, Rev. A.
Strange, Lieut.-Col. A., F.R.S.

CLASS VIII.—POTTERY.

A conference of gentlemen connected with the various branches of the manufacture of pottery was held on Tuesday, the 12th inst., at the Royal Horticultural Gardens,

under the presidency of **Dr. Lyon Playfair, C.B., M.P.,** one of her Majesty's Commissioners. The following gentlemen were present:—E. Stiff, J. Finch, John Haddock, Charles Edward Rand, M. Lewis Brown, John Matlock, H. M. Major, R. Norman, Wm. Copeland, R. M. Smyth, Samuel Alcock, C. I. C. Bailey, W. P. Phillips, George Phillips, Fredk. Battam, John Battam, Samuel Pocock, Henry Doulton, J. D. Doulton, V. L. A. Blumberg, E. V. Morgan, O. V. Morgan, G. J. Kerridge, W. M. Blanchard, George Axton, Thomas Maynard, John Johnson, James Pulham, John George Reynolds, Wm. Bishop, Charles Henry Russell, Joseph Smith Breillat.

The following firms were also represented:—Brown, Westhead and Co., Minton and Co., W. B. Simpson and Son, Wm. Powell and Sons, Boucher, Guy and Co., Geo. W. Walker and Co.

The Chairman said the meeting were probably aware of the general nature of the intended Exhibition, but Mr. Cole would make a general statement on the subject, which would probably be interesting.

Mr. Cole, C.B., then proceeded to state, as on former occasions, the main features in which the forthcoming Exhibition would differ from any which had gone before, the objects to be admitted being limited to certain classes of goods, and to such of these classes as should be deemed worthy of admission. Difficulties would no doubt arise in the practical working out of such a scheme, but it was hoped none which could not be got over by the hearty co-operation of those interested. He alluded to the intention, which it was hoped would be borne in mind, that exhibitors should, where it could be done, state on the labels attached to the objects shown, the names of all the parties concerned in its production, and added that, although the Exhibition Commissioners did not propose to offer any prizes, the distinction of admission being in itself considered a sufficient reward, the Society of Arts would offer a gold medal, which would be awarded to that specimen of pottery which on the whole was considered most meritorious; and, in order to avoid any dissatisfaction from the award of a *dilettante* jury, it was proposed that the exhibitors themselves should be asked to vote the medal. All objects intended for exhibition must be presented, unpacked, on the 10th or 11th of February, 1871, when they would be taken charge of by an officer appointed for the purpose, and as soon as possible afterwards they would be inspected by a jury, who would decide whether any should be rejected (which, he hoped, would not be the case), and the remainder would be displayed in glass cases, provided at the expense of the commissioners. All kinds of pottery would be admissible, from the finest work of art up to such objects as drain pipes, garden vases, &c., for which room might be found in the open air. Any new discoveries in the way of compounding earths, or making potteries, might be exhibited, and also any new kinds of machinery. He was aware that in England anything of this kind was looked upon with great jealousy, but it was believed that the same feeling did not exist in all parts of the world, and that some useful hints might be obtained from the practice of other nations in this respect. Some specimens of the ancient potters' wheel would also no doubt be shown. It was hoped that local peculiarities would all be represented, so that a thorough knowledge of the present state of the art might readily be obtained, and he was happy to say that this would be facilitated by the mode of arrangement. He had spent a great deal of time in the last Paris Exhibition, and had made it a point to endeavour to see everything there exhibited in the shape of terra cotta, but was sorry to say he did not succeed, although he was there some months.

Mr. Copeland said that no doubt many manufacturers would, like himself, be inclined to exhibit valuable works of art, and it was therefore of great importance to them to know when the responsibility of the Commissioners would commence. Rule J, stating that the Commissioners would take the greatest possible care of all objects, but would not be responsible for loss or damage of any kind, he apprehended, referred to the period of the Exhibition itself, after the articles had been classified and arranged in cases; but he felt some apprehension as to their safety in the interim between their delivery at the doors and the time when they were so disposed of.

Mr. Cole said that, substantially, the same question arose at every exhibition, whether that of the Royal Academy or otherwise, and he believed that, owing to the care which was taken, accidents were reduced to a minimum. The probability was that any such delicate articles as were now referred to would, immediately on their arrival, be placed in a glass case, from which they would not again be removed, but, if such a necessity arose, he thought it not unlikely that the assistance or superintendence of the proprietor would be invited.

Mr. Copeland feared there would not be sufficient accommodation to allow of all the articles being at once placed in glass cases, especially as there were but two days for the reception of all the articles. He thought, if they had a large influx of fragile and valuable objects, there would be great difficulty in storing them away.

The Chairman said this objection arose not unnaturally from the confusion which prevailed at previous exhibitions; but the arrangements for that of 1871 would be entirely different. There would be no packing-cases in the way, no exhibitors jostling each other in their anxiety to display their goods in the best possible way; there would be abundance of glass cases provided, and the whole matter would be simply a question of classification.

Mr. Copeland said he apprehended there would be no objection to an exhibitor sending a qualified person to assist in the placing of the articles.

Mr. Cole said any assistance of such a kind would be most welcome.

Mr. Bailey (Fulham) asked if there were any rule with regard to the amount of space to be allotted to each exhibitor, because one man might send such an immense quantity of goods, all meritorious in their way, as would occupy half the space at disposal.

Mr. Cole said there was no rule as to space, which would be determined by the judges upon the merits of the articles sent. It might happen that so many things would be sent as to entail on the judges the unpleasant duty of making a selection, but this could not be definitely known until the 12th February, although it was hoped that some approximate idea of the required space could be formed before then.

Mr. Bailey said he did not quite understand whether or not the exhibitors would take any part in the nomination of the jury.

Mr. Cole said the nomination rested with Her Majesty's Commissioners, but he had no doubt that every possible pains would be taken to obtain the services of persons thoroughly competent, and as impartial as it was possible for human nature to be.

Mr. Battam asked if there would be any check to the number of articles sent by each firm?

Mr. Cole said there was not, except the rule that only one specimen of the same article should be sent. He apprehended that if manufacturers adhered to the rules which were laid down, and sent nothing for which they could not assign a reason, there would not be much superfluity. In the case of large, cumbrous articles and machinery, they would not expect persons to send them to the Exhibition without some means being afforded previously, by which their admission would be insured.

Mr. Bailey suggested that each exhibitor, when sending in his application, should state the probable amount

of cubic space he should require, and then if anyone's ideas appeared rather too extensive, an intimation might be conveyed to him to that effect.

Mr. Doulton said that, on former occasions, his firm had exhibited the ordinary potter's wheel, and would be happy to do so again; he would take an opportunity of consulting with his neighbours in the trade, so that an arrangement might be made.

Mr. Cole said that, on a recent visit to the Potteries, he had found an impression abroad that persons might get articles modelled by one man, painted by another, and finished by a third, and then exhibit them in their own name, taking all the credit to themselves, but he believed a ticket could be devised which would meet this difficulty, by requiring the exhibitor to state whether he was the producer or merely the proprietor, the ticket also containing blank lines for the name of the modeller, painter, &c.

The Chairman said he was glad to find that foreign countries, especially France, were taking up this Exhibition with great energy, and therefore he hoped every effort would be made to render it worthy of England, and to show that English pottery had a character and qualities of its own, as had been established at former Continental exhibitions. Pottery had been chosen for the first Exhibition because it was such an advanced art in England, that it was considered it might be shown in a better state of preparedness than any other, and as it was desirable to start well, great importance was attached to the pottery division of the approaching Exhibition. He would also add—which would be of interest to exhibitors, who, of course, desired that their productions should be seen by a large number of visitors—that the Commissioners were taking measures to add to the attractiveness of the Exhibition by making arrangements with celebrated organists and musicians in all parts of the world, so as to add to the inducements already held out by the Industrial, Horticultural, and Fine Art Exhibition.

Mr. Cole desired to add, that it was intended to devote a considerable portion of the proceeds to the purchase of such articles as were considered worthy of acquisition by the nation, for the purpose of being lent to local museums and collections.

Lieut.-Colonel Scott, R.E. (secretary), then explained, by means of a plan, the structural arrangements of the Exhibition, after which he invited the gentlemen present to accompany him on a visit to the works in progress.

THE EDUCATION BILL.

On the 7th inst. the House of Commons resumed the adjourned debate on Sir M. Lopes's amendment on clause 45, which proposes to reduce the local rate to a maximum of one penny in the £ on the rateable value of the area of each district. Mr. Melly supported the spirit of the amendment, but preferred the maximum of 3d.; and Mr. V. Harcourt preferred an elastic limit, and proposed that the rate should never exceed one-sixth of the expenses. Mr. W. E. Forster pointed out that Sir M. Lopes's apprehensions of a sixpenny rate assumed that there would be no voluntary school in a parish, no saving by union of parishes, and that the expense was 30s. a child. That estimate had originally been suggested by Mr. Gladstone as a rough one; but further inquiries showed that 25s. 7d. was about the correct figure; and of this about 36 per cent. would be furnished by the government grant, about 34 per cent. by school fees, and 20 per cent. by voluntary contributions or rates. Therefore a 3d. rate would be amply sufficient, as a general rule. There might be a few exceptional cases of poor districts where it would not suffice, and here he proposed that the difference between the product of a 3d. rate and a capitation grant of 7s. 6d. should be made good by an extra Privy Council grant. Sir Stafford Northcote suggested that the deficiency remaining beyond the government grant and the school fees should be divided between the rates and the Consolidated Fund. Mr. Lowe, Mr. Disraeli, Mr. Gladstone, and others, having addressed the House, the Committee divided on the amendment, which was negatived—273 to 88.

Clause 45 having been agreed to, Mr. V. Harcourt moved an amendment to clause 46, which was negatived by 176 to 21.

Mr. Kennaway moved an amendment to exempt from local taxes any parish which can prove that it possesses within itself sufficient school accommodation, but the government refused to accept it. Sir C. B. Adderley also failed in attempting to exempt, to the extent of their contributions, voluntary subscribers to public elementary schools. From this up to clause 55 the amendments made were chiefly verbal, the only division being on a proposal by Mr. Cross to require school boards to publish their accounts in the local newspapers. It was negatived by 217 to 89; but Mr. W. E. Forster afterwards admitted a provision giving them the power, if they think fit to use it. Two more clauses of the Bill were then agreed to, and progress was reported at clause 57.

The discussion was resumed at the morning sitting, on the 8th inst., and from clause 58 to 65 the Committee proceeded rapidly. A discussion of compulsory education, which is involved in clause 65, was first raised indirectly by Sir T. Bazley, who proposed a scheme, partly developed in amendments to the clause, and partly in an independent schedule to the Bill, which directed the Education Department to require the attendance at school, for 30 weeks in the year, of every child between 6 and 12 years of age, with a dispensing power for children of 11 who may pass a certain examination. Mr. Pease proposed an amendment to this, giving the Education Department a discretionary power. Lord R. Montagu, Mr. Leatham, and others opposed compulsion altogether; but it was supported by Mr. Mundella, who urged that it was the only means of grappling with the vast amount of ignorance, pauperism, and crime, and that the demand came from the people themselves. Mr. W. E. Forster admitted the necessity of some amount of compulsion, but maintained that the Bill went as far as was prudent or possible, and he pointed out that universal compulsion would be impracticable until complete school accommodation had been provided, which could not be for two years. Mr. Hardy said that personally he was in favour of indirect compulsion, but he preferred to give the discretion to the Privy Council rather than to the school boards. On a division, Mr. Pease's amendment, giving a permissive turn to Sir T. Bazley's scheme, was carried by 259 to 92, but, immediately after, the whole scheme itself was rejected without a division.

The Committee then reverted to the consideration of the clause, and Mr. Mundella moved his amendment, which obliges the school board to compel the attendance of all children between five and twelve. The permissive principle, however, was again affirmed by 230 to 92.

The consideration of the same clause was resumed on the 11th inst., when Mr. J. Lowther, supported by Mr. Fawcett, moved an amendment striking permissive compulsion out of the clause altogether. It was resisted by Mr. W. E. Forster, and the Committee, on a division, again affirmed the principle of permissive compulsion by 274 to 119. A conversation ensued about the ages between which children shall be required to attend school. The clause proposes from 5 to 12, but in the end, at Mr. Forster's suggestion, it was amended, so as to give the school boards the discretion to fix the limits between the ages of 5 and 13.

At the instance of Mr. Pell, the penalty of 5s., imposed on the parent for the non-attendance of the child, was made to include costs.

On clause 66, Mr. Pell proposed that existing endowments, applied to the maintenance of a public elementary school, shall be treated as subscriptions, or as funds derived from the rates, but, on a division, it was negatived by 103 to 23. From this point the Committee made rapid progress up to clause 81—the first of the Parliamentary grant clauses—on which an amendment moved by Mr. Candlish, refusing the grants to all future voluntary schools, was negatived by 190 to 70. In this clause also Mr. Forster inserted words making the promised provision for the building grant.

On the next clause, 82, there was a renewal of the controversy of denominational against secular education. Mr. Forster proposed his promised amendments, limiting the amount of the grant to the income derived from other sources and confining it to secular education, and also that both kinds of schools should be treated impartially. Mr. Trevelyan stated his objections to increased denominational grants, and explained the reasons which had induced him to leave the government rather than support this clause as amended. Dr. Playfair argued in favour of denominational schools. Mr. Richard and Mr. Winterbotham reproached the government for its concessions to the Conservatives on the question of denominationalism, and Mr. Trevelyan raised the question of increased denominational grants, but in the division he was beaten by 317 to 86.

Sir S. Northcote renewed his proposal to divide the deficiency which may remain after the school fees and the Privy Council grants between local and imperial taxation, but he received no encouragement, and allowed it to be negatived without a division. Clause 82, as amended, was agreed to.

The remaining clauses of the Bill were agreed to, with the exception of the 84th, which was omitted.

On the consideration of the postponed clause 22, Mr. W. E. Forster proposed an amendment which was agreed to, and a clause was inserted after clause 31 "for the payment of chairmen of school boards."

Mr. W. E. Forster proposed a clause for "school boards for the metropolis," which, after some discussion, was added to the Bill. Certain other clauses of less importance were added, but it was found impossible to conclude on that evening, and progress was reported.

MANAGEMENT OF PUBLIC WORKS, MUSEUMS, &c.

The following is extracted from the *Times*, August 17, 1860:—

In Committee of Supply on the Civil Service Estimates (British Museum), Mr. Ayrton, after complaining that every effort was made to induce visitors to go to South Kensington, whilst nothing was done to induce the public to resort to the British Museum, said a great evil was, that all our museums and collections of different kinds were not under one directing hand. They were all placed under separate trustees and managers, and hence there was no unity in their management, while the different collections were kept separate from each other. He hoped that some measure would speedily be taken to put the Departments of Art and Science on a proper footing.

The Chancellor of the Exchequer (Mr. Gladstone,) after some observations with respect to those of officers in the British Museum, said the hon. member for the Tower Hamlets (Mr. Ayrton), alluded to the purchase of Burlington-house. He regretted, as much as the hon. member could do, that such long periods should elapse before any conclusion could be arrived at as to the disposal of buildings of that kind, the price of which had been paid, and which entailed a large annual charge for interest. He had no hesitation in saying that this, and other circumstances of a like kind, were entirely owing to the lamentable and deplorable state of our whole arrangement with regard to the management of our Public Works. *Vacillation, uncertainty, costliness, extravagance, meanness, and all the conflicting vices* that could be enumerated, were united in our present system. There was a total want of authority to direct and guide. When anything was to be done, they had to go from department to department—from the executive to the House of Commons, from the House of Commons to a committee, from a committee to a commission, and from a commission back to a committee—so that years passed away, the public were disappointed, and the public money was wasted. He believed that such were the evils of the system that nothing short of a revolutionary reform would ever be sufficient to rectify it.

CORRESPONDENCE.

RAILWAY AXLE FRACTURE.

Sir,—The very valuable paper on this subject, by Mr. W. B. Adams, does not appear to be very exhaustive, for no notice is taken of various causes of wear and tear, such having no place in common road locomotion, that render the utmost economy in materials and steam unattainable under our present railway system. Mr. Adams's excellent arrangement for causing the axles to assume the radial position does not provide against the torsion which takes place when either of the wheels run over a different length of rail in passing round curves. The coning of the wheels is an infinitesimal remedy, and entirely fails to effect the original intention of keeping flanges free of the rails, because the cross level, if true when laid, does not continue so after the passing of one or two trains, consequently the flanges may be seen continually grinding against one or the other rail, even when running on a straight portion of the line.

The break power is not alluded to in the paper, which has so great an effect in distorting the axle by being applied to one wheel only of a pair. In Mr. Adams's improved radial wagon the break must of course be double, so as to clip the wheel between two break blocks. The American mode of overcoming the difficulties of curved lines is very effective to a certain extent, that is, to carry the wagon or car at each end upon a four-wheeled bogey carriage, with each pair of wheels close together, when the radial principle is very fairly carried out.

Steam-power, however, can never be applied with true economy and least wear and tear until we shall be able to cause it to act upon the outside wheel alone, for all power applied to the inside wheel, while running on a curve, is expended merely in grinding and distortion. The appliances to effect this purpose would be the means of spontaneously throwing the inside wheel out of gear at such time.

It is not, however, one of the most improbable of events that, ultimately, the iron rails may be given up, to some extent, for steam locomotion on common roads, as being, upon the whole more economical and convenient, when, of course, a new style of light trains and perfect steerage would have to be introduced, as well as our roads much improved.—I am, &c.,

Henry W. Reveley.

Reading.

NEW BOOKS.

The Elements of Practical Perspective. By E. A. Davidson. Price 2s. (Cassell, Petter, and Galpin.)

The Natural History of Commerce. By J. Yeats. LL D. (Cassell, Petter, and Galpin.)

The Romance of Commerce. By H. R Fox-Bourne. Price 7s. 6d. (Cassell, Petter, and Galpin.)

The Metamorphoses of Insects. By Emile Blanchard. Translated by Dr. Duncan, Secretary of the Geol. Soc. and Prof. of Geology, King's College, London. Price 15s. (Cassell, Petter, and Galpin.)

Autobiography of a Lump of Coal, a Grain of Salt, &c., &c. By Annie Carey. (Cassell, Petter, and Galpin.)
Elementary Lessons on Logic. By Prof. Stanley Jeavons. (Macmillan and Co.)
Seaside Walks of a Naturalist. By Rev. W. Houghton, M.A., F.L.S. Price 3s 6d. (Groombridge and Sons.)
Spon's Tables and Memoranda for Engineers. Selected and arranged by J. T. Hurst. 64mo. Price 1s. (E. and F. N. Spon.)
On the Strengths of Beams, Columns, and Arches, considered with a view to deriving methods of ascertaining the practical strength of any given section of beam column, or arch, in cast iron, wrought iron, or steel By B. Baker. Assoc. Inst. C. E., author of "Long-span Railway Bridges,' &c. 8vo. Price 9s. (E. and F. N. Spon.)
Spon's Dictionary of Engineering, Civil, Mechanical, Military, and Naval, with technical terms in French, German, Italian, and Spanish. Edited by Oliver Byrne, editor of "Appleton's Dictionary" Illustrated by upwards of 2,000 engravings. Price 13s. 6d. (E. and F. N. Spon.)
Tabulated Weights of Angle, T, Bulb, Beam, Round, Square, and Flat Iron, for the use of Naval Architects and Shipbuilders. By Chas. H. Jordan, M.I N.A. 32mo. Price 1s. 6d. (E. and F. N. Spon.)

GENERAL NOTES.

The Thames Embankment.—The Victoria or Northern Embankment of the Thames, from Westminster to Blackfriars-bridge, was opened on Wednesday, the 13th July, by command of the Queen, by His Royal Highness the Prince of Wales and Princess Louise.

Tarasp.—The Rev. N. Whitley, in a little book just published, calls attention to the value of the mineral waters of Tarasp, about nine miles from the Austrian frontier, near Martinsbruck, in the Upper Lugardine. There are saline, chalybeate, and sulphurous springs, and their distance from London is three days' journey.

Hill Settlement in India.—Lord Napier of Magdala is taking the greatest interest in placing working parties of English soldiers in the hill stations. The Bishop of Calcutta has consecrated churches at Darjeeling and the neighbouring Kurseong. There is a report that Raneeket is to be the seat of government. Tea cultivation in the Kangra Valley is going on successfully. Captain Gregory is trying to introduce Assam brick tea into Thibet, by means of the Mishmee tribe.

Export of Machinery.—Steam-engines were exported, to April 30, this year, to the value of £575,041, as compared with £409,492 in the first four months of 1869, and £431,472 to the corresponding date of 1868. The increase observable this year was chiefly attributable to the greater demand for steam-engines from Egypt, which took them to the value of £105,424 in the first four months of this year, against £29,054 in 1869, and £18,259 in 1868. General machinery was exported, to April 30th, this year, to the value of £957,670, as compared with £848,934 in the corresponding period of 1869, and £725,960 in 1868.

The Trou de la Traversette.—The *Nord* observes that at the moment when so many great canals and tunnels are in course of course of construction, it may not be uninteresting to take note that, at the end of the 15th century, in 1497, the Monte Viso, between Provence and Italy, was pierced through for a length of 800 yards, at 2,400 metres above the level of the sea. This passage, astonishing for those days, but now impracticable, is known in the country by the name of "Trou de la Traversette," and may still be explored to an extent of 72 metres. Opinions vary considerably as to the origin, some attributing it to Hannibal, some to Marius, others to Cæsar, others to Francis I. Moreri, however, declares that this important work is due to the initiative of Louis I., Marquis de Saluces, who caused the rock to be bored by means of fire and steel, so as to form a passage for loaded mules. There still exists a convention passed between the Marquis and the representative of the Count de Provence, acknowledging the great profit likely to accrue to that country from the opening of the passage for the exportation of goods. The tunnel thus executed fell afterwards into decay, and, under the First Empire, the entrance alone subsisted.

Cotton Seed a Paper-maker's Fibre.—A Lancashire paper-maker has succeeded in turning to profitable account particular kinds of cotton seed, as a material for the manufacture of the best kinds of paper. The seed is to be obtained in quantities large enough to supply the wants of all the paper-mills in the country; and it produces a fibre of the finest quality, at a price that will bring it into lively competition with Esparto grass. Of all the substances hitherto suggested as a substitute for rags, the best practical judges regard this as the most desirable. One important feature in its use is that it necessitates little alteration in the ordinary machinery of paper-mills, while it will in a great measure overcome the difficulty of our river pollution, caused by Esparto.

Ventilation of Hospitals.—A committee of the Paris Academy of Sciences is now considering this very important subject, and a communication from M. Cornill Wœystin has just been presented and referred to this committee. M. Wœystin criticises the present method of ventilation of hospitals, and asks how it is that, while certain doctors assert that a supply of eight to ten cubic mètres of air per bed and per hour are sufficient to keep a ward in good conditions of ventilation, others insist upon a supply of twenty and even sixty cubic mètres, while some even fix eighty as the minimum quantity. He accounts for these immense discrepancies in the following manner:—In a ward containing, say, ten beds, the warm air is introduced between the two ranks of beds by means of five orifices in the central passage, while the vitiated air is drawn off through other orifices behind the beds. Thus, says M. Wœystin, a number of currents are formed from the inlets to the exit passages, which do not sufficiently draw away the intermediate layers of air, and thus cause many regions or currents of air not sufficiently ventilated, which become veritable reservoirs of infection; and this he believes to be the true reason of the increasing demand for a larger amount of fresh air. The introduction of a greater quantity of fresh air, according to M. Wœystin, only increases the rapidity of the currents, and has little effect upon the strata of air which lie above and around them, between the inlets and the ports of evacuation; the object, therefore, should be, not to introduce masses of air, but to make better use of that which is admitted. To remedy this, M. Wœcystin suggests the application of a well-known system—that of wire-work, or gauze; he recommends that the orifices for the introduction of fresh air should be covered by such a screen, reaching from the floor to the ceiling, and that the exit holes should be protected in like manner, so that the movement of the air should be graduated and dispersed over the entire contents of the ward. The importance of this question cannot be over-rated; all the world knows what relief has been obtained of late years, in the case of fevers, by a free use of fresh air, and the subject has been tested in a very remarkable manner in France, both in towns and in camps. Patients have been placed under tents where the supply of fresh air was constant, and the temperature low, with an amount of success that gives immense importance to such experiments. It must not be forgotten, however, that draughts do not supply wholesome ventilation; and the shutting off, or rather the attenuation of them, must conduce to the comfort and well-being of the sick.—*Food Journal.*

MEETINGS FOR THE ENSUING WEEK.

Tues ...Syro Egyptian, 7½. Special extra meeting, for the exhibition of a collection of drawings of Egyptian antiquities, by the late Messrs. R. Hay, F. Arundale, and C. Laver, between 1822-30. Messrs. Simpson and Bonomi will give explanations.

Wed ...East India Assoc., 3. (AT THE HOUSE OF THE SOCIETY OF ARTS.)

Thur ...Zoological, 4.

Fri ......Quekett Club, 8. Annual Meeting.

Sat ......R. Botanic, 3¾.

Journal of the Society of Arts.

FRIDAY, JULY 22, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

BEQUEST.

The Secretary has received from Messrs. Dawes and Sons, the solicitors for the executors of the late Mr. Alexander Robb, a letter, announcing that, by the will of that gentleman, a sum of £200 has been bequeathed to the Society.

THE EDUCATION BILL.

The number of hours devoted by the House of Commons to this Bill during the past week has been considerable. On the 14th inst., the Committee resumed, and were occupied for a long time in discussing new clauses and the schedules. Mr. W. E. Forster added clauses enabling the metropolitan school board to pay its chairman, and giving the Education Department power to dissolve school boards. Several new clauses were moved by private members, but none of them were accepted. Mr. W. E. Forster, however, consented to a modification of a clause, suggested by Sir C. Adderley, by which the school boards would be enabled to appoint officers to enforce the Industrial Schools Act. On a clause, moved by Mr. Laird, to provide for elections in districts under improvement commissioners, Mr. Forster took the opportunity of stating that, on the report, he would move an amendment, giving the election of the school boards directly to the ratepayers in boroughs as well as country districts.

On the second schedule, which prescribes the rules for the election of school boards, there arose an animated discussion, provoked by a motion made by Sir C. Dilke that the election shall be by "secret voting." Mr. W. E. Forster was willing to accept the ballot without the qualification of "secret," for the limited period of a year from next September, under tho direction of the Education Department, and he pointed out that there were no school boards likely to be elected within the next twelve months, except in the metropolis or the few districts which would at once call for the creation of boards. Mr. Beresford Hope, Lord J. Manners, and Sir J. Pakington complained of this attempt to foist into the Bill a question which had no connection with education. Mr. Hardy expressed the same view in even more forcible language, and was answered by Mr. Gladstone. Ultimately the Committee divided on the question of the ballot, which was carried by 234 to 155.

Lord C. Hamilton moved to substitute "voting papers" for the ballot, but the proposal was rejected by 228 to 157. Mr. W. E. Forster then proposed to strike out the epithet "secret," on which Sir L. Palk asked what was meant by a ballot which was not seeret? The Marquis of Hartington repeated an explanation, given before more than once by Mr. W. E. Forster, that the word secret was omitted because it was interpreted by some to mean a ballot which not only might be, but must be, absolutely secret, and the government did not wish to commit the House to that on so short a discussion. On a division, the word was struck out by 288 to 47.

On a motion by Sir J. Elphinstone to report progress, Mr. Disraeli appealed to the Government to withdraw the ballot question, and deprecated the introduction "into a House almost unanimous upon the general question, of a matter of political controversy which has already led to much discord, and which may prepare for us difficulties in another place, at a period of the Session when it is most desirable that all elements of difference between the two Houses should cease." He hoped the Prime Minister would find it consistent with his duty not to press this question. Mr. Gladstone declined to recede, and argued that the ballot was not an innovation in local elections, and that the present proposal was temporary and limited. Sir J. Elphinstone's motion was negatived by 210 to 114, and immediately afterwards a motion was made by Lord J. Manners to substitute for the ballot the usual mode of electing guardians; but this was rejected by 196 to 127.

Repeated divisions then took place, which it is unnecessary to particularise, and the House sat to an almost unprecedently late hour.

At a morning sitting on the 19th inst., the House considered the Bill as amended, and many of the points previously raised were again brought forward.

Mr. Dickinson, with the assent of Mr. W. E. Forster, carried, by 86 to 53, a clause giving the managers power to make alterations in the school regulations. Sir G. Jenkinson again endeavoured to exempt from rating persons who maintain a voluntary school in an efficient state, but he was beaten by 120 to 76; and Mr. M'Arthur was equally unsuccessful with a proviso requiring that in every district there shall be one school with a conscience clause. The division against him was 168 to 66. At the suggestion of Mr. Holms, the election of the first Chairman of the Metropolitan School Board was taken from the Education Department and vested in the School Board, with the proviso that he is to be one of their own number, or to become so by virtue of his office. The transfer of the election in ordinary boroughs from the town councils to the burgesses, anounced by Mr. Forster in committee, and now proposed to be carried out by an amendment in clause 27, gave rise to some controversy. It was opposed by Mr. Dixon, Mr. Mundella, Mr. Muntz, Lord John Manners, and others, but on a division the change was effected by 273 to 57.

Lord A. Hervey moved that no school in which the Holy Scriptures are not in daily use shall receive a Parliamentary grant. It was warmly advocated by Mr. Newdegate and also by Sir J. Pakington, but on a division it was rejected by 205 to 89.

The ballot question was then revived by Lord J. Manners, who moved to strike out the words in the second schedulo requiring the poll to be taken by ballot, but on a division they were retained, by 197 to 106. Mr. Forster then moved to add words directing the ballot to be taken in accordance with the principles of the Metropolitan Management Act, 1855, but this was opposed by Sir C. Dilke and Mr. Harcourt, and, after a short discussion, the debate was adjourned.

THE INDIAN RAILWAY GAUGES, PERMANENT WAY, AND ROLLING STOCK.

By W. Bridges Adams.

"In a multitude of counsellors there is wisdom," for whomsoever has perceptive faculties wherewith to pick it out of the mass. Our steam transit by land would seem to be a vexed question, but much of this vexation will disappear on analysis. The truth is, most people will regard things from their own side of the question, and take it for granted that what suits themselves is the best for everybody. They forget that, in the days of animal transit, we had bridle paths, and wheel roads, and occupation roads, highways and turnpikes, and also "halfpenny hatches," and think because we now have steam, all roads must be exactly alike, of one indivisible gauge. Yet we have, in the history of steam locomotion, the direct contrary shown. Every possible variety of gauge has been tried, from the seven feet of the Great Western down to the under two feet of the Festiniog. We have had the Irish gauges, varying from seven feet

to two feet six inches, said to have been all added together, and the mean taken to obtain the present five feet three inches. Again, we have the Indian gauge of five feet six inches, arrived at because it was thought the width best adapted to get a powerful locomotive with inside cylinders, and without which it was supposed impracticable to build a steady engine. Again, we have our so-called national gauge, of four feet eight inches and one half, arrived at first by an assumption that the ordinary road gauge of five feet was best for the rail, and then the discovery that the inside of the rail, and not the outside, was the true gauge; and, after that, some patchwork, leaving no integral measure either inside or out. Once upon a time John Braithwaite did, on the Eastern Counties, establish an integral five feet, but a very short time elapsed before that was altered to work in with the non-integral standard.

The Broad Gauge and the Future.

Had the seven-feet gauge—the broad-gauge as it was called—been laid from London to Liverpool, as a main business line, instead of from London to Bath and Bristol, as a "gentleman's line," it is probable that it would not have been found too wide, provided all the appliances had been in conformity with the width; but they were not so. It was a gauge and nothing more, except the good gradients. The Box-tunnel ruled the width of the carriages, and the seven-feet gauge could carry no more passengers abreast than the narrow gauge. As a rule, the most economical arrangement is to make the vehicles twice the width of the gauge. Less is waste, more is risky. The Great Western, therefore, should have had vehicles fourteen feet wide instead of eight, and as the height of passengers is the same in all gauges, the steadiness and freedom from oscillation would have been at the maximum. Again, there was a capacity for building engines with the maximum of power, speed, and safety. With good levels, the larger the wheels the better. With steep inclines, large wheels are an evil, the gravitation being behind the axles. Engines were built with wheels ten feet in diameter, not too large in proportion to the gauge, but the steam power applied was considerably less in proportion than that used with smaller wheels on the narrow gauge. So the whole thing was a failure.

When we consider that one revolution of a ten-feet wheel gives a forward progress of over ten yards, and that 176 of such revolutions make a mile, and that in the broad gauge there was scarcely a limit to the diameter of the cylinders and length of stroke of the pistons, or the power of the boilers, such a system might easily have reduced the journey from London to Liverpool to three hours, and with the appliances and improvements constantly going on, and, more than all, with the ample traffic, the line would have paid better. If the wealth and commerce of England continues to grow in the next twenty years as it has done in the last forty, this will yet come to pass. Provided the giant be not "weak in the knees," his pace *must* beat that of the dwarf, and speed of transit in a commercial country is even more important than cheapness, for cheapness ever grows by quantity and population in the long run.

Division of Gauges.

The smallest gauge belongs to the sparsely-peopled, mountainous country; the broadest gauge and greatest power to the richest and most level country, for the highest speed. Other things being equal, the shorter the train in proportion to its width, the more manageable it becomes. The longer and more powerful the engine, provided it has corresponding work to do, the cheaper can that work be done; and the main streams of London traffic will continue to grow as they have grown. It is not lightness that is needed so much as power. Speed necessitates strength and weight, and what is wanted is the reduction of friction to the minimum, with ample carrying power. We do not think that the Metropolitan line has yet culminated in perfection, but we can conceive the astonishment the Londoners would feel if, some fine morning, they were to find the heavy rolling stock all removed, and its place supplied by the Festiniog railway, with a train as long as Hungerford-bridge, and all the passengers taking their seats two and two, and back to back, with directions to keep their seats, as in a Thames wherry, to prevent upsetting.

The "Battle of the Gauges," long fought in England, with the result that the small mileage of the broad had to succumb to the large mileage of the narrow, is now transferred to our Indian territories. We may be quite sure that, when our earlier Indian engineers determined on departing from the English standard to an integral 5 ft. 6 in. instead of 4 ft. 8½ in., they had a reason for it, and a strong one, to overpower the instinctive repugnance to change. The reason was the desire to obtain a more powerful engine than the narrow gauge would admit of. The space between the wheels on the narrow gauge is only 4 ft. 6 in., and a 4 ft. boiler, with its integuments of blanket, wood, and metal, nearly fill it up, leaving no adequate space for the side frames. Then there was the crotchet of crank axles and inside cylinders, which needed extra elevation of the boiler, the total height to the top of the boiler being about 9 feet, or nearly double the width of the gauge, not a favourable condition of stability, as is occasionally proved when running on a new and unsettled line and toppling over, as was the case with poor Alfred Jee in Spain. The added 9½ inches gives more space, with a wider base, and there is no doubt that, if our railways were now to commence, the 5 feet 6 inches would have preference over the 4 feet 8½ inches.

The Philosophy of the Gauge.

The question of gauge width is not an arbitrary matter. It is governed by laws of proportion, like the whole universe. The data are speed, bulk, and weight. The richer and larger the country, the greater the demand for speed, till the maximum be attained; and though in some cases speed is more costly, there are considerations outweighing cost, such as making a government ubiquitous, and making a small number of troops do the work of a larger number in the way of police or defence. If a country be poor, its inhabitants must be content with jaunting cars, or their analogues on rails—such vehicles as conveyed soldiers in the olden time, seated back to back to keep the centre of gravity within the wheel.

If heavy minerals are to be conveyed, they can be stored in small boxes of any shape with a low centre of gravity. In the slate works of Wales, rails have at times been formed to a guage of eighteen inches, round iron bars tied together at the joints, and with sheeve wheels a foot in diameter, and storage boxes direct on the axles. The whole of the rails could be slewed in any direction, as they only lay on the surface of the ground.

But if bulky goods or passengers are to be carried, tho gauge must be widened, or the vehicles will overset. As a rule, the bodies of the vehicles may be made twice the width of the gauge, and maintain steadiness. A 2 ft. gauge will therefore give a 4 ft. body, containing two passengers abreast, seated fore and aft. With their knees touching, they would thus occupy 16 square feet, or four feet per passenger. But if the access and egress is to be easy, the interior of tho vehicle must be at least six feet in height, especially for ventilation in a hot climate. And even with wheels two feet in diameter, the total height above the rails will thus exceed seven feet, to a two feet breadth of base. Such vehicles can only be adapted for a comparatively slow movement, and with a high wind the chances are that they might be blown over. And it is evident that an engine on such a line must have its boiler and cylinders overhanging very considerably. And be it remembered that any sinking or irregularity in the rails with a 2 ft. gauge, doubles the angle of instability

as compared with a 4 ft., and so on with a 5 ft. 6 in. gauge, the stability increasing with the width.

Again, to carry passengers on the 2 ft. gauge in one train, exclusive of the engine, would require a train 100 feet in length, and station platforms in the same proportion. On the 3 ft. 6 in. gauge, with the same proportionate space, 33 feet length would suffice, with 33 feet of platform. And supposing the whole diameter to be 3 feet, the height of the body remaining the same, the total height from the rails would be 7 ft. 6 in to a 5 ft. 6 in. wheel base, instead of 7 ft. to a 2 ft. wheel base.

And, under almost all circumstances, the haulage of a short train offers far less resistance than that of a a long train of equal weight. The number of wheels is greater in the latter, and it is obvious that the fewer the wheels, provided the axle bearings are not overloaded nor the pressure too great on the rails, the less will be the total resistance.

Permanent Way.

Nor, supposing traffic to be found in abundance, is there any economical advantage in constructing the narrow gauge for long distances. Very long trains become unmanageable, so a greater number must be run; and do what we will, the practicable speed must be greater on the broad gauge than on the narrow, while the risk should be less, supposing appliances to be what they ought to be, with the frictions reduced to the minimum.

Other things being equal, what does the structure of a permanent way involve? First a pair of rails, the strength of which must be alike, whether for broad or narrow gauge, according to the load used on the driving-wheels of the locomotive. These rails may be of the worst mechanical form, as a cylindrical bar, or a very shallow girder form, as the American rail, or of a deep girder section, vertically strong as the square of the depths, or the rail may be supported on a lower table, or suspended from the upper table, or fished or unfished. Whatever form be chosen, good or bad, the cost is the same, broad gauge or narrow.

Secondly, the sleepers. They may be of transverse or longitudinal timber. If longitudinal, they will cost the same, whether for broad or narrow, but the broad will exceed simply in the extra length of the tie-bars. If transverse sleepers, they will exceed in length in the same proportion, but with a corresponding increase in steadiness.

But both longitudinal and transverse sleepers of timber are now generally given up in India, and their place supplied by metal more or less analogous to the system of stone blocks used in the early English lines. They are metal piers or supports, generally of cast-iron, a brittle substance, involving a special selection of ballast, but eosting the same, whether for narrow guage or broad, plus or minus the length of the tie-bars.

High Speeds for Government and Military Uses.

Looking to our rule in India, it is impossible to dispense with main lines, for strategical purposes, adapted to the the highest speeds and the heaviest trains, for the transit of government officials and bodies of troops with, if need be, artillery, capable of being worked on the rails. Our rule there is, upon the whole, a beneficent one; not the best imaginable, but the best the world has yet seen in India, and our power must be ubiquitous, and not slow-moving, as it was in the Sepoy rebellion. The 5 feet 6 inches gauge is adapted to these purposes. On the levels of India there is no difficulty in obtaining speeds of sixty miles per hour, with all imaginable steadiness. An engine with coupled driving-wheels eight feet in diameter, would in 220 revolutions measure off a mile, and with cylinders 21 inches in diameter and three feet stroke of piston, would take a train of 400 tons gross at this speed, equal to some 2,000 men in light marching order. Or the same engine could tako a series of saloon vehicles, each measuring internally 40 feet by 11 feet, or 440 feet floor area, with every appliance for eating, sleeping, and washing, and so free from noise and vibration that the ordinary routine of government offices could be pursued therein. We have not yet achieved all that is practicable with our locomotive power, and long and large cylinders are very favourable for economy in expansion and saving fuel. Such an engine, with reduced wheels and eight coupled drivers, would take 600 tons at 40 miles per hour, including artillery and armour-clad moving forts, or 800 tons over the gradients of 1 in 300 proposed by the Indian government. Our heroic William Peel did, at the head of his brave men, drag his heavy ship's guns over a parched soil to quell the Indian mutiny, and died in his deed; but the worst uses to which we can put our heroes is to kill them by unneeded work. It is quite within our power, and at a lessened cost, to make heavier guns than those of William Peel locomotive by steam-power, instead of human drudgery.

In making lines of railway, one argument is, that less land is occupied by a narrow gauge than a broad. This may hold good when people are very thick on the ground, as to first cost; but to set against it there is this reply, that in proportion to the gauge so is the amount of traffic that can be dealt with. A narrow guage means a comparatively peddling trade. No doudt peddling is a portion of the economy of humanity, the small end that culminates in the high-speed railway; but the pedlar, though he commences commerce, is not the equivalent of the first-class merchant.

Frictional Resistance of Gauges.

There is another argument, that the frictional resistance on the narrow gauge is less than on the broad. This is quite true, but chiefly on curves, and only as a consequence of existing vicious structure. If garden rollers be used instead of wheels, the narrower the gauge the less will be the friction on curves, and the minimum resistance would be obtained by a single rail—could we only balance it—with an equivalent strength of material. Over half-a-century back, there was a Duchess of Marlborough, who, obliged by infirmity to ride, wanted to ride along the gravelled walks of her large garden without disturbing the borders. So she had a vehicle constructed with one central wheel and a pair of shafts, balanced by the pony in front. In this ease the load was carried directly over the axle centre.

The Great Western, with its broad gauge, attains the maximum of curve resistance, but simply because garden rollers are used thereon instead of wheels proper. If independent wheels, or their equivalent, were provided, and compensating axles, the cost of haulage, and the wear of material, and the possibility of accident, would largely disappear.

In laying out railways in India, there is no more reason for confining them to one gauge then there is elsewhere, and the value of the land may be omitted from the calculation. Nor, as a matter of proportion, is there any reason why what is called light rolling stock should be confined to a narrow more than to a broad gauge. Taken per passenger or per ton of goods, the broad may be as proportionably light as the narrow. Only if the goods or passengers be scanty in either case, there must be disproportionate dead weight, and therefore the true commercial policy is to provide, not for the possible maximum, but for the maximum average of transit. This is, to some extent, met by the increase or diminution of the number of vehicles in a train, but does not affect the question of the engine. Upon the whole, it is a doubtful advantage increasing and diminishing the number of the vehicles in a train for general traffic. The train must go backwards and forwards, whether full or empty, just as a stage-coach or omnibus does, and the vehicles may as well go at regular as irregular intervals, keeping the traffic more certain.

Causes of Friction.

It cannot be too strongly impressed that, however disadvantageous surplus dead weight may be, there is a much more serious evil yet to deal with—surplus friction. So long as the so-called wheels shall continue to be mere rollers and not wheels, and so long as the axles shall not be allowed to diverge and converge to one another independently, to suit the radii of the curves, and to compensate for any derangement of the frames, so long will the trains be sledges, and not rolling bodies, with the constant risk of breaking the axles and getting off the rails, and the cost of wasting as much more engine-power than that needed for simple haulage, and the constant destruction of both tires and rails, involving maintenance of way as well as other maintenance. And this holds good whether on straight lines or on curves, the straight lines being practically crooked ones, by hitherto unavoidable defects in structure.

If the engines be rightly constructed, straight lines are not a necessity, save for very high speeds; but for economical construction, to avoid obstacles, such as river crossings or getting round mountain spurs, or ground elevations, curves are very desirable, and there is no difficulty in constructing powerful engines to work equally well both on curves and straight lines, of course slackening the pace on curves, not to arrest friction, which may be otherwise dealt with, but to lessen centrifugal force.

Locomotive Engines.

In the construction of engines, one main object, always supposing tho utmost efficiency, is simplicity of structure and fewness of pieces. If an engine could be made as efficient with one cylinder as with two, it would be an improvement both in cost and in repairs, but human art has not yet shown us how to do with less than two efficiently; yet there are advocates who claim four ten-inch cylinders to be better than two of fourteen inches, because they contrive with them to make a flexible engine to roll round curves. The "bogie engine," so called, is, in truth, merely two engines connected to a long boiler with a central fire-box by pivots, making the boiler into a beam, which is by no means the function of a boiler, the office of which should be solely to make steam. These two engines roll round curves, simply because they have very short wheel bases, and for no other reason. But it is claimed that one driver can work them both, but so also could he work the same two engines coupled together by the footplates, with a separate boiler to each, dispensing with bogie pivots and complication of parts, and with much greater durability of the machines, and much greater facility of repairs. Again, it is claimed that the whole weight of the engine is useful for adhesive power. Similar would be the case with two, four, or six coupled engines, connected fire-box and fire-box ends together. Steadiness can only be obtained with a long wheel base; and power of going round curves, by a flexible base. The bogie engine will do this, and so will the coupled engine if rightly coupled, with the advantage that the simplicity of the latter saves it from damage in collision. And it is only in case of extremely sharp curves that such engines are needed. For curves not sharper than three chains, or 66 yards radius, there is no difficulty in constructing engines with two cylinders and eight driving wheels, to roll without flange friction, and a traction force of 20,000 lbs. at the rail equal to 2,000 tons on the level, supposing the draw rods and coupling links to hold together. And a pair of connected engines, with eight small driving-wheels each, and two cylinders each, twenty-one inches in diameter, and with three feet stroke of piston, would be able to work curves of two chains radius, or 44 yards, with a tractive force at the rail of 40,000 lbs., equal to a train of 480 tons, up a gradient of one in 30, at 20 miles per hour. Only when such gradients exist, the traffic is very rarely abundant enough to warrant such trains, unless for military purposes.

Subsidiary Gauge.

In considering the question of a subsidiary gauge for comparatively slow movement, for commercial purposes, we must take into account the various purposes it has to serve. It has to be a feeder to the main lines, to permeate the towns and villages, to go direct on to the planter's land to take in his crops, without intermediate loading by bullock carts; it has to run along the common roads, and therefore it should be constructed so as to avoid the use of raised platforms for the vehicles, and, in fact, everything but Way and rolling stock. Especially should it be provided that the gauge works in with the municipal and other tramways on roads and towns. There is no difficulty in constructing the tramways so that either plain wheels or flange wheels may run upon them. The best form for the tram is a curved channel, in which the half-round tires of common road wheels may run with the minimum of friction, and the flanges of the rail-tires should correspond to the centres of the channels. This tram needs no tie bars, and the cost is absolutely the same whether laid to one gauge or the other; and the tram could be worked by a light engine when required. A tram or subsidiary railway is essentially one of small trains, and, even if for no other reason, the gauge should be narrower than that of the main lines, in order to prevent the possibility of its being destroyed by the heavy engine stock of the main lines.

A 3 ft. 6 in. gauge will give a 7 ft. body, a size ample for the purpose. Rightly made both in permanent way and wheels, and with the friction reduced to the minimum, wheel tires $4\frac{1}{2}$ inches in width, with wheels 2 ft. 6 in. in diameter, would be ample, and each vehicle wheel should be limited to 1 ton, or 4 tons per wagon, exclusive of the wagon itself on four wheels. The engines should be limited to three tons per wheel, and engines could be constructed, with eight coupled driving wheels, to run round curves of 99 feet radius, and up a gradient of 1 in 50, at a speed of 15 to 20 miles per hour, with a train-load of 120 tons, and weighing, when loaded with fuel and water, not more than 20 tons, or $2\frac{1}{2}$ tons per wheel, a load that would require a period of a quarter of a century to wear out either rails or tires if of the best quality. It must always be remembered that the destructive power of an engine in running must be measured by the heaviest load on any one wheel, and the wheels must be multiplied, till the undamaging load on each be attained. But great power necessitates considerable length, and the machine must be made laterally flexible. How to attain this point with the greatest simplicity and the smallest number of parts is the only question for consideration.

Permanent Way.

The same consideration holds good in the mechanical structure of permanent way. The rail should be in itself as far as possible inflexible, both vertically and horizontally, whatever be the load calculated for. It should be suspended on the sleepers beneath the shoulders of the upper table, and not propped on the lower table, for the obvious reason that thereby the maximum angle of stability is attained by the smallest quantity of metal, the necessary quantity of ballast is reduced to the minimum, and the packing is facilitated without "opening out," with a tithe of the labour, and the action of rain is far less mischievous. It is quite practicable to make such permanent way wholly of wrought iron, firmly held in tho ballast, without fishes, screw-bolts, or wood-keys, for the heaviest of all possible work, with 250 tons of metal per mile; of medium strength, 190 tons, and for tho light 3 ft. 6 in. gauge, 120 tons per mile, with only four types or parts, and under 10,000 pieces per mile, and without any brittle cast-iron, costly in freight.

The cost of the permanent way may be reduced, by the use of timber instead of wrought-iron sleepers very considerably. But in such case hard timber must be used, impervious to rot or to insects. Such timber exists in

India, and the chief difficulty about it—the tendency to warp when not dry—can be overcome by reducing it to short lengths and small scantling. In such case it has all the durability of cast-iron, without the brittleness, and on the light 3 ft. 6 in. gauge the 120 tons of wrought-iron may be reduced to 70, supplementing 50 tons of wrought-iron by 44 loads of hard timber blocks, in small blocks exactly alike as so many bricks, and easily procurable from smaller-sized timber, at less cost than from large.

THE CULTURE OF SALMON.

In the *Journal of the Society of Arts*, for the 10th of December last, a short notice appeared of some experiments for the artificial production of salmon-fry, carried on at the Stormontfield ponds, in Scotland; and I propose in the present article to submit some observations on the whole of that prolific subject. It appears that, in December last, about 100 salmon, male and female, were taken from the River Tay, near the mouth of the Almond, and from these fish the spawn was procured, and 106,000 of the ova were safely deposited in the Stormontfield ponds. There, doubtless, they will vivify, and in due time come to maturity as salmon-fry, and at their proper season will be allowed to pass off on their passage to the sea. Now, it is with reference to these and similar experiments, wherever made, that I desire to make some remarks, chiefly in the interests of owners of salmon fisheries, being one myself, and in the hope that the suggestions I venture to make may be of some practical utility. I conceive, in the first place, that, for experimental purposes, enough has been already done in relation to the propagation of salmon-fry by these means in river waters. Let us examine into this matter, in the order of time. The earliest notice that I have seen of experiments of this nature is contained in a volume of the "Transactions of the Dublin Society," for the year 1799; it is a notice of some experiments made by a German naturalist (M. Jacobi), about the year 1763, which had been communicated to the public by Count Golstein. Jacobi, it appears, by skilful operations, had succeeded in producing living fish from the spawn of salmon and trout, placed by him in suitable boxes and ponds. He did this, and nothing more; and the article detailing his experiments concludes by stating that he had then in his ponds 430 small salmon, which he had placed there when they were six weeks old. No more is heard of them; and it is sufficiently clear that Jacobi proceeded no further than the first stage, viz., that of producing the young of salmon from the ova. So it remained until the year 1833, when Mr. J. Shaw, the manager of one of the Scotch salmon fisheries, advanced a step further. He took up the question with the view of proving that the parr, a small fish found in all salmon rivers, was the young of the salmon, and not a distinct species. Mr. Shaw's experiments are fully detailed in the "Transactions of the Royal Society of Edinburgh," vol. xiv., and it will therefore be unnecessary to report them here. Without any inclination to cavil, or find fault with the further prosecution of these experiments, I conceive that Mr. Shaw exhausted the subject by proving (what was before unknown) that the parr was the young of the salmon, and that, at a specific time, it underwent a change, and was transmuted into the salmon-fry. Having done this, I do not see that any useful progress has been made with the subject during the long period that has elapsed—three decades and more—since his experiments on that head were brought to a successful issue. His operations, when concluded, settled the parr question; enabled the legislature to protect a fish which had not until then been recognised as the young of the salmon, and afforded the means of supplying mature salmon-fry to rivers in which the breed of salmon had become extinct, and transporting them to remote countries as well. Beyond what is here enumerated, has anything else been since done? So far as I know, nothing whatever. As a means of increasing the actual stock of mature salmon in any of our great salmon rivers, I fear the experiments have failed. Had it been otherwise, the river Tay, ere this, would have been overrun with salmon; and in all the other rivers of the kingdom the owners of salmon-fisheries, profiting by the example set at Stormontfield, would long since have had their breeding-ponds and reservoirs, and have restored their rivers to their ancient productiveness.

In view, then, of the experiments, carried on for now more than a century, in river waters, by Jacobi, by Mr. Shaw, and, in continuation, by the managers of the Stormontfield ponds, I think it must be conceded that beyond a given point, these experiments cannot go—the production of mature salmon fry. It will, therefore, be the object of this short article to show that success—I mean a practical and commercial success—in increasing the stock of grilse and salmon, if it is to be attained at all, must be sought for in another direction.

As a preliminary observation, I would submit that, in experimenting on a fish which produces its young in such abundance, say, some thousands of salmon-fry to each pair of adult salmon, results, to be at all satisfactory, should be on a very ample scale indeed. If the salmon-fry that are actually produced, either in the river at large or in breeding ponds, could be utilised, so that any adequate proportion of them should ever return to the river as mature salmon, the whole question might be considered as settled. Now this, I conceive, and nothing else, the utilisation of the salmon fry, is the object we should aim at. If any reliable approximation as to the ultimate results of the particular experiment at Stormontfield now referred to, could be made, it might be found that the salmon experimented upon, if left to themselves in the river, would have effected equal results in the shape both of fry and salmon; indeed, for anything that can be shown to the contrary, the balance might be in in favour of the natural process in the river, as against the artificial process in the pond.

So long ago as the year 1862, in an article in the *Dublin University Magazine* (No. ccxxxix., Nov. 1852), I suggested that the protection of the salmon-fry in sea enclosures, or salt water lakes, was a matter that ought to be investigated, and an experiment that ought to be tried; and the article pointed out several such enclosures ready made by means of railway embankments, where large tracts, accessible to sea and tidal water, are cut off and enclosed on the sea shore, and in which such experiments could easily be carried out. The arguments on which that suggestion was founded are strictly these:—In all salmon rivers the production of salmon-fry, without the aid of artificial means, is on the most profuse scale, to which the grilse and mature salmon returning to the river bear no proportion, or rather, bear only an infinitesimal proportion; this every salmon fisher is aware of. But to give the non-professional reader some correct idea of this great disproportion, I will instance a river with which I am familiar. It is a second or third-class river; its course from the mountains to the sea is about 50 miles, and there are about twenty mill-weirs throughout its course. At one of these mill-weirs, situated about two miles from the tideway, there is a mill-pond or reservoir for head water, something under an acre in extent; it is four or five feet in depth; and in dry seasons, when little or no water is passing over the weirs, almost the whole stream of the river passes into this pond. I have on numerous occasions seen this pond, during the months of April and May, so full of salmon-fry that, as a by-stander once observed to me, a spear thrown into it would stand upright; beyond all question no human means of calculation would give any correct estimate of the numbers contained in it, or any approximation to it. Well, I have seen this incredible, and so to speak, almost solid mass of salmon-fry let off, and have assured myself that without further delay or molestation they reached the tideway and sea, but still the two or three succeeding years

showed nothing in the river but the usual average of grilse and adult salmon, although I can safely say that a single salmon returning for every 500 salmon-fry that went down to the sea would have maintained the average, and sustained the usual stock of the river. Take another example, that of a very small river, whose course from the source to the sea is not more than six or seven miles. I have walked up the ravine through which this river flows for a couple of miles in the summer time, and have found every shallow, pool, and stream teeming with the young of salmon and salmon-trout; there is little or no obstruction in the river; the fry, with every slight fresh or flood, get safely off and reach the sea; but if they all should return towards the river as salmon or salmon-trout, the river would not hold the half of them. What becomes of them? They perish in the sea or tideway from natural causes, or are destroyed by their marine enemies; a minute fraction of their number, and nothing more, ever returns to the river.

These instances will suffice, and the fact of this great production of salmon-fry not being controverted, the inference unavoidably is, that the rivers produce a superabundance of them, but that a great waste and destruction of them goes on in the tideway and sea; if, then, this waste can be brought under control, or even considerably lessened, the whole question would be solved, and results the most satisfactory would be inevitable.

Though no great difficulty presents itself to testing this matter by experiment, yet, strange to say, with one exception, no attempt has been made to solve it since the suggestion first appeared in the *Dublin University Magazine*, as above stated. On one occasion, and once only, that I am aware of, the attempt was made, and salmon-fry were transferred from the river to the salt water. It was done by a public department, under the directions of a commissioner of the Board of Works, but the experiment was in every respect faulty, and a failure; and though I did not witness it, or even hear of it at the time, I ascertained its particulars subsequently. It was made in this manner:—A dozen or two of prime and healthy salmon-fry were brought from the river, and placed in a deep and extensive basin in the rocks on the seashore at Kingstown, near Dublin. This basin never shallows; the tide ebbs and flows in it, but at lowest ebb it had a depth of five or six feet of water in it, and the sides and bottom were encased in seaweed. The result was that, though the entrance was well secured with wire fence, the fry placed in it were never seen again, and this futile and ill-judged experiment failed, even in the negative evidence which the remains of the dead salmon-fry, if they could have been discovered, would have supplied.

This attempt was faulty in at least two essential particulars. In the first place, the salmon-fry, healthy and vigorous when they were placed in this reservoir, had been transferred from the fresh-water, pure and simple, to the sea-water equally pure, the receptacle in question being on the seashore, five miles from the mouth of the river. In the next place, the experiment failed as a test, because of the extreme depth of the reservoir; to give results, the water in the reservoir should have ebbed to six or eight inches, and have been pervious to the sight, and have admitted of a daily examination.

In any such experiment the order of nature should be strictly followed. The salmon-fry, in descending their river, first reach the tideway or brackish water, and it is consistent with my observation that they linger a while in the tideway before they enter the sea, as if to acclimatise themselves to the change. I have seen them and known them to return back with a spring-tide, thus retracing two or three miles of tideway which they had already descended; and, as a passing observation, I would add, it has frequently occurred to me that a considerable destruction of them takes place in the tideway, while they thus linger in it, from sewage and other pollutions; and it is no answer to say that this applies equally to grilse and adult salmon. I do not think it does; the grilse and salmon in all rivers rush up when freshets or floods are coming down, and then this cause is not so much in operation; and, besides, the adult fish may not be so susceptible to river pollutions as their fragile and tender young. There can be little donbt that the purification of rivers, which is contemplated for sanitary purposes, will have a very beneficial effect on the salmon fisheries. But to proceed. I shall now describe with some, but I hope not unnecessary, minuteness, the manner in which, in my opinion, these experiments ought to be carried out, so that some decisive result should be obtained; and first, as being necessary to my subject, I shall describe a pond which I constructed, many years ago, at my fishery, for keeping salmon alive for a day or two for the market. It is built of solid masonry, and is accessible to the fresh water alone, which is supplied to it from the river without intermission, through a four-inch pipe. The pond is 17 feet in length, 9 feet in breadth, and 4 feet in depth of water. It is floored with plank, and is perfectly staunch and water-tight throughout; it has a waste-gate, or sluice, at one end, by which the whole or any part of the water can be run off at pleasure. It always answered well for its purpose, and I have frequently had from one to two hundred live salmon in it at a time. It has high walls surrounding it, and an iron grating overhead for protection; these rendered its construction expensive, and the whole, moreover, is built in a very solid and permanent manner, which would not be necessary in ponds intended solely for temporary and experimental purposes.

I would, then, for the purposes suggested in this paper, have two such ponds constructed, one in the tideway, and the other on the sea-shore. They might be completed at an expenditure of about £25 each, omitting the expensive accessories and solid construction of the pond already described. These ponds might be formed near to or within the demesne of some landed proprietor, adjacent to the shore, and contiguous to some cottage or residence, and should have a wire netting extended over each pond from the retaining walls, about a foot or two in height above high-water mark. The bottom, or flooring, of each pond should be one foot below the level of the low-water mark of the tide outside, so that at ebb, or low-water, there should be always at the bottom of the pond a foot or nine inches of water; but should rock or other difficulty present itself in the locality chosen, a slight regulating process will effect this indispensable condition equally well. To these ponds, the sea-water in the one, and the brackish water in the other, should have free access, so that the tide should flow and ebb regularly in each of them. A few dozen of salmon-fry taken from the river, when the fry are on their passage to the sea in April or May, should be then put into these ponds, and as the salmon-fry are supposed to become grilse in six or eight weeks, I think these ponds cannot fail to solve that question, and the moment the grilse question is solved, the whole question may be considered in hand.

Assuming, for a moment, that these ponds should prove a success, the sphere of operations could be at once and easily enlarged; in every direction, both in England and Ireland, railway embankments have cut off from the sea large tracts of land covered with sea and tidal waters. I travelled, last week, on the line of the Dublin and Drogheda Railway, where several of these salt and tidal water lakes are passed; that at Malahide, I should say, comprises several hundred acres, any portion of which might be appropriated to this purpose; but, indeed, such lakes, natural and artificial, are ready made for use in various parts of the United Kingdom, requiring very little outlay to render them available for the culture of salmon and other fish.

The Chinese and other nations rear fish for culinary purposes. Why should not we? The ancient Romans

did so in the time of the Cæsars, and the remains of some of their extensive fish-ponds and fish-preserves may be seen at Baia, near Naples. Our advanced civilisation has militated, and does militate in many respects, against the salmon fisheries, and it is therefore the more incumbent on us to seek out every means of preserving them, which those who preceded us were under no necessity of doing, from the superabundance of the fish which prevailed.

We have succeeded in keeping salmon-fry in river ponds for two years together, during which time they have thriven, assumed their natural changes, and attained their usual growth. Do the same thing in sea and tidal waters for half the time, and results will declare themselves.

I shall here, as having some relation to the present subject, make a few observations as to the food of salmon, although such investigations more fitly belong to the anatomist or naturalist. This, too—the food of the salmon—is a vexed question. The opinion which most prevails is, that they derive their nourishment in the river from insects, or animalculæ in the water; fishing people express it by saying that they live upon suction; certain it is that little or nothing is ever found in the stomach of the salmon. It is said by some, in explanation of this, that digestion in this species is very rapid. In the pond referred to, which was built only for the purpose of keeping salmon alive for two or three days at furthest, yet I have occasionally, for the purpose of observation, kept a couple of salmon locked up in it for a month or two, but could never perceive any deterioration in their appearance, other than that of the same run of fish at large in the river; for, as all know, from the day that salmon enter a river until they quit it for the sea, they gradually deteriorate in condition, colour, and size. Still, this prevailing opinion about their food, like many others, may yet be found to be an error. Instance the parr question, and perhaps the grilse question too. The great and sudden increase in condition and size of spent salmon when they have been a short time in the sea is strong evidence of an abundance of food in that element, whether derived from the water or from animal or vegetable productions. I have examined, for this purpose, the interior of many hundreds of salmon caught in the sea and caught in the river, but have not found anything that would sufficiently account for the splendid condition and size of the fish examined; but I have occasionally found a substance in the stomach and in the "pyloric appendages" (as Mr. Buckland in his report designates them), which substance it has often occurred to me might be food recently taken; and beyond all doubt I have found on the sea-shore, in considerable quantities, an aquatic or vegetable production identical with that I have sometimes found in the stomach of the salmon. I almost hesitate to make this observation, it is so opposed to the general belief; but as it is not altogether foreign to the subject of the present paper, I leave it in the hands of those who are more competent to investigate it.

It is time I should conclude this paper, and shall do so with a few general remarks. It is not satisfactory to think that, in every thing relating to our Irish salmon-fisheries, progress has been remarkably slow. Step by step each principle advances, with long intervals between. Requirements of urgent necessity remain in abeyance, until at length a familiar fact forces itself into acceptation, but unfortunately, in many cases, a period of twenty years has elapsed between the principle that had become established and the one that has been exploded. This very slow progress is not in accordance with the impulses of the present age. The food question presses on us, and demands, in its many phases, continual attention; and the subject we have been discussing, viewed either in its ordinary or in its exceptional aspect, bears a very intimate relation to that question, and offers an ample field for its cultivation. To neglect or trifle with the salmon-fisheries is worse than a blunder—it is a sin. So long as we have a fish native to our rivers, and breeding at our very doors, which produces its young at the rate of some thousands per pair, it is our own fault if we loiter on the way, and do not, by every means in our power, push investigation and experiment to their ultimate result.

With reference to the English rivers, which I believe only came under cultivation since 1861, the prospect, I am glad to perceive, is hopeful. I met with, a short time back, some reports by the English inspectors, Messrs. Buckland and Walpole, which I read with the greatest interest and advantage; those reports evince large conceptions and sound and judicious views; and I would earnestly commend to the zeal and intelligence of those gentlemen the prosecution of the experiments referred to in this paper. Such experiments on the coasts and foreshores can only be carried on by those in authority, and if they should prove successful on a small scale, power could easily be taken, in an Act of Parliament, to carry them out more extensively, by a clause giving powers similar to those already conferred for the cultivation of oysters.

America is beginning to turn attention to this subject of artificial propagation, as appears from the experiments now being carried on by Mr. Samuel Wilmot, near Lake Ontario, but still all in the one direction, the production of salmon-fry in river waters. Let us hope, if new ground is to be broken, as suggested in this paper, that the Celt or the Saxon may not be last in the race.

Piscator.

January, 1870.

CORRESPONDENCE.

RAILWAY AXLE FRACTURE.

Sir,—Mr. Reveley is quite sound in his criticism on my paper on axle breakage. It does not exhaust all the manifold defects of railway mechanism, but this could scarcely be done in three pages of the *Journal*. That I have not overlooked them may be gathered from many previous publications of mine. With regard to the brakes applied to the radial wagon, they are suspended from the horizontal axle guards, a block to each wheel, taking off thus the torsional strains on the axle, caused by the use of one brake, and the body is thus free from all jar. The brakes are self-acting by gravitation levers, the normal condition being for the blocks to be pressing on the wheels when not lifted off, which is done by a cord passing over the tops of the vehicles and descending in bights to take every lever, with sheeve action reducing the lifting weight. The levers are hinged, to permit free radial movement of the wheels. The guard at one end of the train, or the driver at the other, or both, lift all the brakes, when starting, by their winches, and drop them when stopping. And in case of an accident, such as a coupling breaking away on an incline, all the blocks are released by self-action, and press instantly on the wheels before such action can take place, and on both halves of the train, calling the driver's attention; thus every wheel has a block, and any number of carriages can be stopped in the same space as a single one. It is really the block system, not of running, but of material stoppage, supplied to the trains.

With regard to the wheels or curves, to compensato for the different lengths of rails, I use loose wheels, either in the ordinary mode, or by making every wheel serve as an axle at the periphery, by allowing a spring tire to slip round on it as a friction cluted, yielding to every required movement.—I am, &c.,

W. Bridges Adams.

GENERAL LIFE-BOAT SYSTEM.

Sir,—It is not a little satisfactory to find that my advocacy of the above, as conveyed in my letter published

in your *Journal* of 6th May last, has found some acceptance, especially on the part of shipowners, and I thank "F. D. L." for his letter on the subject in your *Journal* of 8th instant. There is, however, a slight error on his part in mentioning "tin" as a suitable material for air-casings. It would be cheap enough, but it would be by no means reliable, as it would quickly decay from rust. Zinc would be very little more expensive, and could be depended on, for the inside air-tight lining of the wood casings, bow and stern, which would be also air-tight. "F. D. L." speaks as a shipowner, and is quite right in mentioning the liability of boats suspended in the davits in a hot sun to open out and be unseaworthy; but it should be borne in mind that my proposal to have all boats made safe includes the boats of poor fishermen, which are constantly in the water, and always, in consequence, water-tight; and as those fishermen are often so poor in means, I have studied, and practically carried out, perfect safety with cheapness. I have experimented with the plain zinc case, with cork cuttings in bags, and, finally, with plain wood cases, built into bow and stern, and I hesitate not to state that the latter answers the required purpose most efficiently. About a month since, having just finished the boat casings, I called in the aid of several sturdy fishermen to prove them. The boat, 16 feet long only, when full of water, was buoyant and manageable with eight heavy men, and it only took two minutes for one man with a bucket to clear the boat of all water. The casings are small, and by no means in the way; they add to the strength of the boat. I sincerely trust that we may, ere long, have a short Act of the legislature, enforcing a system of safe boats. Without the aid of Parliament it will be a hopeless task, for, as the old saying has it, "man thinks all men mortal but himself," so each fisherman or boatman thinks or believes, as he pushes off afloat in his frail bark, "If any one is to come to grief, oh! it wont be me;" and it is only when too late, and beyond all help, that they regret their obstinacy in not providing against sudden danger. There is one other strong plea for government enforcing a safe-boat system round our coasts. Of all those tens of thousands of persons who at this season resort to the sea-side for health, &c., scarcely one per cent. knows anything of a boat; it is enough for them if a boat is gaudily painted and fast-looking; and the wonder is that more accidents do not happen; as it is, each year we have an unfailing crop of disasters. Scarcely a day or week passes without the words "fatal boat accident" meeting our eye in the public journals. And I would put the question, in all earnestness, "Ought such to be allowed, when it might so easily be prevented?"—I am, &c., Joseph Acheson.

Beachfield, Totton, July 12, 1870.

THE EARL OF MALMESBURY ON SPELLING REFORM.

Sir,—The following passage, from the Malmesbury correspondence, just published, will be of interest to the friends of spelling reform, as showing that the absurdity of the present orthography is drawing the attention of persons of influence, Mr. Gladstone, J. Stuart Mill, Professor Max Muller, with several other names of note, having of late expressed themselves to the same effect.

Commenting on the use of *redde*, for the past tense "read," by a Mrs. Harris, Lord Malmesbury remarks:—"'Redde' is used in the original of all the letters of this date, and so it was spelt in the days of Shakespeare, and during most part of the last century. The Civil Service Commissioners, who govern the future career of our youths by their decisions, would spin the candidate who dared to write *redde* for 'read.' Such is the extreme importance which they attach to modern orthography, that it would seem to outweigh moral and physical gifts; and yet spelling has been the most arbitrary of fashions. There is not one Prime Minister, from Lord Bute down to Lord Palmerston, whose autograph letters, which I have seen, would not have been plucked before that tribunal." If this is true, how absurd it is to impose upon children of tender age, in elementary schools, a burden which even Prime Ministers are unable to bear.—I am, &c., E. Jones.

Liverpool.

ASSAM AND ITS PROSPECTS.

Sir,—Assam is the most favourably-circumstanced province of our eastern empire, to demonstrate the advantages of a combination of inland navigation, being traversed in its whole length by one of the largest rivers of Asia, and subject to periodical floods greater in extent and duration than those of any other region over which the monsoon passes. The richness and extraordinary depth of its alluvial soils are adapted for the culture of all the products of India, besides the teas and other productions of China. Notwithstanding, it is the most backward region of India, the roads, generally, mere tracks through jungle, leading to wretched villages of wood huts, of such flimsy construction that an hour's storm or flood would dismantle, or a fire utterly destroy. There is only one substantial town in the province, Gowhatty, on the Brahmapootra, 400 miles from the sea, a situation of wondrous natural beauty, and of incomparable commercial fitness as an inland port and entrepôt. No cultivation to be seen through the greater part of the country, except in small patches, far apart, on the banks of streams, or won from the matted luxuriance of primeval forests. Public works there are indeed, though on too limited a scale of employment as yet to demonstrate their advantage by any marked increase of revenue. Immigration and labour are the chief requirements for improvement and progress; hearty encouragement to capitalists and enterprising settlers from without and from within, the adoption of a firm and consistent discipline of industry towards the native population, who spontaneously concede to us the prestige of superiority, and thus furnish the ready opportunity of rescuing them from that intense indolence which adds to the sensual sloth of the brute an intellectual depravity as disgustingly mean as it is degradingly vicious. The first step in the education of adults in India is the implanting of industry; and Christian instruction without this preliminary is unabiding, and progress in civilisation impracticable. The imposition of the land-tax in Assam, graduated according to circumstances, but in no case remitted, would instigate exertions and create forecast; and every fair facility should be afforded to immigrants for entering into labour contracts, and enforcing their fulfilment. Cure the Hindoos or the Assamese of their idleness and improvidence, and you rescue them from the terrible periodical famines, or at least considerably diminish the severity of their effects.

The relative position of Assam to the populous regions of the interior of eastern Asia is likewise a very important element in its progress to prosperity. The valley of the Brahmapootra is the shortest and most economical outlet for the trade of south-west China and Thibet; and it remains for engineering science to aid the enterprise of discovery, by rendering practicable for mercantile transit the route through the mountain barriers, or by the southern flank of the mountain chain. It is erroneous to imagine that the wild hill tribes would be obstructive. They are not unfriendly when frankly treated, and might be easily controlled, or their hostility neutralised, by the subsidised alliance of a dominant tribe. The great obstacle lies in the jealousy and covetous exactions of the mandarins of Setchuen and Yunnan, in their endeavours to exclude all foreign merchants. The city of Taisan-loo, in Setchuen, near the Thibetan frontier, is only a huge Chinese custom-house, to force their exclusive dealing on the Thibetans, and shut out all foreign merchants. Many of the Chinese merchants themselves, and a majority of the llamas, and merchants, and in-

fluential persons in Thibet, are favourable to opening trade with India. The latter especially are impatient under the system of Chinese extortion, and a very little encouragement from without may induce them to cast off the galling yoke. The astute and supple Chinese have always overmatched them in diplomacy, though their inferiors in war.

There are two great levers, not yet put into effective action, to remove the impediments of trade with the interior of China from our north-east frontier. The Viceroy at Calcutta holds the one, and our plenipotentiary and superintendent of trade at Pekin holds the other. Inland restrictions must, sooner or later, be withdrawn, as they have been on the maritime border; and trade once emancipated, one remarkable effect would be immediately apparent. The direction of the Assam tea trade would be reversed; the Thibetans and their Tartar dependents, who now get an inferior commodity at an exorbitant price from their Chinese rulers, would get their supply from Assam, and even the Chinese of Setchuen would avail themselves of the great opportunity. It reads strangely, sending tea to China (coals to Newcastle), but I believe my statement will prove true.—I am, &c., R. Langford Locke.

Suddya, Upper Assam, May 27, 1870.

NEW BOOKS.

Peach Culture. By James Alexander Fulton, Dover, Delaware. Price 7s. 6d. (Trübner and Co., Paternoster-row.)

The Practical Distiller. By M. la Fayette Byrn, M D., Graduate of the University of New York. Price 7s. 6d. (Trübner and Co.)

The American Botanist and Florist. By Alphonso Wood, A.M. Price 12s. (Trübner and Co.)

The Laws of Magnitude. By Francis Guthrie, LL.B. (U.S.), Lond., Professor of Mathematics at Graaff Reinate College, Cape Colony. Price 12s. (Trübner and Co.)

In the Press.

A Practical Treatise on the Manufacture of Soaps. By Campbell Morfit, M.D., F.C.S., formerly Professor of Technological Chemistry in the University of Maryland. (Trübner and Co.)

The Geography of Ancient India. By Alexander Cunningham, Major-General, Royal Engineers (Bengal, retired). (Trübner and Co.)

Scientific Results of a Journey in Brazil. By Louis Agassiz and his Travelling Companions.

Geology and Physical Geography of Brazil. By C. F. Hart, Professor of Geology in Cornell University.

GENERAL NOTES.

Lifting of a Steam Tug.—The operations for lifting the steam-tug *Brother Jonathan* (sunk off the George's Basin, Liverpool), by submarine balloons is progressing, so far, favourably. The first balloon was submerged on Thursday afternoon, placed under the deck, fastened, by means of a gripper, to the kelson, and successfully inflated—a result which was recorded by three hearty cheers. There are several other balloons to be fixed, some inside, some outside the vessel. The day when the attempt will be made to lift the vessel will be publicly announced. The balloons are made of airproof and waterproof rubber cloth, shaped like balloons, and covered with strong rope network, to which the lifting attachments are made. The mode of inflation is very ingenious. Metal cylinders, fitted with pipes and valves communicating with the mouths of the balloons, are charged with zinc filings and sulphuric acid. They are then lowered into the water, the opening of the valves allows the zinc particles to fall into the acid, hydrogen gas (so much lighter than common air) is rapidly evolved and conducted to the interior of the balloons. When inflation is complete, a stop-cock shuts the gas securely in the balloons, aided by the pressure of the surrounding water. The services of a diver are required in the process of inflation.

Revenue of France.—The returns of the receipts from indirect taxation, for the first quarter of the year, are very satisfactory, as will be seen by a comparison of the totals for the same period for three years:—

	Francs.
1868, January to March	298,269,000
1869 „ „	308,436,000
1870 „ „	320,072,000

Compared with 1868, almost every item in the list shows an increase in favour of the present year; compared with last year, we find important augmentations in the receipts from stamps, general imports, sugar from French colonies, fermented liquors, an increase of £213,480 on home-made sugar, tobacco; post-office and transit of letters more than £40,000; while the items showing a falling off are:—Registration and mortgage dues, nearly £40,000; foreign sugar, £28,760; and a few others of small amount.

Artistic Products of France.—The opinion seems to be growing in France that the importations of productions in which art enters does not keep pace with that of ordinary manufactures, and official documents seem to support that opinion. It appears that, while the total exports of France rose from 1,893,000,000 of francs in 1836 to 2,789,000,900 in 1868, those of productions in which art entered fell from 652,000,000 to 584,000,000. Everything, it is said, shows that since the Great Exhibition of 1851, and especially since 1856, foreign nations have made great strides, and have succeeded in diminishing the superiority of French art-manufactures. The exports of metal work, including silvered and gilt bronze, suffered a diminution in value to the amount of 15,000,000 of francs between 1856 and 1868. The group of jewellery, goldsmiths' work, and clocks exhibits an increase of 16,000,000 since 1847, nearly the whole of which was in jewellery, the other items exhibiting little or no progress. Furniture shows an increase of 10,000,000 in the same period, small wares and musical instruments about 4,000,000 each, and carriages not more than 2,000,000. In the group of *articles de Paris*, there has been an increase of only 23,000,000 of francs in the twenty years, divided as follows:—Perfumery, 7,000,000; artificial flowers, 6,000,000; paper hangings, 4,000,000; fancy articles, 2,000,000; mathematical and philosophical instruments, 2,000,000; and engravings and lithographs, below half a million.

Pure Gas.—Mr. Magnus Ohren, in his inaugural address to the British Association of Gas Managers, speaking of the quality of gas, said:—Gas can be made practically free from impurities, and it is but right that the consuming public should have pure gas to burn, especially now that chemical science has shown us the way to free our gas from those impurities which, 30 years ago, we supplied with the gas, because we had not then the knowledge required to grapple with those difficulties. About that time, with gas at 10s. per 1,000 cubic feet, I remember perfectly well, when testing the gas for sulphuretted hydrogen by means of acetate of lead—the only test for sulphur known to gas engineers of that day—I often found the test of a shade which, if found in the gas of the present day, would make Dr. Letheby's hair stand on end with horror at the amount of impurity. Mind, I am giving you my experience of 30 years ago, when I was a pupil of the engineer of one of the London gas companies. Chemical science has, however, made vast strides since then, and the case is very different in the present day. Gas can now be, and should be, sent out to the public free from visible sulphuretted hydrogen and ammonia; and, further, no well-regulated gas establishment should now send out gas of a less illuminating power than 12 standard sperm candles, burning 120 grains, when compared with 5 feet of gas burnt through the Letheby London burner, nor less than 13½ candles burnt through the gas referees' or Sugg's new "London" burner, and I believe the consumers have no cause to complain that this is not done.

Finance Accounts of Victoria.—The finance accounts of the colony of Victoria show an estimated expenditure in 1870 of nearly £3,500,000. In examining the mode of raising this large amount, only about one million and a half sterling is to be regarded as derived from the taxation of the people; that sum is produced almost entirely by the Customs' duties, the Excise duties being of very small amount. The remainder of the income comes from public works, such as railways and water supply, from the sale and rent of Crown lands, from postage, fees, fines, forfeitures, licences, and other sources for which a direct return is given for the money paid. The national debt, which has been incurred for the construction of railways, waterworks, and other extensive and reproductive undertakings, amounts, in round numbers, to £12,000,000. For the interest and extinction of the principal of this debt the colony pays annually no less a sum than £938,890. The other principal items of expenditure are—public works, including railways, waterworks, the postal and telegraphic service, roads and bridges, &c., £1,038,174; education, including industrial schools, £230,179; arts and sciences, £39,673; police, £203,762; gaols, £25,790; penal establishments, £32,305; medical services and stores, £9,061; charitable institution, £189,193; the administration of justice, £142,410; immigration, £73,488; border duties refunded to New South Wales, £60,000; the Governor and the various legislative and administrative departments, £308,000; defences, 73,530; and state aid to religion, £47,000, leaving about £80,000, to be divided among other services, which it would be tedious to enumerate. It will thus be seen that there is annually spent, in adding to the assets of the colony—by the construction of public works, in the education of the people, and in the care of the poor, the sick, and the infirm, a sum fully equal to that raised by actual taxation, while close upon another million is devoted to paying the interest and cancelling the capital of the national debt.

The Wages of Foreign Workmen.—The *Saturday Review*, in noticing Mr. Ford's report on the condition of the labouring classes in foreign countries, gives the following:—Mr. Ford's elaborate statistics will be read by this class with curiosity and advantage. From these we learn that, in the carding department of cotton manufactures, the workman who in England would receive £1 7s. per week, receives £2 10s. 3d. in America; the grinder receives £1 6s. 9d., in lieu of 19s. 6d.; the weaving overseer, £2 9s. 7d., in lieu of £2 5s.; and that in certain departments of the woollen manufacture, where £1 10s. or £2 is paid in England, £2 18s. 9d. is paid in America; where £1 10s. is paid in England, £2 17s. 11d. is paid in America. On the other hand, in both these manufactures, certain departments of work are paid less than in England; *e.g.*, in America, brushers get only 15s. 3d., whereas in England they get from £1 1s. to £1 3s. 6d.; and warpers get only 19s. 6d., against the English wage of £1 2s. In iron-rolling, the American puddler gets £3 6s., to the £1 12s. of his English rival; the puddler's helper, £1 18s., to the 15s. of the Englishman. The American blacksmith, £2 1s. 10d., to the £1 12s. of the Englishman. On the other hand, the American furnaceman gets only £1 14s., where the Englishman gets £3 or £3 12s. In the iron founderies, American moulders get £2 6s., where English moulders get only £1 12s.; and American engineers, £2 5s., to the £1 of their English compeers. In hardware manufactures, moulders earn about the same wages as in England; furnace tenders, £1 11s., whereas they would only get 15s. in England; machinists, £2 12s., £1 5s. being the English wages; pattern-makers, £2 11s., in comparison with the English wage of £1 12s. In paper-mills, the wages of the American finisher are £1 16s., while those of the English finisher are from 12s. to 18s.; the American millwright gets £2 14s. 3d., where the English one gets only £1 2s. In the shipbuilding trade, where the English shipwright receives only £1 5s., the American gets £2 11s.; and where the English painter gets £1 4s., the American gets £2 2s. It ought, however, to be remembered that, while wages are high, living is also dear. Clothing is costly, and tenement-houses, where the unskilled artisans of the cities must live at first, are gloomy, comfortless, and unhealthy. After all, the wages are sufficiently high to enable workmen to save enough for their transport westward. The western—the most western—states are the ultimate goal of the thrifty and ambitious mechanic. California is the seventh heaven of the working man's paradise, *i.e.*, if the enjoyments of a paradise may be measured by money payments. Here, bricklayers get from 18s. to £1 4s. a day; blacksmith's helpers, 8s. to 10s. a day; brush and broom makers, "£15 a month and found;" coachmen, "£7 to £10 a month and found;" carriage builders, 14s. to 16s. a day, farm labourers, "£6 a month and found in winter, £8 a month and found in summer;" gas-fitters, 14s. to 18s. a day; gardeners, "£6 to £8 a month and found;" miners, "8s. to 14s. a day and found;" quarrymen, 10s. a day; sawyers, "£8 to £20 a month and found;" waiters, "£4 to £8 a month and found."

Fresh Meat Preservation.—The following is extracted from a circular issued by Professor Gamgee:—"For the benefit of those unacquainted with our process, we may state that the animals slaughtered have to be selected in good condition, and free from injuries or bruises. When dogs are allowed to bite and lacerate the flesh of sheep, or when bullocks are gored or contused in railway trucks, the parts injured and inflamed very frequently putrefy, notwithstanding every precaution in the preservative process. Not only is this a great guarantee that meats preserved are of good and wholesome quality, but it shows how important it is to attend to the humane treatment of animals that are to serve as human food. The causes of failure, which, with increased experience, we have learned to eliminate, are, imperfect setting of the meat (especially in hot weather), the non-penetration of the preservative gases to the deepest parts of the meat, and an excess of moisture. Once thoroughly understood, the result obtained in one instance can always be relied on. In 1868 and 1869, several parcels of meat were shipped across the Atlantic, and even to New Orleans, and reached their destination in excellent condition, though simply protected by cloths, and packed in bulk in deal packing-cases. On two occasions, in the winter of 1868-69, the meat became slightly mouldy, owing to the small amount of moisture lost by it in the intensely cold weather during which it was in the preserving chamber. The same enemy, mould, has interfered with shipments from Ohio, during the past winter; but a parcel of eleven sheep arrived in London in a perfect state of preservation, on the 29th April, after having been no less than 31 days on the way, enclosed in a common packing-case. Being asked, in the month of January last, to provide samples for shipment to the East and West Indies and Australia, we resolved, from the success with which salted meats have been transported from the antipodes in tallow, to adopt this plan. Tallow was prepared with great care, and by a process which undoubtedly tends to render it but slightly liable to decomposition. Boxes and casks were used in which to transport this tallow-packed meat; but notwithstanding repeated trials, every sample failed to keep. We were, therefore, compelled to turn our attention to other modes of packing. The greatest success has attended the packing of meats in metal cylinders. For trade purposes, special arrangements will have to be made on board vessels, since wooden compartments can be erected gas and water tight, and the meat therein packed as in our preserving chambers. In these it can be kept for an almost indefinite length of time. It is necessary to protect the preserved meat from salt-water, which not only affects its flavour, but destroys it. For ships' purposes, and as a substitute for the troublesome and expensive plan of carrying live stock on board, we can rely on hanging the meat in the store-room, with the simple protection of a cloth covering."

Journal of the Society of Arts.

FRIDAY, JULY 29, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON FERMENTATION.

By Professor A. W. Williamson, F.R.S.

Lecture I.—Delivered Monday, April 25th, 1870.

I have sometimes wished, when building castles in the air, that I could, after a few hundred years, come back and see the state of science at that time. I am convinced that those who will look back, from such a period as a few hundred years hence, at the present state of our knowledge of nature, in any one department, will be surprised at its smallness; in fact, even now, when we work at all earnestly at any one part of the field of nature, we cannot refrain from feeling how little is our knowledge compared with our ignorance. But, if that is generally the case, I think it is peculiarly the case in those studies in which life is concerned; and the phenomena of fermentation have that peculiarity that they consist of processes in which vital organisms are concerned, and in which there is every reason to believe that vital organisms, or living beings, take an active and leading part. I need not say that, for that reason, the explanations which we have, even of the simplest and best known of the phenomena of fermentation, are, as yet, mere sketches of the reality. It is, however, not the less useful or the less important to know them for that reason.

When we chemists are classifying substances, we adopt a principle of classification which I think is almost inevitable, but it may be as well that I should mention what it is. We put the simple things together, and the complex or difficult things together, and then we try to put between them, in as regular an order as possible, the intermediate links of the chain by which they can be connected; and I believe that our best—I might almost say our only—explanations consist in thus arranging, in a natural order, the facts which we have to consider, and then viewing them, and stating what we see, in the clearest and least ambiguous terms. Now, the term "organic," as applied to a certain class of chemical substances, might be replaced—and I think, for some purposes, ought to be replaced—by the term "complex." The substances which we are in the habit of including under the term organic are peculiarly complex; in fact, they are the most complex with which we have to do. The phenomena of fermentation relate mainly to them, and consist principally of a process of change—the breaking-up of those organic bodies into rather less complex substances than themselves—a process of partial analysis. Of course, when I say that, I give what I conceive to be a characteristic idea of the general method, and I must not be supposed to assert that all processes of fermentation are analytical.

Amongst the characteristics which, I think, are particularly useful and interesting, as serving to distinguish organic from inorganic, complex from simple substances, is their different behaviour under heat. I have found it exceedingly interesting and instructive to bear in mind the fact that while simple and inorganic compounds, as we generally call them, are sometimes destroyed and resolved into other compounds by the action of a high temperature, yet many of them are not. Amongst inorganic substances we find some which are broken up or changed by exposure to a high temperature, but there are others which can stand even the highest temperature without undergoing any permanent change, that is to say, they return, on cooling, to the same state in which they were before the heat was applied. With organic substances that is not the case. All organic bodies are broken up into minute particles, and assume new arrangements, when they are heated to a sufficiently high temperature; and that is, I think, a distinction which is of considerable theoretical as well as, perhaps, of some practical importance.

The processes of breaking up which are effected by heat upon organic bodies are, in the very great majority of cases, different from those which are effected by the action of these wonderful little organisms, the ferments; and it is a peculiarity of the action of the ferments that they effect the breaking up—the analysis—of complex organic substances, and form products which, for the most part, we have obtained from those materials by no other process.

Amongst the processes of fermentation, there is one which, from its pre-eminent importance, and from the fact that we have had occasion to study it more fully than any other, ought to be first mentioned. I allude to the process of fermentation by which alcohol is formed artificially. I may say, indeed, it is the only process by which alcohol is ever made. It is a process which consists in breaking up some kind of sugar, for sugar is a word which, although popularly restricted to one particular substance, which is extracted sometimes from the sugar-cane and sometimes from beet-root, is used by chemists in a more general sense, serving to characterise a family of bodies which have much in common with one another, being for the most part all of them sweet, and containing the same elements, but in slightly different proportions. They all possess many properties which are of some importance. These different kinds of sugar are broken up by the action of ferment into alcohol, and also into another product, carbonic acid gas, which has been long known, and for a long time the process of alcoholic fermentation was supposed to consist simply in a separation of sugar into these two products, alcohol on the one hand and carbonic acid on the other. A more careful examination of the products has shown, however, that these two never appear alone. I believe I may safely say, from the researches of Pasteur and others, that no case of the formation of alcohol by fermentation has been known to occur in which several other products have not been formed simultaneously with these two. With regard to the difference of properties of these two bodies, there are one or two points of some little interest, especially this one, that whereas alcohol is an eminently combustible substance, and is well known to have properties of that kind, being frequently used as fuel, on the other hand, carbonic acid, the other chief product, is completely burnt—it is a substance incapable of undergoing any chemical change whatever analogous to combustion. Alcohol is a substance which I need not show you, although in its pure state it is not very common, but I will, in order to remind those of you who may be less familiar with its leading properties, make a little carbonic acid by a short process. I will put a little muriatic acid upon some white marble,

and the apparent ebullition which you see takes place is known to you all as due to the liberation of carbonic acid. You might imagine the thing to be fermenting, only that the process in that case would be less rapid. Now, if I plunge this little burning paper gradually into the jar containing the carbonic acid, it will burn more and more faintly, and get extinguished when it enters the gas; it is totally impossible to set fire to the gas. And there is one other fact that we may notice at the same time—the great specific gravity which characterises this gas. I will show you that, in this way. I will go through the motion of pouring from this jar containing it into another smaller jar, and no doubt the heavy carbonic acid will pass from the jar in which I first collected it into the lower one, where we shall find it by means of the taper as before. You see that, on lowering the lighted taper into this small jar it is extinguished as it was before. I will show you the test by which we usually discover the presence of carbonic acid. I have here some water containing lime in solution—some lime water—and I will pour it into the large beaker glass, in which there is probably still some carbonic acid left. You see the solution immediately becomes turbid, or, as we express it, a precipitate is formed by the combination of the carbonic acid with the lime water. A compound is formed, which is nearly insoluble in the water, called carbonate, which goes down as a precipitate.

In addition to alcohol and carbonic acid, I ought to mention another kind of alcohol, which occurs to a considerable extent in some distilleries where raw grain or potatoe starch is used. This substance imparts to the product a very unpleasant odour, and some unwholesome qualities. It is known by the name of fousel oil. It does not mix with water, and if I were to pour some of it on water it would float, without dissolving to any considerable extent. There are some other products which are even more interesting and important; two especially I ought to mention. One is the clear substance which you see in this bottle, and which you might imagine to be oil; it is a fluid largely made now, and known by the name of glycerine, but in chemical language I should say that this was an alcohol. It is a substance which, by tasting, you might mistake for sugar, for it possesses a sweet taste, resembling sugar, but, to chemists, it is a kind of alcohol, and its appearance during fermentation together with ordinary alcohol is no doubt due to a process of the normal kind.

Another product which I might compare to the carbonic acid which I just now showed you, is this beautiful crystalline acid substance, which has been long known by the name of succinic acid. It got that name from the fact that it was originally prepared from amber. By subjecting the amber to dry distillation, succinic acid, among other products, is formed. Glycerine and succinic acid, as well as common alcohol and carbonic acid, are always formed when any kind of sugar is made to decompose by the process which is termed alcoholic fermentation, and it is seldom that there are not other —and probably, in smaller quantities, several other—products formed besides those four. In fact, the different kinds of spirit which are obtained by the process of fermentation and subsequent distillation—I mean those kinds of spirit to which no artificial flavouring material is added (gin is a general name given to certain spirits which are flavoured by artificial means) such as brandy, rum, and others—owe their distinctive peculiarities to the presence of small quantities of volatile substances which are formed during the process of fermentation, regarding which a good deal has been observed, and several important facts have been collected.

There is another process of fermentation which I must mention, for it is important from its frequent occurrence, and that is a process by which another kind of sugar usually, but sometimes common sugar, is transformed. The substance which most naturally undergoes this fermentation is milk-sugar. These hard lumps in this bottle, which, if you were to take out and taste, you would not imagine to be sugar, are made by the crystallisation of the solid substance in whey. The whey is evaporated carefully to a small bulk, and this substance which results is known by the name of milk-sugar. When a solution of this is mixed with cheese, which is the best ferment for the purpose, it gradually turns acid. I dare say it is known to all of you that milk itself, which contains this body, and cheese, or rather caseine dissolved with it, together with the fatty globules of milk, when exposed to the air, turns acid. That acidity is due to a change which takes place in the sugar. The sugar disappears gradually, and is transformed into an acid substance, of which I have a little bottle here. It is a strong acid, and here in another bottle are a few of its salts—a lime salt and a zinc salt, which is a very beautiful and characteristic compound. I shall have occasion hereafter to show you a large bottle which is now at work, in which I dissolved, not this particular kind of sugar, but the ordinary sugar. I put with it a quantity of calcic carbonate, and some old, lean cheese, with a considerable quantity of water. The mixture was kept at a temperature above blood heat for some considerable time, and a compound of lactic acid is being formed. That is a process analogous in its general features to the fermentation which forms alcohol, but it is a change of sugar, in which no alcohol is formed. Sometimes there is a trace of alcohol, but there is not necessarily any, and no carbonic acid is formed; but instead of those products, the elements of the sugar break up into different groups, and arrange themselves in another manner. That is really the nature of the process, as far as our most careful experiments have gone, and the acid which we make in that way, which is lactic acid, or acid of milk, is really sugar, of which the elements are arranged in a different way, so as to acquire acid properties.

The third process, which I must mention from its remarkable products, is one which, perhaps, in some respects ought rather to be compared with putrefaction, for it is a process which has many of the most important characteristics of putrefaction. In order to deal with the question of fermentation generally, it is necessary to allude to some varieties of such chemical changes which are usually classed under the term putrefaction. As a general rule, I think the characteristic of processes of putrefaction is mainly the unpleasant nature of the products which are formed. It is not long since a distinguished chemist, in speaking of alcoholic fermentation, said that it is really a putrefactive process; and in its intimate nature it is, as far as we know, a process much like the truly putrefactive processes, and different from the processes of eremacausis or oxidation. This other process to which I allude consists in forming the acid substance which I have here, and which I will not open, because it is not a very pleasant body. It is a substance which is known, although I believe not very commonly, in butter. The peculiar rancid odour which butter acquires when it is kept too long, especially in warm weather, is due to a transformation of some of its materials into this particular acid, which Chevreul, a very distinguished French chemist, separated from butter, and he named it from that circumstance butyric acid. If we leave some of this product of the last fermentation—some of this lactate of lime, the lime salt of lactic acid—under the same conditions in which it was formed, that is, if we leave it in the same vessel in which it had been formed from the milk or sugar, and leave cheese with it, and keep the mixture warm, the lactate will gradually decompose, and carbonic acid will be given off together with hydrogen gas, and at the same time we find that the lactic acid will be decomposed, and in place of it we get this butyric acid, and generally some valerianic acid, and a little acetic acid.

Amongst the processes which really are analogous to fermentation in their nature, but which differ in one particular, I must mention one other, the process of

forming vinegar, or acetic acid. This large bottle contains vinegar in a form which most of you, I dare say, have not seen. These fine white crystals are the pure substance which, mixed with water in an impure state, are generally known by the trivial name of vinegar. We call that acetic acid, or hydric acetate. The formation of this body from alcohol represents a variety of fermentation, which is of considerable importance and of frequent occurrence. Everybody who has noticed the process which takes place when animal or vegetable matter is left to itself in contact with air, especially in moist localities, must have observed that there is a gradual disappearance of the organic matter. For instance, if you leave a piece of wood in a moist place, under certain conditions of very frequent occurrence which are favourable to this process, the wood gradually gets soft, and becomes transformed into a brown substance, and if you leave it long enough—in this country, several years generally would be needed for this purpose—it gradually disappears. If you were to put a piece of that decomposing wood into a closed glass vessel, and examine the air above it, you would find that the wood was really burning. I am using the word combustion in the ordinary chemical sense—I mean by that word that the oxygen of the air which you have enclosed with the wood is being taken up by the wood, and the products of combustion, carbonic acid and water, are being formed from the substance of the wood. One great class of the processes of fermentation is of that kind. They consist not in a mere breaking up of the materials already contained in the organic substance, but a change of their arrangements, which is due, more or less, to the absorption of oxygen, and this formation of acetic acid, or vinegar, is a case of that kind. In fact, if we were to leave some ordinary fermented wort in an open vessel, so that the alcohol were left there in the mixture in which it had been formed, we should find that the alcohol would gradually disappear, and give place to an acid substance. The process is well known to wine-makers and to brewers, and their art consists, amongst other things, in the avoidance of this process of the oxydation of their alcohol. While the acetic acid is being formed, oxygen from the air is taken up, and in that respect this process of acetic fermentation differs from the other three processes of fermentation which I have described. When you make alcohol and carbonic acid from sugar, the air takes no part in the process; when you make lactic acid from the sugar, the air is not wanted; and when you make butyric acid from lactic acid, then again the air may be completely excluded, and the process will go on without it. But when you make acetic acid from alcohol, you must of necessity allow the free and continuous access of air, and the air gives up some of its oxygen to this fermenting alcohol, to transform it into acetic acid and water by a true process of fermentation.

Now, the question arises whether this formation of acetic acid ought to be classed, as I am at present classing it, amongst the processes of fermentation. If it is due to the absorption of oxygen, you might naturally inquire whether one ought not to place it amongst the common processes of combustion, and it is right that I should state that by some authorities it is at present so classed. My reason, however, for stating what I have done, that it is a process of fermentation, is this, that it is usually effected by the action of a peculiar organism, called the vinegar-plant, an organism which I shall have occasion to show you hereafter, which does exert in that particular process the function of taking up oxygen from the air, and of inducing the alcohol to combine with it. There are many other processes by which we could get it, but the actual process by which we do get it is a process in which this vital organism, the vinegar-plant, is the agent of its formation. It might be made by mere processes of combustion, but it is made by a process of fermentation.

There is one singular feature in the first and best known of these processes—the alcoholic fermentation—which you will notice when I tell you something of the way in which the processes of fermentation present themselves, even without very great care on the part of the observer. If, for instance, you were to express the juice of some sweet fruit—say grapes—and if you were to leave that expressed juice in contact with the air for a little time, having first squeezed it through some suitable cloth or filter, so as to have it clear, of course there would be no solid particles in it when you put it aside; but, if you leave that in a tolerably warm place, in contact with the air, you would find that little solid particles would appear in this juice, that they increase in number, and that, in proportion as they increase in number, and as the quantity of them becomes greater, so does the process of effervescence—the evolution of gas from the grape juice—become more and more rapid. These little solid particles, which are not present at first in the grape juice, but which gradually make their appearance when it is exposed to the air, are what we commonly call, in the ordinary case of alcoholic fermentation, in this country, yeast—either beer yeast or wine yeast; it is the same organism in each case. The peculiarity of the process is this, that these substances—this yeast—which seems to make the sugar into those products which I enumerated to you, does not disappear while doing the work, but is produced by the very process. The more active the production of these yeast cells, and the more speedy the growth of these yeast cells, the more effective and rapid is the process of fermentation, and no fermentation of the kind which I am speaking of at present—the alcoholic fermentation—has ever been known to take place in the absence of these organisms. That circumstance I just mention briefly at present, but the fact that these yeast cells appear whenever the process is going on—and the more they grow the more rapid is the fermentation—has led people to suppose at first, and to believe afterwards, that these yeast cells were the agents of the transformation, the active substances which decomposed the sugar in contact with the water, and induced the transformation which we noticed. Now, the very fact that one of the two substances which are reacting upon one another chemically (because the changes are chemical in their fundamental nature), should not disappear, but should rather increase by the process, is entirely anomalous—it is entirely at variance with the simplest and best known facts of chemistry, so much so, that if it were not established upon incontrovertible evidence, I believe that most chemists would be inclined to disbelieve it, and to say it cannot be,—it is impossible,—it is a mistake. If you tell me, as a chemist, that this yeast is transforming sugar by its action on the sugar, and that instead of being consumed the yeast is actually increased in quantity by doing that work, I should say it is nonsense—it cannot be, because in all the cases of chemical action which I know best, nothing of the kind occurs, but the very opposite. When one substance acts upon another, each one disappears in the process, and is transformed into a product having other properties. I need hardly give you illustrations of that; but one or two simple cases may not be useless, as serving to fix clearly this important circumstance in your minds.

I will take at first one of a particularly elementary and simple kind, a process of combustion. I will take a little strip of metal, magnesium wire, and will hold it for a short time in the flame of a spirit lamp, so as to raise it to a sufficiently high temperature. The light you see emitted is due to the combustion of the oxygen in the air with the metal magnesium, which I hold in my hand. This is one of the simplest possible cases of chemical action. The metal has disappeared. The strip of wire is gone, and oxygen from the air disappeared also. At the same time a white powder was formed. I dare say you did not notice it, but here is a quantity of the same substance in a bottle. It consists of oxygen from the air combined with the metal magnesium, and the point is this—that all the magnesium which took

part in that process disappeared and went to form this white powder, and all the oxygen which took part in the process also disappeared. The two united together, each disappeared as such and went to form this new product. And, moreover, we can tell, from an examination of the proportions in which the substances combine, exactly what weight of oxygen would disappear for every part by weight of magnesium. If your burn, for instance, three grammes or three pounds of magnesium, you would require exactly two grammes or two pounds of oxygen. For instance, three pounds weight of magnesium would combine with two pounds weight of oxygen, and the product of the two together would be five pounds in weight. I may show you the same thing with soda, not the substance which is commonly called by that name, which is a carbonate of that base. I have here a little pure soda solution in a bottle. I will pour some into a beaker-glass, and I will show you one property which characterizes it, viz., that of changing the colour of this red paper into blue. Now, I will pour some of this acid body, the oil of vitriol, into another beaker-glass. If I put the paper which has been discoloured into this pure acid, it would be dissolved; but I will dilute some of it with water, and then you will see that paper, which has been rendered blue by the agency I have just used, is brought back again to red by the agency of this acid. Now, if I mix the acid with the soda, we shall have audible evidence of violent action going on. I will not go on with the process, but I have purposely taken the two substances in presence of very little water, in order to show you that the heat evolved makes the liquid boil with great violence. I could have avoided that by adding water in the first place, but I wished to show you the vigour with which they unite together. If I were to go on adding acid to the soda, little by little, feeling my way until I had just completed the action, I should have got some water formed and some of the beautiful salt which I have here, a body which is neither soda nor acid; it is a salt called Glauber salt, or sodic sulphate, and all my materials would have disappeared in the process. If I use them in proper proportions, all the acid and soda would disappear, and go to form these two other products. I might dissolve some of this sulphate in water, and might put red paper or blue into it, and it would not affect either of them; it is perfectly neutral in that respect. The proportions by weight in which this combination takes place is this. If I add 40 parts by weight of soda, and 49 of oil of vitriol in a state of purity, I should have as the result, 18 parts by weight of water, and 71 of sodic sulphate, and if I add together the weight of my materials and the weight of my products, I get the same—89. Nothing disappears in the process; all the acid and all the base which takes part in it is employed. Each particle which took part in the process disappeared as such, and it passed over into another form.

I will mention one other case, because it is somewhat more complex. I may take the case which I was showing you just now, the white marble and hydric chloride, or muriatic acid, which I used for making the carbonic acid gas. In that case, I used two materials, carbonate of lime, as it is commonly called, and hydrochloric acid. We get three products; on the one hand is a salt, which is commonly called chloride of calcium, a solid substance used for drying gases, as it has a great affinity for water; another is water; and the third, as I showed you, carbonic acid gas. There, again, we have precisely the same thing. All the marble and all the hydric chloride which takes part in the formation of those three products disappeared as such, and they resolved themselves into other compounds possessing different properties; but the weight of the products is equal to the weight of the materials. That rule holds good throughout all ordinary cases of chemical action.

On the other hand, in fermentation it is not so; one of the active substances is formed, and the more active the fermentation, the more does it grow. In fact, if you want to get yeast, you must go to a place where the breaking up of sugar into alcohol and carbonic acid is going on; or if it is in the south, you must go to where wine is being made, you go to a wine-maker, and get the yeast from him. The only way of getting yeast is from that process of fermentation which sets in spontaneously under the conditions I named to you.

I ought, however, in justice to the wonderful process which I alluded to, to give you two or three other particulars regarding it. I showed that sugar is broken up by the ferment into these products, but no case is known of pure sugar—and when I say pure sugar, I mean sugar in the purest form in which we have it—being decomposed by yeast. If you were to put some ready-made yeast—thriving, growing, yeast—into a solution of chemically pure sugar, some of your yeast would decompose, some of it would resolve itself into other products, and other parts of it would be absorbing those products which are present in the liquid, and whenever the process is to be carried on advantageously and rapidly, it is customary to add some saccharine liquid—some other substance capable of nourishing the yeast. When I want good fermentation I do not take water to dissolve my sugar, and put yeast into it, but I boil some of this malt, which is one of the best materials for the purpose, in water, and take a decoction of malt, or decoction of yeast, and put the sugar into it. In such a liquid there are several bodies which we know; and I may safely say that there are a great many others which we do not know, and there is no doubt that their presence is of considerable importance to the chemical change which takes place. There are substances which I shall presently have occasion to show you and to speak of, formed by the germination of the grain, by the formation of the malt, which are related somewhat to this body which I have here. This was some pure wheat flour—every kind of flour would not do—and it is supposed that some people mix other materials with flour. It was kneaded up with water, pressed together, and, whilst the pressure was being continued, water was allowed to trickle over it. I have in another bottle some of the water that flowed over it. There is a white substance deposited from this water, which is commonly known and much used by the name of starch, and starch is, in its chemical composition, first cousin to sugar; it is a substance which passes over very readily into a kind of sugar by a process I shall presently have occasion to allude to. But the little ball of flour while being kneaded had the starch washed away from it, and I have left, as the result, a substance which is commonly known by the name of gluten. If I were to describe it in chemical language, I should say it is something like flesh, or tho muscular fibre of animals, for, in chemical composition, it approaches very nearly to that. When barley is malted, and kept in a warm place for some time, the grains begin to germinate and decompose, and some bodies are formed from this gluten, which is partially broken up. The malt contains also some sugar made from that starch—grape sugar, as we usually call it.

If we had only those extreme cases, I really do not know what we should do. If we had in our science one set of bodies which appeared so constantly to act at variance with the general laws which the others obey, I think we could not call chemistry a science. I have taken two or three examples to show you the definite proportions which we find to regulate the ordinary process of combination. I might have taken thousands, but the point is that this law does not appear to apply at all to these chemical changes which we call fermentation. One of the active substances in fermentation is being formed, it is increasing, not disappearing at all, and the contradiction is so strong and manifest that the only way out of the difficulty will be to do something of the kind which I was speaking of some time ago, that is to say, see if we cannot get some intermediate facts which will serve to connect the extreme ones; to see if we cannot

get at first something between the two classes, and then try to get some further links between them. There are processes of chemical change—I will not call them processes of fermentation, for I do not know whether they are, but which are analogous to it, and some of them are very interesting and very beautiful. I have here a substance called amygdalin, made from bitter almonds. It is a bitter tasting substance, and consists of four elements which it is not necessary that I should name. In this other bottle I have a paste formed of sweet almonds, which have been crushed with a pestle and mortar, and I will put some of it into the warm distilled water in this flask. Into the mixture I will put some of this amygdalin. If I were to leave it without that addition, there would be very little change; the substance would gradually subside, but there would be no product given off in the way you will presently see. After letting it stand for a few minutes, I will pour some of the mixture into an open vessel, and we shall be able, without difficulty, to perceive a fragrant smell, which is due to the presence of a liquid of which I have a quantity here, a substance known by the name of oil of bitter almonds. If we were to perform the same experiment on a large scale, and macerate some of this amygdalin with almond paste, put them together with warm water, distil the mixture, and collect what comes over, we should find that water would pass over, and with it would be a few drops of oil of bitter almonds, and the amygdalin would be decomposed in the process. There is in the sweet almond paste a substance which I cannot describe in better terms than by comparing it to that gluten which I showed you just now. It is very similar to it in its composition, and by the contact of this, the synaptase, as it is called, with the amygdalin, the elements of the amygdalin are broken up into several products; one of them is the oil of bitter almonds, another is prussic acid, which generally accompanies the oil, the third is a variety of sugar of the kind which is called grape-sugar, and there is probably also some formic acid. Here we have the breaking-up of a complex body, amygdalin, into several simpler bodies by the action of the body called synaptase; but there is not in the process, as far as I know, any living organism at work. There is a substance which is somewhat similar to these living organisms, but there is no organised structure, as far as our knowledge goes at present.

Take another experiment. I have here something which is not a *blanc mange*, although it looks something like it; it was made by boiling potato starch with water. We let it cool, and then turned it out; some was put into a flask with two or three ounces of crushed malt. It was warmed to a temperature of 60° centigrade for about an hour; there was no boiling. The substance was then squeezed through a cloth to keep back the husks of the malt, and here is the liquid which ran through. It is perfectly liquid, and its consistency is entirely different from that of starch, from which it was made; it is quite sweet to the taste, and there is a large quantity of sugar in it. There is also another body which we class with the sugars; that is, there is in this liquid a good deal of a kind of gum, which we call dextrine, which would easily pass into sugar. The starch, when it was being converted by the action of the malt into those soluble bodies, did not, so far as we know, break up into simpler substances; the process was of a different kind. It assimilated the water—the starch combined with the water, and at the same time divided itself, some of it forming one and some the other product. Here, also, there was not, as far as my knowledge goes, any ferment, or any organised cells in the liquid. If they were present it was an accident, and was not essential to the change which took place. I am the more confident in saying that no ferment was there present, for we can get, and we very often do get, precisely the same formation of starch without any malt at all. If, instead of warming some of that starch with the infusion of malt, I had mixed it with a little—about five per cent.—of that strong sulphuric acid, and had heated it, it would have been dissolved almost like sugar in water. In fact, there are now in Germany, and also in England, manufactories in which starch is converted, by the action of dilute sulphuric acid, into grape sugar, and the same change which we get by organic substances—that is the point—we also get by the action of this mineral acid.

Another change of the same kind I may mention, especially as the subject of it is in itself interesting. I have here a substance which people have been accused of making for the purpose of adulterating quinine. It is made from willow bark, and is believed to possess febrifuge qualities, so that there was some little excuse for what I have mentioned. This substance is called salicine, and when heated with dilute sulphuric acid, in the same way as the starch when so heated was converted into sugar and dextrine, this salicine breaks up in a way which I might compare with that in which some bodies are broken up by fermentation.

Another case of the same kind is afforded by tannin, a substance extracted from gall nuts, and which is present in oak and many other barks. It is used for combining with gelatine, which is the principal constituent in hides, to form leather. If we dissolve this tannin in water, and leave it in an open vessel, it will get mouldy; and if you examined it after some time you would find none of it left. It would all disappear, just like sugar in the process of fermentation, and in place of it you would find, in that particular process, a body which you might easily crystallise out from the liquid, and which I have here; it is called gallic acid. It is a body resembling tannin in some respects, for instance, in the property of forming, in combination with iron, a dark substance, which is used in suspension in water, for writing ink. But it will not do to form leather in combination with gelatine. If you left the tannin in an open vessel, it would decompose, and there would be left gallic acid, and some other material which was formed at the same time would have disappeared. By boiling tannin with dilute acid, we get the process performed more regularly. Upon boiling some tannin with dilute sulphuric acid, you would find that water would be taken up by it, the tannin would combine with water, and it would break up into sugar and gallic acid, the process being exactly like that which I mentioned in the case of salicine. There is a most direct analogy between the process of breaking up which sulphuric acid effects upon tannin and that of fermentation. I ought to say, when telling you of the decomposition of the tannin, that it is effected by little animal organisms present in the liquid, and it appears that they are the agents of the transformation.

Then there are some other processes of considerable importance, from their occurrence in the animal economy—processes which, I believe, must be classed between those experiments which I showed you a little while ago and the process of fermentation—I mean processes which occur in the operation of digestion. I have here a gelatinous solid, which contains a substance called pepsine, which was made by dissolving the inner lining of a pig's stomach in diluted hydrochloric acid at about blood heat. The inner lining of the stomach of that and similar animals is dissolved gradually, and that solution possesses the property of dissolving muscular fibre, white of egg, and other similar substances; it is, in fact, artificial gastric juice, and it would, for instance, dissolve that lump of gluten which I showed you just now—which looked something like india-rubber—and when this pepsine dissolves albumen by digestion, for the process is doubtless of the same kind as that which occurs in the animal economy, it does so by breaking it up into bodies which are no doubt simpler than itself, bodies which we do not know accurately and fully. They are called peptones, for it is common enough to give names to bodies, even before one knows them well. I do not know whether it is a good plan, but it is

customary. These bodies are a good deal similar to those which are present in malt, and in such like mixtures which have undergone vital changes.

Then I will give you one or two other cases of similar processes. Here is a singularly beautiful acid, called hippuric acid, which decomposes with very great readiness if left in the liquids in which it is orignally found. When that organic mixture is exposed to the air it undergoes a process of putrefaction. The general appearances which take place in the liquid while the substance is decomposing would certainly be described by anybody as a putrefactive process, and there is formed by its decomposition some of this other beautiful acid, called benzoic acid, because it was originally obtained from the fragrant gum benzoin. At the same time there are other products given off which decompose. Now, we can by mineral substances effect the same decomposition of that hippuric acid. A German chemist, to whom we owe many researches in these matters, showed, some years ago, that if you boiled hippurie acid with dilute sulphuric acid, it takes up water, and breaks up into benzoic acid, and this crystalline substance, called glycocol, or sugar of glue. It got that name from the circumstance that it was obtained originally from glue by a decomposing action, and it has a sweet taste. It has no analogy to sugar in its nature, but it has that superficial resemblance that it is rather sweet.

This hippuric acid affords another case of a body which is broken up either by putrefaction, or by the action of dilute sulphuric acid. It affords a strong argument, and other cases I have adduced afford, like it, an argument that the action of these organic substances resembles the action of sulphuric acid. If we get the same change in several cases by the action of an organic body as by the action of a mineral body, the fact certainly goes some way towards showing that the two substances must be, in their mode of action, generally alike. There is another case, that of urea, which in contact with water forms a carbonate. That may be done by either class ef re-agent.

There are, however, some chemical processes even simpler than these, and for that reason they are better known to us, which really may be studied with advantage side by side with those I have mentioned, and they will, I think, afford us, on further consideration, a key to the explanation of these processes. I will only mention two. One is a process which is well known in its general features, and it is a process of breaking up truly analogous to those I have mentioned, but a perfectly simple breaking up of alcohol into two substances, both of them well known now, one being water, and the other ether. It is a process which consists in dividing the elements of alcohol in such a way as to get nothing formed but these two products, though side by side with this change there are some secondary changes which do not belong to the process. This change is effected solely by the action of oil of vitriol or sulphuric acid. It has been long known, and it was a subject of wonder for some time that, if sulphuric acid is mixed with alcohol and heated, you can distil off some alcohol from the mixture in the form of these two products; then you may add some more alcohol, and if you distil that off, it is also broken up into ether and water; then you may add some more again, and you may go on adding alcohol to that original quantity of sulphuric acid, and it will decompose each successive portion into these two products. There is no limit known to the extent to which sulphuric acid will effect that change. You perceive, therefore, that this, in its general features, is a process analogous to those which we were considering at first.

I may illustrate that by an experiment. First, I will show you how we discover the presence of sulphuric acid. The common test is, to add some salt of baryta—this which I have here is a chloride—to the sulphate, when we get at once a precipitate sulphate of baryta. The sulphuric acid, in making the ether, passes over into a compound that does not possess this property. I have some of it here. It is a clear liquid, and on mixing it with the same re-agent I used just now you see that it will not form the precipitate, I put some of the same baric chloride into it, but, as you see, the liquid remains clear. But I can bring back my sulphuric acid to its original state. Mr. Taylor, my assistant, was heating some of it just now, and it has been standing so long that it has returned to its original state already. It has returned from the state in which it does not precipitate baryta to the state in which it does. There is in the process a successive departure of the sulphuric acid from its ordinary state, and a return to that original state; it is a kind of circle or cycle. The substance passes over into a compound which does not precipitate baryta, and then it returns again to its original form, and that is the key to the anomaly. When the sulphuric acid has effected the decomposition of one portion of alcohol into ether and water, it comes back again to sulphuric acid, becomes exactly what it was in the beginning, and is able to recommence precisely the same combination. I will give you another example of it. I have here a substance used in one of the commonest manufactures, that of oil of vitriol, in which the same operation occurs. I have there a substance at work called nitric oxide. It is converting a quantity of sulphurous into sulphuric acid. In principle it would so convert an infinite quantity, but in practice it is limited by convenience. It acts by carrying oxygen from the air to one portion of sulphurous acid and then to another, and thus it goes on, and effects successive oxidations of a great number of particles of sulphurous acid, forming sulphuric acid from them, and it does that in virtue of a process perfectly analogous to that which I just now mentioned. The gas, after one operation, returns to the same state in which it was in the beginning of the first operation; it is a cyclical process. I have here some of the nitric oxide combined with oxygen, and when in that state it has the red colour which you see in the flask. If we blow a little sulphurous acid into it, the red colour will disappear as the nitrous acid gives up the oxygen, the nitric oxide itself being a colourless compound, but in combination with oxygen it is red. As the sulphurous acid passes into it, the nitric oxide parts with the oxygen and becomes colourless, but on again blowing in a littlo oxygen it returns to its former red colour. This shows you that there are processes, of simple, normal, chemical action, somewhat analogous to those fermentive properties which I formerly described. Each one of these processes takes place in perfectly definite proportions, the peculiarity being that one material which takes part in them returns at the end of one operation to the same state in which it was at the beginning of the operation, so that the processes are cyclical, and this re-agent is able, by acting successively on a large quantity of particles, to repeat its action very frequently upon them, and beyond what would appear to be its definite combining proportion. You see this red compound of nitric oxide and oxygen has lost a great deal of its red colour. I will not wait until it is completely bleached, but will blow in a little oxygen, when we shall get a return to the original deep red colour. This is the ordinary process by which sulphuric acid is made on a large scale in lead chambers. The sulphurous acid is allowed to remain a considerable time in the chamber, and is passed on from one to another, as it is acted on by the nitric oxide, which passes through the successive stages of its action by a process which I should be glad to name cyclical, as I shall have occasion again to revert to a similar process of the same name. At our next meeting I shall have to analyse some of the best-known, and also some less familiar instances of cyclical action, that wo may arrive at a conception of their nature.

THE EDUCATION BILL.

This Bill passed through Committee in the Commons on the 21st inst. It will be remembered that, on the

19th inst., Mr. Forster proposed to insert words in the second schedule, directing that the ballot should be in accordance with the principles upon which a poll is taken under the Metropolis Management Act, 1855. Sir C. Dilke and Mr. Harcourt now opposed the amendment, on the ground that it would make the ballot ridiculous. Mr. Hibbert maintained that complete secrecy might be obtained under this form of voting; and Mr. Forster again explained the reasons why he had introduced the ballot into the Bill, and why he had chosen this particular form; and, on a division, his amendment was carried by 185 to 115.

On the 22nd inst., the Bill was read a third time in the House of Commons. On tho motion being made by Mr. W. E. Forster, Mr. Dixon gave notice of his intention to bring in a Bill to amend it, and expressed his regret that school boards were not to be established everywhere, and he thought that in many rural districts they would not be formed. He also regretted that there was not to be universal compulsion, and complained that the government had carried their measure by courting the support of the Opposition, and thwarting the views of their own friends. Mr. Cowper-Temple, on the other hand, congratulated the government on their success. Mr. Miall backed up Mr. Dixon's complaints, especially on the ground that the views and wishes of tho dissenting bodies had been disregarded in this measure, which he did not regard as a truly Liberal one. Mr. Gladstone replied, denying the claim of Mr. Miall to speak the sentiments of the great mass of Dissenters, and bade him withdraw his support from the government the moment it ceased to promote the cause he had in view. In this particular matter, it was their duty to rise above sectional views, and to consider only the general welfare of the empire. Sir J. Pakington joined Mr. Cowper-Temple in congratulating the government on the success of the Bill; and Mr. W. E. Forster thanked the House for the assistance he had received from all quarters, and reviewed the progress of the Bill, the principle of which, he showed, had been consistently adhered to, and concluded by expatiating on the beneficial results which might be anticipated from what he admitted to be, after all, an imperfect measure.

The Bill was then read a third time, and on the same day it was brought up to the House of Lords, and read a first time there.

On the 25th instant, Earl de Grey, in moving the second reading of the Bill, described the principal provisions, which, however, he did not offer as a perfect system of national education; but it would preserve what was good, and supply what was wanting in the present system, and would secure that the means of elementary education should be brought within the reach of every child in the country. The Duke of Marlborough congratulated the government upon having brought in a measure which he regarded as, upon the whole, satisfactory. He could not, however, see why the original conscience clause had been departed from, and expressed his belief that the religious difficulty had been greatly exaggerated. He pointed out objections to a time-table conscience clause, to the clause relating to compulsion, and certain other provisions of the Bill, but he trusted it would, with some amendments, contribute greatly to the prosperity of the country. Lord Shaftesbury said that the Bill, with all its imperfections, was the best which the government could have carried against the combinations of Secularists and political Dissenters. He cited various authorities to show that the religious difficulty practically never arose in teaching children of different denominations, and then, passing to the compulsory clauses of the Bill, he pointed out the difficulty of carrying out a system of compulsory attendance in many parts of the metropolis, in consequence of the wandering habits of the population, and suggested evening schools and classes as going far to solve the difficulty. He thought the Bill was a step in the right direction. Lord Howard of Glossop thought that the government had met a great difficulty with boldness and success; but some emendations would be necessary, in fairness to the Roman Catholic body, to which he belonged. The Duke of Richmond congratulated the government upon their refusal to ignore the existing denominational schools. Having referred to the more salient educational clauses, which would require consideration, he passed to the election of boards by ballot. He objected to this attempt to prejudge a great question, and gave notice that he should move the omission of the clause in committee. After a few observations from Lord Harrowby, Lord Fortescue, and the Duke of Rutland, Lord de Grey acknowledged the general support which the Bill had received from both sides of the House. He briefly replied to the objections raised during the debate, and said he should propose to go into committee on Friday next (this day). The Bill was then read a second time.

In reference to the attacks on the government by Mr. Dixon and Mr. Miall, the *Times* says:—"They (the extreme Nonconformists) seem to have expected the government to propose a measure conceived entirely from their point of view; but it is the duty of a government to endeavour to consult all sections of the community, and to legislate for the practical benefit of the people, not for the victory of any special theories or sects. That is the spirit which has conceived and carried this measure. The government found an immense agency ready to their hands in the voluntary schools, and they felt it would be at once wasteful and unjust to throw such a resource aside. Secular knowledge is at least none the worse because it is accompanied with religious influence and spread by religious zeal. The demand of the League was that the government should absolutely ignore this vital influence and impose one strict system throughout the country. Fortunately for the future co-operation of all, the government have so carried the measure as to give a victory to neither party. The Church has unquestionably made some sacrifices, and the Dissenters are called on for a corresponding concession."

DIAMONDS AND GOLD AT THE CAPE.

The following extracts are from the diary of Mr. G. S. Higson, who has lately surveyed this region:—

March 28th.—Started from Bainsvley, near Bloemfontein, and outspanned for the night at a drift at the lower end of Wonderkop, on the Modder River.

Crossed the drift, on the opposite side of which is a fine section of the blue and ochreous-coloured clay shales, belonging to the New Red Sandstone era, capped with common blue basaltic trap or ironstone of the country.

Outspanned in the Middelveld, on the farm of Mr. Bens, where I noticed one of the hills had a thick coat of coarse sandstone, under the trap, and overlying the clay shales. Rode on to the farm of Piet Jacobs.

Travelled by way of Holloway's farm, Koodoosdam, Oliphantsfontein, and Jan Wessels' to Bultfontein, or Du Toit's Pan.

Stayed at this pan, where so many small diamonds have been picked up. In two excavations for water, good sections of the shale formation are brought to view, intersected and upraised by the basaltic dykes; in one, to an angle of about 7 degrees, sloping off from each side of the dyke, and striking E. and W.; in the other, the shales are tilted up to about 25 degrees. This is contrary to the experience of the late eminent geologist, Andrew Geddes Bain, in similar dycynodon formations in the Old Colony, where the effusions of trap have not disturbed the horizontality of the shales. [*Query*—May not this have something to do with the local distribution of the diamonds?]

Left Pniel, and by the side of the road, going up the river, between the station and Mr. Hayward's farm, came upon an interesting section of the igneous strata, where the clinkstone and amygdaloid had run over the basaltic

trap, thus showing that the fiery eruptions were of two different eras, the former being the latest. Crossed the river at a good drift called Klipdrift. A half-drunk Coranna was here very impudent to us, but cooled down afterwards, and showed us a diamond picked up the day before on a ridge close to where we crossed. It was about 2 carats in weight, and of very pure water. Arrived at night at Jan Blom's kraal.

On to the Diamond diggings below Pniel, and found about 60 white people there, the hills dotted with wagons in every direction. Some parties were dry sifting, and some washing with cradles. The formations on both sides of the river are similar—basaltic, greenstone, and quartz dykes intersecting the ground, and crossing through the river from side to side.

A native picked up a diamond of very superior lustre and shape not far from this. It weighed upwards of 20 carats, and appears to be the half of an octahedron of double the size, which has been broken through its centre. Went about the hills searching, but without success. Examining a gully about $1\frac{1}{2}$ miles down the river, I was successful in discovering an immense deposit of the underlying rock of the diamondiferous region. It is a porphyritic gneiss, and no doubt has a very extensive range in South Africa. Mr. Hübner showed me specimens of the same fundamental rock, which he had found covering a large area of country to the north: it is the underlying stratum at the Tatin and Northern Goldfields, at the Chief Machin's town, in the Bamangwato hills, and forms the great mass of the Maquassie range of mountains in the Transvaal; but Mr. Hübner had been unsuccessful in tracing it again after leaving the Maquassie. Mr. Hübner calls it a porphyritic granulite, but I have rather adhered to the nomenclature of Dr. Atherstone and others. My thus finding the same underlying rock across the Vaal forms a connecting link between the mineral regions of this part of the country, the Transvaal, and the far Interior.

Proceeded about 16 miles down the Vaal; formations the same as before.

Sieved and searched a whole day without success. One of the diggers turned up a beautiful stone weighing $10\frac{1}{2}$ carats; this man had been working and searching about seven months without any remunerating benefit.

Washed again, and found a small diamond at the bottom of my dish, which the party kindly made me a present of. A friend of Mr. Bain's this day turned out a beautiful stone of 12 carats while picking.

I shall now give a short account of the *modus operandi* at present in use at the diggings. After loosening the red ferruginous gravel by means of a pick, and removing the large boulders, those who are not possessed of washing apparatus, and the means of transporting the diamondiferous soil to the river, merely pass it through a fine sieve, and then examine the remainder to detect the precious gems. In this way many have been obtained, but as a diamond or a ruby, when covered with moist ferruginous dirt, is not easily detected, no doubt some have been passed over and thrown away among the *debris*. Washing, although requiring more hands and appliances, is no doubt a much more certain process; the ground is first puddled in a shallow trough, about 5 feet long, 2 broad, and 6 inches in depth; one man pouring water upon it, while another works it well about with a shovel; as the trough is slightly inclined, almost the whole of the sand, &c., is thus got rid of; a couple of spadesfull of the gravel is then thrown into the top sieve of the cradle (which is simply a box on rockers, with three metal sieves of different sized perforations), and while one man rocks, his assistant pours two or three buckets of water on it; by this means, the smaller stones are carried down to the undermost sieves; the rocker and his mate then examine the top sieve, which has retained all the large pebbles, and lucky indeed are they if a gem should be discovered in this, as it is sure to be one of the largest size. The second sieve is emptied out on to a sheet of iron, or other sort of table, at which the searcher or searchers sit, and when all the ground is worked out of the puddling box, the last sieve is examined for the smaller gems. At the bottom of the cradle is a small ledge, against which a little fine gravel collects, and it was from washing this *debris* in a wash-hand basin that I was enabled to procure a minute diamond, a small nugget, and several specks of gold. I have no doubt, on further exploration, that payable deposits of the precious metal will be brought to light. Rubies are pretty plentiful, but small; the largest I saw was between 4 and 5 carats. When a native finds a surface diamond he fires a shot, and hardly a day passed, during my stay, that one or more of these reports were not heard.

Diamond sifting and washing is no child's play, and I would advise no one that cannot handle the pick and shovel well, and whose constitution will not enable him to stand cold and wet feet from morning to evening, to proceed to the diggings, for it will only be throwing away time and money.

From their cheerful appearance, their good order, and their willingness to oblige one another, I have no hesitation in saying that nearly all those engaged at the diggings meet with a fair *modicum* of success.

MEETINGS.

EAST INDIA ASSOCIATION.

A meeting was held, under the presidency of **Sir Charles Trevelyan**, on Wednesday, by permission of the Council, at the rooms of the Society of Arts, Adelphi, to discuss questions associated with the government of India. Among those present were—Lord Lyveden, Sir Vincent Eyre, Sir Arthur Cotton, C.B., Sir Thomas Bazley, M.P., Sir D. Wedderburn, M.P., Sir Charles Wingfield, M.P., Sir A. Kemball, the Hon. H. G. Liddell, M.P., Mr. Whitwell, M.P., Mr. William Fowler, M.P., Mr. S. S. Dickinson, M.P., Mr. C. Wren Hoskyns, M.P., Mr. C. B. Eastwick, M.P., Mr. Andrew Cassells, Mr. R. Vicars Boyle, C.S.I., Mr. W. S. Fitzwilliam, Mr. Thomas Briggs, his Highness Mooloo Wallah, Nowrozjee Furdonjee, of Bombay.

The Chairman, in the course of an address which occupied nearly two hours in delivery, entered at length into the questions connected with Indian finance. While allowing that those who now enjoyed Indian pensions should continue to enjoy them, he proceeded to point out that the present government system was one which would lead to difficulties of a serious character. The great danger, he said, was the open-handed munificence which ruled all things in India, and he complained that duties now much devolved upon deputies, whereas, in former days, the principals transacted all duties. With respect to the administration of the Indian army, he said that although the warlike Powers against which the Indian armies contended in bygone times were now no more, and although such changes had been made that one regiment, by means of the railways, could now be made to do the work which ten could formerly do, the army administration cost upwards of £15,000,000, a sum larger than the cost of the French or Prussian armies, and considerably above the military service of England, for herself and the colonies. The Indian army, in fact, was made to absorb the third of her revenue. He dwelt upon the "length of service" system of promotion as practically bad every point of view, for it determined for men their plan of life, gave a pension list of field officers, led to dissatisfaction in the Queen's service, and was an enormous cost. He summed up the army question by saying that to keep up a military staff in India, such as we have at the present time, was sheer waste. The next point he debated was that of the public works. The money taken for these purposes was about £14,000,000, and, though

public works were excellent things, yet when the question was between them and good faith, and bankruptcy, and war taxes, then consideration should be given. In India, the result of going too fast in these matters was public waste of every sort—tumbling churches, barracks, and bridges. Why, the magnificent European barracks erected in India turned out to be mere sun-traps, and were wholly uninhabitable. Smaller works carried out with thrift would have been useful; but, carried out by a vast system of centralisation, the nearest approach to which in this country was the War-office, there was an entire absence of responsibility and real control, with a lavish expenditure, reminding one of the worst time of Roman history, and all out of the hard labour of ryots. He declared that with one centre of administration, no matter whence it was, it was impossible to deal with Indian finance, which, uuder the present system, must always remain a matter of surprises. India was not one country, it was several, and each Presidency might have strong reasons for practising economy, if there was no pulling out of a common fund, if each made up its financial statement. He proceeded to speak of the evil of there being no check, as in England, and no fear of a check, on the finances, and he contended that, instead of these questions being "nibbled" at any longer, the bull should be at once taken by the horns, and the system of governing the finances of India from a single centre discontinued. On the question of the taxation of India, he held that direct taxation of the Indian Empire was a mistake, and that indirect was the most popular form of taxation in that country, and he declared that he knew that the unfortunate people not only had fraud practised upon them, but extortion as well. The great want of India was cheap capital, and with that, after an inquiry by a committee of both Houses, we should be able to clear away the evils which weighed India down.

Mr. Dadabhai Naoroji, the hon. secretary of the association, then submitted a paper on the "Wants and Means of India," and in introducing it he said that no man in Her Majesty's Empire was more loyal to British rule than he was, and therefore in his paper he spoke his mind freely. This nation should understand the wants of India, a country under foreign rule, which could be made to pay for that rule if rightly administered and if properly understood, and the great want was the introduction of cheap capital.

The paper was taken as read.

As the result of the meeting, the following resolution was adopted:—"That with a view to meet the present critical position of public affairs in India, to allay the alarm and dissatisfaction produced by the recent enhancement of taxation, and to place the financial administration of the country on a sound and satisfactory footing, the Council of the East India Association be requested to prepare and present an humble memorial to Parliament, praying that Select Committees of both Houses of Parliament be appointed to make a searching inquiry into the general administration of her Majesty's Indian territories both at home and abroad, more especially in relation to the conduct of the Financial Department since the transfer of the sovereignty from the late East India Company to the Crown, and to report the result of their investigation, with their observations thereon."

GENERAL NOTES.

Cordova Exhibition.—Manufacturers who have applied for space at the International Exhibition to be held at Cordova, in October next, by decree of the government of the Argentine Republic, are reminded that their goods ought now to be immediately despatched from this country in order to be in time for the opening. The necessary documents to insure admission duty free, together with particulars as to shipment, &c., can be obtained of Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, to whom any further applications for space must be at once addressed.—*Times Money Article*, July 22nd, 1870.

Silk Trade of Lyons in 1869.—During 1869 the number of bales of silk registered at the office of the *Condition*, at Lyons, amounted to 51,326, of the total weight of 3,324,862 kils. The average of the preceding nine years was 45,283 bales, showing an increase in 1869 of 6,043 bales above the average. The following shows the number and weight of bales of silk registered for the last ten years:—

Year.	Bales.	Kils.
1860	42,942	2,897,454
1861	38,985	2,600,087
1862	52,634	3,623,400
1863	48,880	3,342,035
1864	49,710	3,508,632
1865	43,772	2,923,953
1866	37,959	2,605,625
1867	42,798	2,795,134
1868	49,871	3,222,807
1869	51,326	3,324,862

The following shows the quantity of silk registered each month during the past year:—

Month.	Conditioned.	Weight.	Total.
	kils.	kils.	kils.
January	187,353	51,450	238,803
February	202,661	61,429	264,090
March	250,932	85,285	336,217
April	194,853	50,892	245,745
May	230,994	107,914	338,908
June	151,485	60,134	211,619
July	165,780	53,517	219,297
August	189,242	50,689	239,931
September	205,160	50,096	255,256
October	202,042	63,894	265,936
November	253,996	65,508	319,504
December	295,627	93,929	389,556
Total	2,530,125	794,737	3,324,862

The total of the first six months amounted to 1,635,382 kils., whilst that of the second was 1,689,480 kils. The loss in weight by the conditioning of the silk, which varies with the quantity of moisture in the atmosphere, averaged, during the year, 1·39 per cent. for organzine and raw silks, 1·71 per cent. for trame, or 1·47 per cent. altogether for all qualities of silk. The maximum loss in weight was in the month of January, of 2·26 per cent., and the minimum in August, of ·42 per cent. The quality of silk registered was as follows:—

	kils.
Organzine	1,062,874
Trame	744,458
Raw	1,295,367
Various qualities	212,670
Reeled	9,484

The following shows the quantity of the various qualities of silk, with the countries from which they were imported during the past year:—

Country.	Organzine.	Trame.	Raw Silk.	Total.
	kils.	kils.	kils.	kils.
France	417,583	113,181	233,761	764,525
Piedmont	95,098	10,267	5,340	110,705
Italy	197,067	126,669	183,029	505.765
Broussa	51,370	552	61,311	113,233
Levant	54,255	1,372	37,340	92,967
Bengal	89,389	55,580	83,569	228,538
China	62,870	322,937	421,594	807,401
Japan	96,242	113,836	268,596	478,674
Persia	...	64	827	891
Total	1,062,874	744,458	1,295,367	3,102,699

Cornwall Polytechnic Society.—The 38th annual exhibition of this society will take place in September next. Medals and prizes in money will be awarded for machinery and models, mechanical and other scientific inventions and improvements, specimens of naval architecture, natural history, scientific papers, specimens of ornamental art, pictures, drawings and photographs by professionals and amateurs, school productions, plain needlework, and all objects of interest connected with mechanics, science, and the fine and industrial arts, which are considered deserving by the judges in the various departments.

Norway.—The following return shows the value of the imports and exports of Norway from 1856 to 1868:—

	Imports. £	Exports. £
1856	3,709,000	3,200,400
1857	3,511,000	2,799,990
1858	2,505,000	2,773,200
1859	3,107,000	3,120,000
1860	3,502,000	3,516,000
1861	4,367,000	3,244,000
1862	4,193,000	3,682,000
1863	4,431,000	4,049,600
1864	4,290,000	4,557,600
1865	4,164,000	3,621,600
1866	5,850,000	3,662,400
1867	5,456,000	3,863,222
1868	5,880,000	3,900,000

Olive Oil.—The oil made in the district of Oneglia is better than that of Southern Italy, and large quantities are refined before being exported. The process of refining the oil is very simple. Large shallow tin boxes are made with small holes pierced in the bottom; this is then covered with a thin sheet of wadding. Four, five, or more of these boxes are placed on frames one over the other, and the oil being poured into the top box, is allowed to soak through the wadding and drop into the next box, and so on until it gets into the last, when it runs off into the tanks. The wadding absorbs all the thick particles contained in the oil when it comes from the mills, and leaves it perfectly clear and tasteless. The oil thus refined is almost exclusively exported to Nice, where it is put in bottles, and sent all over the world as "Huile de Nice." Olive oil is all sold by weight. The total quantity exported from Oneglia, in 1868, was 6,182,490 kilos. (121,822 cwt.); of these, 257,610 kilos. were shipped direct to England; 5,885,592 kilos. to France; 39,288 kilos. to Genoa, to be there transhipped for America.

Decline of Manufactures in Turkey.—At one time, Turkey was noted for the skill of her handicraftsmen. The varied manufactures, which fully supplied the consumption of the empire and of neighbouring countries, have rapidly declined, or become altogether extinct. The steel manufactories of Damascus no longer exist; the muslin looms of Scutari and Tirnova, which, in 1812, numbered 2,000, are reduced to less than 200 spindles; the silk looms of Salonica, numbering from 25 to 28 in 1847, have fallen to 18; Broussa and Diarbekir, once so renowned for their velvets, satins, and silks, do not now produce a tenth part of what they yielded forty years ago. Bagdad was once the centre of very flourishing trades, especially of calico-printing, tanning and preparing leather, pottery, jewellery, &c. Aleppo was still more famous for its manufactures of gold thread, of cotton tissues, cotton and silk, silk and gold, and nankeen stuffs. These once occupied more than 40,000 looms, which are now reduced to about 5,000. While, however, the manufacturing power of the country has thus fallen off, its producing power has increased so as to render it capable of supplying Europe, to an indefinite extent, with bread-stuffs and certain raw materials.—*Parliamentary Report.*

Reunion.—The total value of produce exported, in 1868, from this French colony amounted to 21,172,822 francs, or £847,913, and consisted of—Sugar, to the value of 18,000,000 frs.; coffee, 500,000 frs.; vanilla, 150,000 frs.; cloves, 100,000 frs.; rum, 100,000 frs.; potatoes, 75,000 frs.; vegetable fibre, 75,000 frs.; sacking, 75,000 frs.; hides, 50,000. Of the sugar, France took 30,000 tons, and Australia 7,000 tons; the rest was divided in small quantities between India and other countries, Great Britain taking none. The value of imported goods, during the same period, amounted to 26,678,600 frs., equal to £1,067,144; they consisted of—Rice, to the value of 8,500,000 frs.; cotton, linen, and woollen goods, 3,000,000 frs.; wines and spirits, 2,000,000 frs.; oil, soap, and candles, 2,000,000 frs.; salt, 2,000,000 frs.; grease and lard, 1,500,000 frs.; wheat and flour, 1,000,000 frs.; horned cattle and mules, 1,000,000 frs.; guano, 1,000,000 frs.; coal and timber, 500,000 frs.; haberdashery, 500,000 frs.; iron goods, 500,000 frs.; eather goods, 500,000 frs.; gram and dried vegetables, 500,000 frs.; salt fish, 500,000 frs. Besides sugar, coffee, and vanilla, a vast quantity of maize is grown in the colony, more than suffices for local wants. The export of this grain is, however, forbidden by a decree dating as far back as the possession of the island by the French Compagnie des Indes, and which, from some singular oversight, appears never to have been repealed.

The Trade in Eggs.—Some interesting details respecting the trade in eggs have been published by a German paper. It appears that the use and importation of eggs in England increases vastly from year to year. From 1843 to 1847 the average yearly imports amounted to 73 millions of eggs; during the next four years, 103 millions; in the following year, 147 millions; and in the next, 163 millions. In 1861, 203⅓ millions; in 1864, 335⅓ millions; and in 1866, as much as 430,878,880 eggs, to the value of £1,097,197. By far the greater part of the exports come from France, and very few eggs are brought from Germany. The cargoes of eggs are chiefly shipped in steamers, and are landed principally at Southampton, London, Folkestone, Newhaven, and Shoreham. The time of egg-laying begins in France from January to March; April, May, and June are the most productive months; in July the production begins to fall off, it takes up a little again in August and September, and leaves off entirely in October and November, and in December is absolutely *nil.* In order to obtain eggs, even at this time, scientific means are employed. The stalls are warmed, and the hens are fed with buck-wheat and meat. Poultry-keeping in France is chiefly in the hands of the small landowners, who carry it on in an energetic and business-like manner. This is particularly the case in the provinces of Burgundy, Normandy, and Picardy. Paris also consumes 12,000,000 francs worth of eggs. One may generally assume that the districts which grow buck-wheat produce most eggs. The harbours from which the greatest exports of eggs takes place are Calais, Cherbourg, and Honfleur; at Calais the eggs are packed in chests with straw, 1,100 eggs to each chest; at Cherbourg and Honfleur, in chests of 600 to 1,200. The business is very profitable, and such results might probably follow in Germany, if the landowners, especially the smaller proprietors, would introduce a rational system of poultry keeping. Of late years large quantities of eggs are opened in the German markets, and the yolk sold cheap, the white being sold for manufacturing purposes. The province of Galicia, in Austrian Poland, produces a great quantity of eggs, most of which are exported abroad. Ten years ago, this trade was concentrated at Cracow, whence the eggs were forwarded to Prussian Silesia, and, when the Vistula was navigable, to Warsaw. During the last few years, however, the trade has been very much extended. The chief places to which eggs are now exported are Breslau, Berlin, and Hamburg, from which places they are sent to various parts of Europe. The number of eggs thus exported last year was 6,600,000, whilst in 1862 it was only 700,000.

Journal of the Society of Arts.

FRIDAY, AUGUST 5, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

APPOINTMENT OF VICE-CHAIRMEN.

Lord Henry G. Lennox, M.P., Chairman of the Council, has appointed S. Redgrave and Seymour Teulon, Esqrs., to be Vice-Chairmen for the ensuing session.

THE LIBRARY.

The following works have been presented to the Library :—

Annual Report of the Commissioner of Patents of the United States, for the year 1867 (4 vols.).

A medal, in commemoration of the visit of the Sultan of Turkey to the Corporation of the City of London, by J. S. and A. B. Wyon, has been received from the Corporation.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON FERMENTATION.

By Professor A. W. Williamson, F.R.S.

Lecture II.—Delivered Monday, May 2, 1870.

We left off last week at a point at which we had come to recognise a difficulty, which we did not, to any appreciable extent, succeeded in solving. By considering in succession a certain small number of processes in which substances induced chemical changes in others which were in contact with them, we classified them, beginning with some very complex cases—cases in which substances of formulæ so long that, even if I ventured to give you chemical formulæ at all, I should hesitate to give you their formulæ—took part in the decomposition, and gave rise to products themselves having formulæ of no small complication. From those we passed to the consideration of some bodies less complex in their structure, and undergoing changes very much like those which we at first considered, but having this remarkable peculiarity that, in these somewhat simpler cases, the changes were effected not only by organic bodies comparable to ferments, but also, in certain instances, by simple mineral bodies, such as the acids. In this intermediate class we found that the same effects are produced, sometimes by diastase, or such like bodies, and sometimes by sulphuric acid. Then we came to some still more simple cases of decomposition, produced solely by bodies of such simplicity, that we chemists have got a tolerably definite idea of them. I gave two cases which, I believe I may say, are pretty well understood. The resemblance between the different terms of that long series served, as I think it will be admitted by those who followed the chain of reasoning, as an argument in favour of there being some great resemblance in the process which takes place in these changes in the successive terms of the series; and I propose, before we proceed further in the study of these wonderful decompositions, to analyse somewhat the nature of these changes in the simple cases which we last considered, in order that we may get, if possible, something like a master-key—a very simply-formed piece of iron—which will open a variety of locks. The two cases which I allude to were, first, the formation of ether and water from alcohol by the action of oil of vitriol; and, secondly, the ordinary process of making oil of vitriol in the so-called lead-chambers ; and I think it will be admitted, even from the very brief and imperfect statement which I was able to make, that we have evidence of the fact that the active substances do return, after they have been doing one bit of that work, to the point from which they started before doing it. I gave a couple of illustrations of that fact. Sulphuric acid is converted, while making alcohol into ether and water, into a substance called sulpho-vinic acid, which differs from it in a good many properties, and then it comes back again to sulphuric acid. Just so with nitric oxide, in the process of making oil of vitriol; it first takes up oxygen and assumes the form of those red fumes, then hands that oxygen over to the sulphurous acid which is in contact with it, thus coming back again to the state of nitric oxide from which it had started. Hence the term which I have suggested for this process is cyclical, to denote the fact, which I consider essential, the leading fact, that it is a cycle, the idea of which implies that the road by which it returns is not the same by which it goes, and I want that idea to be suggested by the word. In the case of etherification, I wish I could lawfully use formulæ on the black board, but it would not do, for I am sure that the greater number of my audience will agree with me that it would be a liberty which I ought not to take; but chemists are in the habit of denoting, by the aid of formulæ, particulars which require to be fully explained. I mention that because, excluding that ordinary process, the particulars of my argument must, of course, be omitted, inasmuch as I do not use the language by which alone those particulars can be conveyed. When the sulphuric acid acts upon alcohol, and transforms it, by a succession of these cyclical processes, into ether and water, the general kind of process is this :—A little particle of the acid—because each one acts like the rest, and we had better consider one as a sample of the rest —first takes something from a contiguous particle of alcohol, and then it hands over this something to another particle of alcohol. That which the acid takes in the first instance is called, in our ordinary language, ethyl. It is a group consisting of carbon and hydrogen, very much like hydrogen gas—it is a group of those elements, and behaves in a manner closely analogous to hydrogen itself. The acid, in doing that particular work which we have to consider, first takes a particle of this ethyl from one particle of alcohol, and whilst it does so, it gives to the alcohol something in exchange ; that something is hydrogen. And by doing this, the sulphuric acid which has taken up this ethyl is converted into sulpho-vinic acid ; it has gone half round the circle, in fact. The remainder of its journey consists in reversing, in another way, with another particle of alcohol, that very same kind of interchange which it had undergone in the first instance, that is, it gives up again this little portion of ethyl which it had taken, and resumes hydrogen in place of it. Just as that is the general process when sulphuric acid acts upon alcohol, forming it into

ether and water, so in the other process, which I just now reminded you of, there is a similar action, only there is this difference—of course, I speak within those narrow limitations which are imposed upon us by our very imperfect knowledge of even these best-known processes—but, as far as we know, the nitric oxide merely takes up oxygen, but gives up nothing in exchange. Those red fumes which you saw were really nitric oxide *plus* oxygen, not nitric oxide in which oxygen had replaced something else, and that was a difference between the process in that case, and in the one to which I just now referred. Then, again, it simply gives up that oxygen to the particle of sulphurous acid.

The illustrious Liebig, to whom we owe, in this order of phenomena as in every other order which he has touched, some of the most valuable ideas which have guided our researches, suggested many years ago, for the explanation of the phenomena of fermentation, a theory which certainly has rendered very great service, and not the less so from the that it has been replaced by one more perfect. In building a house, it is certainly no proof that a scaffolding is unnecessary that in the final structure the scaffolding is not maintained; and so in the progress of our science, as in every other science, each part of the work must be judged from its usefulness in aiding the carrying on of the building, even though the particular substance which was placed there at the time does not finally form part of the structure itself. Liebig's explanation really is classic, and well worthy of a few minutes' consideration. He classed together a considerable number of cases of chemical action which bore, at least upon their surface, a considerable resemblance to one another, and he saw in them something in common, and by this one resemblance which they had he classed them, considering it to be their essential characteristic feature. For example, there is a substance which is made, by a process of oxidation of a compound something like lime. It is called baric peroxide. Thenard had found that the oxygen which is here taken up by the baryta can, by a particular process, be passed over to water, so that, in fact, Thenard, from this oxide of baryta, made, by a process which I will repeat on a small scale, some oxidised water, or peroxide of hydrogen, as it is commonly called. Here is some of the peroxide suspended in water, and by adding an acid hydrogen salt, the hydric nitrate, in small quantities (for if I add it in too large quantities, I should destroy the peroxide, which is a very tender substance, and requires to be treated tenderly), I should gradually transfer the oxygen from the baryta, with which it was at first combined, to the water which is here present. This oxidised water, or peroxide of hydrogen, gives up this oxygen which it has just taken up very easily indeed—in fact, the difficulty is to prevent it doing so. Amongst processes of that kind, I will show you one simple one. I will pour into the water in this large beaker glass some of the solution which I have just prepared, and then add to it a few drops of this red liquid, which is a solution containing chromic acid combined with potash. You see, no doubt, that although I have only added half-a-dozen drops, there is evidence of a chemical change, and the deep blue colour which is formed by the contact of the two liquids is due to the formation of a new compound. The chromic acid, which has a red colour, takes up oxygen from that peroxide of hydrogen, forming a blue compound. I have purposely chosen this particular instance, because the process is a slow one, and we have time to see its intermediate changes. I will leave the glass here, and in a few minutes you will see the blue colour will have disappeared, and in place of it we shall have a dirty green colour, hardly visible. Whilst that change takes place, if we were to take means to examine carefully what was going on, we should find that oxygen gas passed off, and if we examined the green substance present at the end of the process, and compared it to this original red chromic acid, we should find that it consists of chromic acid *minus* oxygen. The peroxide takes away oxygen from this chromic acid, and yet the chromic acid has got hold of its oxygen pretty firmly; it requires a considerable amount of energy to tear away even that part which is torn away by the process. But at the same time the oxygenated water is losing part of its oxygen. The deoxidation of the peroxide induces the chromic acid to give up some of its oxygen; the one body induces in the other a change similar to that which itself is undergoing. The peroxide of hydrogen is losing oxygen, and it makes the chromic acid also lose oxygen. To state the process in general terms, I may well use the expression of Liebig, and call it contagious action. There are many other cases of similar processes. Here is a bit of rotten wood; if I were to moisten it and put it into a convenient flask, leaving room for a quantity of air, closing the mouth of the flask with a good cork, and leaving it for a day or two, also putting with the air a little hydrogen gas, which, you know probably, is capable of combining with oxygen, I should, on examining the mixture of air and hydrogen after it had been in contact some time with this rotten wood, find that the hydrogen had been removed from the air, and at the same time the oxygen of the air which had been mixed with it had disappeared. Now, this wood is actually undergoing a process of combustion—it is actually absorbing oxygen, or being burnt, very slowly indeed, but still at a rate which is not unimportant, if you want it to last for any length of time. De Saussure, who noticed this, attributed the oxidisation of the hydrogen gas to the fact that the wood is itself undergoing oxidation. I will take another case of the same kind. I will put into a little flask some of that peroxide of hydrogen, and will show you another decomposition of it, which is rather more convenient in one respect than the one I first took, as it will show us something more of the process. Into this little flask I put some of the same oxidised baryta which I used just now, and I will fit up the flask in such a manner that the gas, which will come off in a tolerably large quantity, can be collected for examination. I will then put in contact with it a substance called silver oxide, first driving out of the flask all the air which it at present contains. Having driven out the air, I put in a few drops of the nitrate which I employed in the first instance, and then I will put in a solution of silver oxide, which is, in some respects, a good deal like this chromic acid, at all events in one important respect, for it has oxygen, which it can give up under sufficiently strong pressure. You now see there is a great deal of effervescence going on, and the gas which is coming off from the little flask is rising into this jar, where we shall very easily be able to ascertain whether it is oxygen by the ordinary test. I should have been glad, if it had been convenient to do so, to give you one other instance in which a remarkable fact was discovered by Professor Brodie, viz., a case of an action of this kind, where the oxygen taken from the peroxide is in quantity exactly equal to the quantity of oxygen from the other body. Whilst that gas is collecting, I must enter shortly upon a theoretical question, apologising for doing so, not that I am ashamed of it, for it is one of the most important theories we possess, but on account of the brevity with which I am compelled to treat it. Oxygen, in the free state, is admitted by chemists to consist of two little atoms linked together. In each of the compounds which I used there was one little atom of the kind. One atom leaves each of them, and when I get free oxygen, I affirm that there has been a process of combination, that the oxygen from the one substance actually combined chemically with the oxygen from the other. This is a theoretical result which has been, in great part, established by Sir Benjamin Brodie, with the help of materials from various sources. What I mentioned in the other case holds good equally in regard to chromic acid and the other cases in which there was apparently no definite proportion of the kind. There is an actual chemical combination between the oxygen of one substance and

that of the other, it is not merely that the one substance is compelled to decompose because the other is decomposing; there is between the one substance and the other an interchange, so that a constituent from each one combines with a constituent from the other. To do justice to the importance of this fact I should need to describe a great number of chemical reactions, which at present would be impracticable, but you may take my word for it, that the kind of process which I have described is now known to be one of the commonest in chemistry. The other day, when I mixed two of the commonest substances, there were interchanges between the constituents by a process perfectly analogous to that which takes place here. Here it happens, by an exceptional circumstance, that the element which from the one body combines with the element of the other is of a like kind, whereas, as a rule, you find that unlike elements unite together in these processes. Thus it is that the anomaly which Liebig noticed ceases to be an anomaly, and is brought back to a case of common regular chemical action by the aid of that theory to which I have just alluded.

To return to our experiment. This glass vessel is now full of the gas, and by applying a taper which has been lighted and blown out, but is still glowing, we shall find, on putting it into the jar, that it immediately ignites, which is the ordinary test of oxygen gas. By the aid of that theory, which has been discovered since the time of Liebig's suggestion, this one case of apparently anomalous action has been proved to be a perfectly normal and regular case of combination, and the same kind of thing has been done with regard to other cases of the same description. A number of other processes which he classes with these may be shown to be due, not to any exceptional force that is at work in these cases, not to the force of any particular contagious action among chemical substances, but to tho ordinary forces which induce chemical combination in the cases best known to us. Liebig's theory of contagious action has been alluded to, by a high authority in this country upon philosophical matters, as being a law of chemical action of a generality comparable to the law of gravitation in astronomy, and for that reason, if for no other, it must be of considerable importance to know what bearing our most advanced knowledge has upon that law. I dare say you see the connection between it and the case of fermentation. I will not go into particulars, further than is necessary in order to show you the general analogy.

First, I will take the case of alcoholic fermentation, as being the case best known. The ferment consists of little cells—which I hope I shall be able to show you at our next meeting—each one containing several chemical compounds, but itself a little living being. I will not say at present whether they are animals or plants. When you have these little organisms in water, or sugar, or in any moist substance, they are constantly, and of necessity, undergoing decomposition. You may arrest the decomposition by various agents, but if you do so, you kill them, or suspend their activity as yeast. No case is known to us of their acting like yeast without undergoing at the same time a process of chemical decomposition—being broken up into simpler substances than those which were contained in them. I pointed out, last week, that the sugar which is being decomposed by the yeast is by that process being broken up into substances which were contained in it, and that was what Liebig noticed. He said that this yeast is a substance which tends to decompose—it is breaking up into simpler substances, and it induces in these particles of sugar which are in contact with it a decomposition similar to its own. The action which it is undergoing is contagious, and passes over to the contiguous particles of sugar; and he adduced cases like that of oxygen, as affording analogies among simple well-known bodies. I think what I have said with regard to the case of oxygen will be sufficient to show you that in those simple cases the idea of contagion is certainly not applicable.

A foreigner, who was describing some time ago the luxuriance of the crops in America, spoke of a bushel of *mice* being sown in a field, and a hundred bushels of *mice* being reaped. Of course, what he meant to say was *maize*, or Indian corn; but I am reminded of that anecdote by the necessity I am under for a moment of asking you to consider for awhile some living beings under their general functions only. Suppose you had a bushel of actual English mice, and you put them into a granary full of corn. There clearly would soon be a great change. You are supposed to know nothing more about the particular organisation of these little beings than you know about the particular organisation of the little yeast cells. You know that these little things eat grain, and that in place of the grain which they eat there appear various products of decomposition, which can be easily collected and examined. They give off carbonic acid, and so forth, and if you examined the state of that granary after a time, you would find a chemical change, or rather a set of chemical changes, going on in the organisms of these mice. The substance of which they consist would be actually wasting away; they would be giving off carbonic acid, and nitrogenous and other products. And if you also examined the state of the corn which was there at first, you would find that it finally passed over into these same products; and I say that the theory of contagious action is as much applicable to the action of the bushel of mice in the granary full of wheat, as to the action of the yeast cells upon a solution of sugar. There is in the one case, as in the other, an assimilation by the living organism of the material upon which it acts. The materials undergo certain changes, of which the general results are known to us, but of which the particulars are, I may say, in the main almost completely unknown. As to the processes by which these products are formed, it is as well to say that we do not know them. We know a little here and there about them, but it is nothing compared to our ignorance; therefore the resemblance is the more striking, and if we were to believe in the contagiousness of chemical action as applied to the case of the assimilation of sugar by a ferment, and say the ferment gives off alcohol and carbonic acid, and that sugar is also resolved into alcohol and carbonic acid, we should really be describing in its general features a process analogous to that which I have just now mentioned; such a general analogy would be readily admitted by those who go into the particulars of the process, but I think it is of particular importance to have in addition to it something more practically useful to guide us in understanding chemical reactions. For that purpose I will take one or two chemical reactions of an exceedingly common kind. For instance, I will again take that chromic acid solution which I just now employed. Here you see is the green residue which I told you would be produced; I again take some of this chromic solution, throw some of it into water in this jar, so as to visibly tinge the water red; I will slightly acidulate the liquid by oil of vitriol, and I will then pour into the mixture (which I will describe as chromic acid dissolved in water, for the potash which was present is taken away from the compound by the sulphuric acid), a substance which I will merely describe as being greedy of oxygen, sulphurous acid. If Liebig's theory of contagious action were generally true in chemical action, you would no doubt expect that this sulphurous acid, in taking up oxygen, would make the chromic acid also take up oxygen. It is quite possible for the chromic acid to do so, for that blue substance which we had in this jar at first was nothing but chromic acid with oxygen added to it. But instead of this, we shall have at once a reduction of the chromic acid to deep green, which I dare say appears to you almost black. It is precisely the samo thing as that pale, dirty green which you saw before, but in its concentrated state. There is no oxygen taken up by the chromic acid, but it at once loses oxygen. This sulphurous acid wanted to

combine with oxygen, and it tore away at once some of the oxygen from the chromic acid, and there was in this chromic acid a process, not similar to that which the sulphurous acid underwent, but a process precisely opposite to it—one combined with oxygen while the other lost oxygen—and if you examined the liquid, you would find that the sulphurous acid which took part in the process, and has taken up oxygen, is now in the form of sulphuric acid. Again, I have here some granulated zinc, which will very easily evolve hydrogen, particularly when its activity is stimulated by throwing a little copper vitriol on to it. After adding a little water, I will throw in a little oil of vitriol, so as to get an evolution of gas. Then I have here a solution which I think must look black to you, except at the edges, which is a solution of a beautiful salt called permanganate. It is used for deodorising certain fetid waters, and I might compare it to the chromate I was using just now. It consists of an acid of the metal manganese. If I throw some of that into the mixture which I have just prepared, and leave it for a short time, and then examine it, we shall find that, instead of being induced to give off hydrogen like the other body, which is doing so vigorously, we shall find it will do the opposite, and will combine with hydrogen; and the colour which belongs to it, and which can be recognised so easily, will disappear, because hydrogen will be taken up by its oxygen, and it will be reduced and brought down to a substance containing comparatively little oxygen. There, again, as in the previous case of the chromic acid, we find that there is a kind of chemical polarity in the general mode of action, that the one substance acted upon does precisely the opposite of the other. There is no tendency in this case to do the same thing, but the two substances acting upon one another do precisely the opposite, the one taking up what the other loses. Not only is that the case in the instance of the action which I have mentioned here, but in a great number of other cases of considerable interest and importance—bodies which act chemically with considerable energy when allowed to do so, are prevented by others from so doing when those others are trying to do the same thing. If, for example, we put metallic copper into nitric acid, the copper would dissolve with immense energy; it would undergo what I might call a process of combustion. Again, if I put mercury in contact with the acid, the same thing would occur; it would be dissolved almost as rapidly as the copper. But if I put the two together into nitric acid, the copper prevents the mercury from undergoing combustion; and so far from encouraging it to do the same thing, it actually takes from it the power which it possessed before of undergoing a combination of that kind. And more than that, if I take mercury which has been burned—a solution of mercury in the form of corrosive sublimate—and put copper into it, the copper will actually unburn it, or make it come back again from the point at which it had got, and throw down the metal. You can see the process which takes place; on putting a strip of clean red copper into the solution, it becomes grey, and throws down the mercury from the solution. So far from encouraging the mercury to oxidation, it makes it do the opposite to that which it otherwise had a tendency to do.

Again, I will take some of this solution of copper—it ought to be some of the very solution which is being made here, where copper is being dissolved at the expense of mercury—and if I put into it a piece of common iron, perfectly clean and white, it will very speedily combine; and I cannot express its functions in combining better than by saying that it will make copper uncombine, for the copper which was burnt is now being unburnt.

If we go carefully, with the knowledge of their particulars, through the best known chemical processes, we find that there is, as a rule, a force at work which I might describe as polarity—a tendency among contiguous particles which are acting on one another to assume functions which can be best characterised as being opposite to one another. Whatever the one is doing, the other is doing as nearly as possible the very opposite of it, and any tendency to do like work I know not of. There are, however, cases which would appear to be favourable to the notion of contagious chemical action. If I blow out that gas-burner, still letting the gas escape, and then bring near to it a burning splint, it will set fire to the gas, and the same with a candle-wick if I bring close to it a burning match—the match, which is burning, communicates to the wick the process which it is undergoing—but the explanation is this, it does so merely because of the high temperature which it has attained. If by any other process, such as concentrating the rays of a powerfully-heated surface by means of a lens, I raise the temperature of the gas to that point at which it is capable of combining with the oxygen of the air, it will do just as well. The accident that the high temperature is communicated by the burning splint has nothing to do with the process.

There is one other remarkable instance which I must give you, to show the difficulty in some cases of analysing these phenomena. It is the case of the metal platinum, which I can hardly describe better in general terms, as regards its properties, than by comparing it to gold. It is what is termed a noble metal; it does not dissolve in any ordinary acid; you might boil platinum in nitric acid for any length of time and it would not dissolve. On the other hand, silver is a metal which dissolves readily in this acid, and if you melt silver and put platinum into it, it will also melt, and you obtain a compound of the two metals mixed pretty uniformly together. It was noticed that when such a button of platinum and silver is put into nitric acid, not only does the silver itself dissolve, as you would expect, but some of the platinum also dissolves with it; not the whole, but a portion. That seems, at first sight, favourable to the theory of contagion; it seems natural to suppose that the silver in dissolving has communicated the same tendency to the platinum, and made some of it dissolve. But that explanation will not do, and for this reason. When platinum is combined with anything else, I care not what, its properties are not the same as when uncombined. The very essence of chemical combination is that the particles which are in intimate contact unite, and that the compound possesses different properties from the original elements. We know that metals combine with one another; there are many cases known to us of the forcible union of metals, and we have no right to suppose in any case, unless we have actual proof of it, that a metal is present in such a compound with its ordinary properties. Therefore, it is not free platinum, but a compound of platinum and silver which dissolves, and there are some compounds of platinum which dissolve in water, and others which dissolve in nitric acid, so that this process has really nothing to do with contagious action.

In the composition of alcoholic ferments there are several substances of which we know very little at present, I am sorry to say, but the want of this knowledge is so great that I have no doubt it will be soon supplied. Certainly, this is a most important field for the investigation of naturalists who possess an accurate knowledge of chemical manipulation, I mean the simplest and lowest organisms, whose functions are of such importance in these changes, certainly claim much careful investigation. But some of the things which we do know about the yeast cells, I must now state, with relation to the facts and ideas which we have just had before us. In the first place, with regard to their growth; it is very common, in the process of brewing, to feed the yeast cells with a substance which is formed in the germination of barley. When barley is left in a moist state, at a suitable temperature, it begins to sprout, and during that process there is a change in two of its constituents, which I showed you the other day. One is gluten, a body con-

taining nitrogen, which I compared, for the sake of convenience, to muscular fibre, being in reality very closely allied thereto in chemical composition, and during the germination of the seed this substance passes over into some product or products—I had better speak quite generally—known by the name of diastase. In the yeast cells there is a substance very nearly resembling in composition that gluten, and it cannot be doubted that this gluten, or albuminous body as it is frequently called, is capable of undergoing a similar transformation into diastase, and of all foods the yeast cell enjoys most those which contain diastase. I have a good many yeast cells growing in a suitably heated chamber, and those which seem to thrive most are some which were put into an infusion of malt, to which sugar was added. It is common, in the process of fermentation, to put in yeast in tolerable quantity, but the extent to which it grows depends upon the time for which it is left in contact in the material. I am told that the common proportion is about one-twentieth of the quantity of yeast required. For instance, if 20 lbs. of yeast are wanted to effect a given fermentation, you put into the liquid which has been fermented 1 lb. of yeast calculated in the dry state, and give it this diastase to feed upon. At the same time, there is sugar present in the liquid, and during the process of fermentation this pound weight of yeast increases more and more, by a process of true germination and growth. Professor Mitcherlich actually saw, under the microscrope, some little cells of yeast sprout, and put out, from the side of the parent cell, small cells, which gradually increased in size. The actual process, however, has not been seen by many observers. And not only does the yeast cell in that way feed upon these albuminous bodies, which are grouped together by the name of diastase, but it also takes part of the sugar; and these are the two prominent facts which we know with regard to its food—that it feeds upon substances of those two classes; sugar, which contains no nitrogen, and also nitrogenous substances, which are formed by the partial breaking up of the gluten. On the other hand, its decomposition—I mean during its life—I am not speaking of any decomposition which its materials may undergo if it is killed—gives off alcohol, carbonic acid, succinic acid, and glycerine; in fact, the four chief products of ordinary alcoholic fermentation, which I enumerated to you the other day. And while these products are being given off, there is at the same time a considerable quantity of nitrogenous substances being given off. The albuminous matter in the yeast cells is undergoing decomposition, and is giving off nitrogenous substances. There is not any well authenticated case of the yeast cell forming, during its active functions, products of complete breaking up or putrefactive decomposition; all the products which we know best are substances of considerable complexity—less complex than the materials of the plant, but of great complexity; and, accordingly, the notion which Liebig had that the yeast-cell is active in the proportion as its materials are undergoing complete analyses or breakings up, and forming ammonia and carbonic acid, is not now entertained by that distinguished philosopher.

Some time ago, an exceedingly important experiment was made by M. Pasteur, with a view of testing the vital functions of the yeast cells in a definite way. The statements which I have made to you contain a good many terms which are exceedingly general, as, for instance, the allusions to diastase. We really do not know what that is. We know about what sort of a thing it is made from, but not definitely. And the same with the nitrogenous products which are given off by the yeast cells; we know something about them, but only a little. Pasteur put into a solution of sugar, in which some yeast particles were present, some ammonia combined with an acid, and at the same time he put some of the ashes of other yeast cells. He took a certain quantity of yeast and burnt it, so as to remove by oxidation the carbon, hydrogen, and nitrogen of the substance, and the earth substances which remained, which are essential to the formation of a new yeast cell, he put into some fermenting liquid, together with some salt of ammonia. When he did that, he really was treating the yeast cells very much in the same way as a good farmer treats the wheat plant. If you want a wheat plant to increase rapidly, you must, in the first place, take care to supply to it all that the wheat plant takes up in the shape of mineral matter from the soil, and the best way to find that out is to burn some wheat and see what is left. Then you must supply plenty of ammonia, and the more ammonia you supply up to a certain extent, the more rapidly does the wheat grow, by building up various simple substances into the complex substance, gluten, which I was speaking of just now. Pasteur put into such a mixture a few little cells of the yeast, and they did not thrive. They did transform some sugar into alcohol and carbonic acid, but they evidently were not at home, and at the end of a certain time, I forget how long, he found there was actually a smaller weight of yeast present than he had put in. That was a very different result from what happens when nitrogen is supplied to the yeast plant in the form which I mentioned just now as the usual one; and I think the fact is most instructive, and serves to show us what kind of a being the yeast cell really is—I mean whether it should be classed among animal or vegetable beings. I need hardly say that absolute distinctions amongst beings which we find in nature are out of the question; we do not generally get any absolute line of demarcation, for one class flows over into the other; but still the ideas which serve us to classify organic and other beings are exceedingly important, and in a case like this it is certainly of considerable interest to have some leading idea, by which one may see whether there is a reason for placing these beings amongst vegetable or animal organisms, and we cannot help giving special weight in that respect to the kind of process which the respective classes of beings carry out in their organisms. Plants build up complex substances from simple. All the most complex substances that we can get are made in the organisms of plants. They may have been taken over by animals from plants, but they are formed in the main by plants. And the chief chemical activity of animals is precisely opposite; they take those complex substances and break them down, by means of their vital functions, to the simple products which are exhaled and given off in the processes of animal life. Therefore, the question whether the process which the yeast carries on is a synthetical process—a building up, or whether it is in the main an analytical process, is certainly one of the most important which can guide us. Now, I think what I have said must appear to you all most conclusive in that respect—that what we know best regarding the nature of the yeast cells, the food which we know they take in large quantities, and upon which they live, is certainly exceedingly complex, and what the yeast cells take up in preference is certainly sugar, and the very complex nitrogenous substances which are present in solution in the malt, and the products which they give off, are exceedingly simple in comparison. Their functions are in the main (those which we know best, at any rate) analogous to those which take place in animal organisms, and are most remote from those which take place in vegetable organisms.

In a paper which he has recently written on the subject of fermentation, Liebig has drawn attention, amongst other things, to the circumstance that the common alcoholic ferment can be made to eat tartaric acid. If you were to neutralise a solution of some of these crystals in water, and put with the solution some yeast cells, at the same time supplying some nitrogenous material, the yeast plants would grow, and transform that into other substances. In the same way, if you were to put in some of this malic acid (which got its name from the circumstance that it is present in sour apples), the

yeast cells would also transform that; and the samo in other cases. One of the most remarkable decompositions is that of nitric acid, which, by the action of the yeast cells, is deprived of some of its oxygen, and converted into nitrous acid, so that it would appear that the plant can actually assimilate or eat the nitrates, forming these simpler derivatives from them.

There is one case which I should like to show you, of an inorganic action, one in which there is no vital process concerned, but it bears a sort of general resemblance to what I conceive to be the principle of those which I have been speaking of. I have here a piece of platinum in a peculiar state, which is well described by the term "spongy." If I hold it in the flame of common coal gas mixed with air, from a Bunsen burner, the spongy platinum eats the air or the oxygen contained in it and the gas. The word "eat" is not really so inappropriate as it may seem. If I were to put this spongy platinum into oxygen, I should find that it would combine a quantity of oxygen into its substance, and make it part of itself, and the same with regard to the coal gas. So that here you see, from the heat which was given off, the substance is really effecting a chemical change upon the materials which it absorbs, and it effects that change in its own substance. It is admitted that, in some way or other, the yeast organisms—I will not again call them plants—actually assimilate and make part of themselves, the sugar, or tartaric acid, or whatever it may be which they decompose; but they do not give off that substance which they have eaten in the same form. They give off its elements, after they have undergone a re-arrangement in other ways. At our next meeting I propose to bring before you some different considerations regarding the vital functions of these organisms, and some points which bear upon questions of sanitary importance.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

His Serene Highness the Prince of Teck, Sir William Tite, M.P., and Mr. A. J. B. Beresford-Hope, M.P., have been added to the Royal Commission for the Exhibition of 1851. The Prince of Teck has also joined the General Purposes Committee appointed to carry out the annual International Exhibitions.

COMMITTEES OF SELECTION FOR FINE ART.

Painting.—The Viscount Bury, M.P.; the Lord Elcho, M.P.; Sir Coutts Lindsay, Bart.; Alfred Elmore, Esq., R.A. (representing the Royal Academy); Alfred Clint, Esq. (representing the Society of British Artists); Alfred Hunt, Esq. (representing the Society of Painters in Water Colours); Henry Warren, Esq. (representing the Institute of Painters in Water Colours); F. Dillon, Esq.; H. S. Marks, Esq.; — Morris, Esq., and R. Redgrave, Esq. (for miscellaneous art).

Sculpture.—Tho Viscount Bury, M.P.; the Lord Elcho, M.P.; Sir Coutts Lindsay, Bart.; William C. Marshall, Esq., R.A. (representing the Royal Academy).

Architecture.—The Viscount Bury, M.P.; the Lord Elcho, M.P.; Sir Coutts Lindsay, Bart.; Edward M. Barry, Esq., R.A. (representing the Royal Academy; Joseph Clarke, Esq. (representing tho Royal Architectural Museum).

CLASS X.—EDUCATIONAL WORKS AND APPLIANCES.

A meeting of the Committee, Section E. (Specimens of school-work serving as examples of the results of teaching) was held at the Board-room of the Royal Horticultural Gardens, on Saturday, the 30th July, at twelve o'clock, present, Messrs. E. Chadwick, C.B., in the chair, John Bell, T. Chesman, Captain Donnelly, R.E., A. C. King, W. G. Larkins, F. Pitman, T. A. Wright, and P. Le Neve Foster, Secretary. The Committee, after some discussion, settled the course of action they were prepared to recommend to Her Majesty's Commissioners as the best calculated, in their opinion, to secure a satisfactory representation of the objects comprised in this section, and they directed the Secretary to communicate the same to her Majesty's Commissioners.

FOREIGN COMMISSIONERS.

The following have been appointed since last announcement:—Austria, M. Le Chevalier François de Werthheim. Hungary, M. Charles L. Posner. San Salvador, James L. Hart, Esq., F.R.G.S., Consul for San Salvador.

THE EDUCATION BILL.

The House of Lords went into committee upon the Bill, on the 29th ult. In clause 3, Earl Russell proposed the insertion of the words "Minister of Education" or "President of the Board of Education," with the view of confiding the charge of the education of the country to a separate department. He urged that, although the Committee of Council might be able to superintend the existing system, the extension now proposed, and the many difficult and important questions to which it would give rise, demanded the formation of a distinct department.

Earl de Grey, while acknowledging the weight which attached to Lord Russell's views on any education question, appealed to him not to press his amendment, on the ground that the present department worked well, and that its reorganisation should properly be considered along with that of various other departments. Moreover, we were confessedly passing through a stage of transition, and it was better to wait and see what the features of the new system would be, including secondary as well as primary education, before considering the constitution of the department.

Earl Fortescue thought Lord Russell had given cogent reasons for this proposal, while no conclusive arguments had been used in opposition to it. Lord Lyttelton and Earl Stanhope agreed with the amendment, but deprecated a division at the present time, and the proposal was negatived.

It will be remembered that this was one of the principal subjects of discussion at the Educational Conference, held in the Society's Great Room early in the present year, and that the importance of having a Minister of Education was then generally admitted.

On clause 7 (regulations for the conduct of public elementary schools), Lord Carnarvon moved to insert words enacting that no child should be required, as a condition, to attend Sunday-school, or receive religious instruction, when it should be contrary to the wish of his parent or guardian.

Lord Nelson and the Bishop of Carlisle supported the amendment, and Lord De Grey said that the point should receive consideration, but as the Conscience Clause had been very carefully discussed in the other House, he trusted the amendment would not be insisted on.

The Bishop of Exeter thought that poor men would often bo afraid to make a declaration that they did not wish their children to be taught in religion, and suggested, as a means of meeting the difficulty, that the sub-section should run as follows:—"No parent shall bo required to cause his child, as a condition of being admitted, to attend religious instruction."

Lord Salisbury objected to the absurdity of proclaiming in a school that children should choose for themselves whether they would attend religious instruction.

The Lord Chancellor said the clause had been the sub-

ject of compromise in the other House, and he trusted it would not be disturbed in a House in which the Nonconformists were not represented.

Lord Shaftesbury confessed that this was an unsatisfactory compromise, but it was an inevitable one, and he advised the House to accept it, for if the amendment were adopted, the whole subject would be re-opened, and the Bill would be lost. In that case, he felt certain that the next measure would be one of purely secular instruction.

Lord de Grey hoped that full weight would be given to the advice of Lord Shaftesbury; but he expressed his willingness to amend the clause so that no child should be required to attend any religious observance or instruction "from which he should be withdrawn by his parents;" and Lord Carnarvon accepted the amendment.

The Bishop of Gloucester moved the omission of the words providing that the religious instruction be "either at the beginning or at the end, or at the beginning and the end of such school meeting," and was supported by the Bishop of Lincoln.

Earl de Grey thought that some of the objections made to this clause arose from the fact that it was supposed to restrict the teaching of religion to the beginning and end of the day; but as there were two school meetings per day, and religious instruction might be given at the beginning and end of each meeting, it followed that there were four distinct times at which religious education might be given. By adopting the amendment, they would lose the security intended to be afforded by the time-table conscience clause. The Duke of Richmond then advised the Bishop of Gloucester to withdraw the amendment, which was done.

The Earl of Carnarvon then moved an amendment to the effect that the time-table should not only be approved, as provided by the clause, but also be "formed and framed" by the Education Department, but this was negatived without a division.

The Bishop of Manchester observed that one of the conditions under which an elementary school became entitled to the annual grant under the Bill was, that it should be under a certificated teacher. The present annual increase in the number of certificated teachers was 700; and, as upwards of 25,000 would be required to take charge of the new schools, more than twenty years must elapse before the object of the Bill would be attained. Lord De Grey said that the Bill did not deal with training schools, but this subject would receive the careful consideration of the government.

Other amendments were proposed, but withdrawn or postponed, and the conscience clause was then agreed to, with the amendment accepted by Lord De Grey.

On clause 14, Lord Colchester proposed that after the sub-section 2, providing that "no religious catechism or religious formulary which is distinctive of any particular denomination shall be taught in the school," these words be added, "unless a majority of ratepayers of the school district petition the Educational Department in favour of such teaching." Earl De Grey was unable to accept the amendment, because it re-opened that difficult question which induced the other House to adopt the change in the Bill embodied in the section, and after some discussion it was negatived.

An amendment on clause 17, proposed by Lord Lyttelton, to prevent the school boards from remitting the whole of the school fees of any child, was opposed by the Duke of Argyll, and negatived.

On clause 22, Lord Lyttelton moved the following amendment:—After "purpose," insert "provided that in every case under this section the majority of those voting at any meeting to give effect to its provisions shall be not less than two-thirds of those present at such meeting." This was agreed to.

The Duke of Marlborough moved the following new clause, between clauses 22 and and 23:—"If the ratepayers of any district in which a school shall have been transferred to a school board shall, at a meeting duly summoned for the purpose, resolve that such school shall cease to be managed by the school board, and there are trustees or other persons who, in the opinion of the Education Department will represent the management of such school before it was transferred, and who are willing to undertake the management thereof, the school board may transfer to such trustees or persons such school, and convey and assign the schoolhouse and any other property belonging to such school vested in the school board; but in every case such transfer shall be made only—(1) with the consent of the Education Department; and (2) with the consent of a majority of the school board; provided that no money raised by rates shall be applied for the support of such school after the transfer thereof by the school board."

Earl De Grey did not object to the principle of the clause, but thought that it would require some amendment at a future stage, and it was ordered to stand part of the Bill.

On the motion of the Duke of Richmond, clause 23, providing that the managers of a public elementary school might, with the consent of the Education Department, and with the consent of all parties whose consent might be required, alter any regulations to which the management of such school might be subject, was struck out.

On clause 25, enabling free schools to be established in special cases, Lord Lyttelton renewed his objection, and said that children who required gratuitous education ought to receive it in the industrial schools. He moved to omit the clause, and was supported by the Bishop of Carlisle. On a division, the clause was struck out by 65 votes against 61.

The clauses up to 72, inclusive, were then agreed to.

On clause 73, regulating the attendance of the children at school, a discussion arose on the power given to the school board to require children between five and 13 to attend school. Lord Shaftesbury moved to substitute four and ten respectively, for reasons bearing on juvenile employment. Lords Salisbury and Lyveden, on the other hand, preferred that children should begin at seven instead of five, and the Duke of Rutland agreed in recommending ten as the limit instead of thirteen, on account of the importance of the labour of children in the agricultural districts. Lord De Grey, however, urged their Lordships to adhere to the clause, and the several amendments altering the age having been negatived, the clause was agreed to.

The Marquis of Salisbury proposed to add, at the end of clause 94:—"Provided that no conditions shall be required to be fulfilled by an elementary school, in order to obtain an annual parliamentary grant by any minutes of the Education Department not in force at the time of the passing of this Act, unless such minutes shall have been laid for six weeks upon the tables of both Houses of Parliament, and shall not have been objected to in an address to Her Majesty from either House."

Earl De Grey had no objection to accept the amendment, provided the noble lord would make it necessary that the address should be agreed to by both Houses; but Lord Salisbury pressed his proposal, which was agreed to.

On the second schedule, regulating the election of members of a school board, the Duke of Richmond said he thought the ballot scheme by no means applicable to the Bill. He had no objection that tho poll should be taken in the metropolis by ballot, in accordance with the principles of the Metropolis Management Act, but he moved an amendment that in all other districts the poll should be taken in the same manner as the poll for burgesses and ratepayers was usually taken.

Lord De Grey defended the ballot as the most convenient machinery of election, and as being likely to relieve voters from the pressure of political or religious party, and after a few words from Lord Shaftesbury, who regretted that the mischievous word "ballot" had ever been introduced into an Education Bill, the House divided, when

the Duke of Richmond's amendment was carried by 72 to 53 votes. The schedule as amended was then agreed to, and the Bill was ordered to be reported.

On the 1st instant the Bill was reported, when Lord De Grey, in answer to Lord Russell, explained that if a school board committed any act of default, the Education Department might either dissolve the board and direct another election, or substitute a board named by themselves.

On clause 7 (conscience clause), Lord De Grey, in order to meet the difficulty raised by the Bishop of Carlisle, that, as the Bill was worded, a child might absent himself from school on all saints' days, proposed to substitute, for the language used, words to the effect that absence might be permitted on days set apart exclusively for religious observance. This was agreed to.

On the clause relating to compulsory attendance, Lord Colchester proposed an amendment, which would prevent the principle of compulsion from being carried out against the wishes of two-thirds of the ratepayers, but Earl de Grey was unable to accept the amendment, as it would render the clause altogether inoperative.

The Marquis of Salisbury thought there would be very great danger in working the new system of compulsion. In the rural districts, the farmers would oppose it, and even if they were willing to carry it out, the justices would refuse to convict. In the large towns, however, the case would be different, and as we were introducing a principle which was absolutely new, we ought to take the precaution of enacting that the school board should vote in favour of compulsion by a majority of two-thirds. He should, therefore, support the amendment. It was, however, negatived without a division.

Three new clauses were added by Lord de Grey, one providing for the inspection of voluntary schools and the examination of the scholars in religious instruction by an inspector, not one of her Majesty's inspectors; the second, providing for the re-transfer of a school by the school board to the managers, with the consent of the Education Department; and the third, to meet the case put by Lord Howard of Glossop, and enabling managers of voluntary schools to take sites, by agreement, under the Lands Clauses Consolidation Act.

Several verbal and other amendments were made, and on the following day (2nd inst.) the Bill was read a third time, and passed.

The *Times*, while it observes that, "on the whole, the Bill passed out of the House of Lords unaltered," expresses a hope that the clause allowing the establishment of free schools, which was struck out by a narrow majority, "will be re-introduced in the House of Commons."

The history of the Educational Bill is thus virtually complete.

WHAT ART AND SCIENCE, IN THE NEW ARMS OF PRECISION, GIVE TO DEFENCE AGAINST ATTACK IN WAR.

By Edwin Chadwick, C.B.

Economists attending the international congresses of social science and statistics are aware that, in time of apparently profound peace, I have long sought to direct attention to the means of removing the obstructions to the progress of arts, manufactures, and commerce, created by the burthens of large standing armies, and that I have endeavoured to give warning of the dangers of extraordinary aggravations of those burthens by war, provoked in the interest of such armies, in their very nature of offence and menace. Upwards of five or six millions sterling annually, at a very moderate estimate, may be set down as our ordinary share of the European excess of charge occasioned by such armies. And now suddenly, to the surprise of every nation on the Continent, with scarcely a week's notice, a war has been declared, inflicting on the people under the belligerent governments immense bloodshed, and enormous devastation of every kind, and subjecting ourselves, with other surrounding nations at peace, to aggravations of our common burthens, and to reductions in the value of moveable property, to an extent estimated at some hundred millions, or a cost equal to that which might be incurred by a participation in the war itself. As to the moral or the political questions involved, or as to the means of preventing these gigantic evils that may be obtained by an advance of international law and policy, it is not my purpose to enter. But as a practical and material means of prevention, I have made efforts, which I would now renew, to direct attention to the increase of the power of defence against attack, given by the new arms of precision and by other scientific appliances. Our Secretary of War has lately adverted to the growth of this power as a source of hope and confidence, and I find that distinguished military officers are beginning to appreciate its distinct importance. I am desirous, whilst soliciting special attention to it at this time, and submitting grounds for increasing confidence in its efficiency, of expressing regret at apprehended shortcomings, and failures in its application and in the display of its due protective efficacy, in the great conflict now impending.

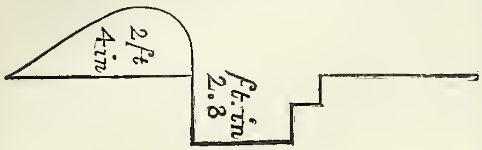
At my suggestion, the council of the Royal United Service Institution recently took steps to bring the subject under discussion, and for that purpose they requested Captain H. Schaw, of the Royal Engineers, Professor of Fortification and Artillery at Sandhurst, to prepare a paper "On the Amount of Advantage which the New Arms of Precision gives to Defence over the Attack." This paper, which contains highly important facts and expositions of technical detail, was read on the 6th of June last, and is printed in the "Transactions" of the Institution. My view of the bearing of the paper is given in the report of my speech upon it, setting forth facts which may at this time obtain attention they have not before received.

The grounds of my apprehension that the principle in question will, in the present sudden war, have but a very limited and imperfect action, are these. It is admitted that personal combat with sword, with bayonet, or lance is now a folly, and an exposure of men to useless slaughter, and that there must be an end of all charges with those weapons, as against the new small arms, the revolver as well as the new breech-loaders. One of General Grant's staff, General Daff, who commanded his artillery, told me that he made his men put aside their swords as encumbrances, and only assented to officers retaining them as directing batons, as it were; and one officer of extensive service tells me he relied on his revolver for any personal encounter, and used his sword only as a walking-stick. Yet we see armies on both sides sent forth arrayed in all the inferior weapons. Another established conclusion is, that all movements in close column "in the open," at anything like the old distances, can no longer be properly made. Yet we have had accounts of recent field exercises in Prussia, as well as in this country, of men being massed under view—of rushes of close columns, under conditions which military officers admit to be impracticable without destruction. But, as against attack with the new arms of precision, it is demonstrated that extempore shelter-pits secure, especially with the new arms, large preponderant advantages to defence. In the American civil war, it was found to be necessary to revert to the Roman system, for an army arriving on the field of battle in the evening would intrench itself during the night, even if it was intended ultimately to act on the offensive, and the opposing force followed the example. I have stated, as a general result of the facts on military testimony, the gain of defence, as against attack, as three to one, under tolerably complete conditions. But the American civil war may be referred to for study, as demonstrative even of a greater gain to defence, for General Lee, with little more than 50,000 men, mainly by the system of earthworks, and chiefly with the common rifles, baffled all

General Grant's attacks at the head of nearly 200,000 better appointed men.

Additional illustrations of this important point are given by Colonel C. Cameron Shute, C.B., in a paper which he read at the Royal United Service Institution, on the military maxims suggested by the last autumn manœuvres of continental armies. In describing the manœuvres of the Prussian army, he states:—

"During the manœuvres in Pomerania, the only occasion on which 'shelter trenches' were used, was on



the last day, by the northern army, near Pansin, when, as I mentioned in an earlier part of my lecture, a long high hill, the key of the position, was partially entrenched, obliging the southern army to make, with part of its force, a very exposed flank movement. In the course of about an hour, as far as I could ascertain, three two-gun redoubts had been thrown up, and four shelter trenches. The infantry were formed in line of quarter columns on the reverse slope of the hill, with about one-fourth of the usual intervals; the intervals were covered as usual with the customary number of skirmishers, which were therefore, in this case, shoulder to shoulder, and hidden and protected in short trenches dug about twenty yards below the crest, on the enemy's side of the hill. The trenches were of such a depth that men sitting on the reverse step were invisible from the front, and when standing in the ditch the earth thrown up in front was of just such a height as to enable the men to rest their rifles, slightly embedded, on it in their usual firing position—standing. When the enemy attacked, the skirmishers commenced heavy independent firing, of course to the greatest advantage; and when he, with his columns, advanced well up to the hill, the defending columns, having their front quite clear, moved quickly from the reversed slope to the crest of the hill, delivered a four-deep fire, and, charging, drove their opponents in confusion from the position."

Mr. Fergusson states to me that such earthworks are specially applicable to his system of fortifications with circular lines, which are difficult to enfilade, and he proposed them for defence by irregulars, "one half with pickaxes and shovels, and the other half with 12-pounders and howitzers, and a few, who are capable of handling them, with rifles, and short swords, and pikes." [He was—twenty years ago—speaking only of the then existing old arms.] "I am convinced," he said, "that the true way to use such irregulars is to provide them with earthworks, such as I am proposing, where the enemy cannot get at them, and where no momentary panic or confusion can be taken advantage of by the enemy, who never sees or knows what is going on in the fort, and must work his way forward, irrespective of the garrison before him."

In America, so decisive is the experience of this system found to be, that they are proposing spades to fix in their small arms, to carry with them in the place of bayonets. This being so, and the experience being, on high professional judgment, so large, clear, and decisive as to the gain of defence with the new arms under such shelter, it may be asked why the general application of the system is not even now provided for? Why is it that we do not see commensurate organisations of "spadesmen"-sappers provided? Colonel Shute gives the explanation:—"I must, however, observe," he says, "that neither the French nor Prussian officers generally are favourable to the use of the spade, unless in exceptional cases. They say they do not wish to have their troops turned into armies of sappers, but that officers must now pay more attention than ever to the accidents of ground for shelter; they consider that the frequent protection of trenches would prove most demoralising, and that there would be difficulty in getting troops to leave them."*

On this it may be asked whether it is "demoralising" to place men under the cover of fixed fortifications, where they can be got, and is there any difficulty in getting them to leave them, when there is fair reason for their doing so? Surely this objection must be dismissed as a mere pretext. The "linesmen," or others—officers unused to the new arms—officers of the non-scientific corps—certainly do not wish to have their troops turned into armies of sappers, for they have the instinct and the clear perception, that this would lead to the chief commands being transferred from them to the commanders of sappers—the scientific corps. This was what did happen in America, after an immense sacrifice of life had been occasioned, and it may be averred the new arms given by science will only be most effectively wielded under scientific commands. It will be for the civil leaders of public opinion to interpose, and to prevent life and property being sacrificed on the greatest scale, and the progress of "liberty and civilisation," as the Emperor phrases it, being obstructed by these widely prevalent professional jealousies.

One reason given for the retention of the superseded arms—the bayonet, the sword, and the lance—is, that to take them away might impair the *morale* of the rank and file, as it would take away the arms in which alone they have prowess. But *that* manual prowess being now comparatively useless, the retention of the arms for it is to occasion useless slaughter. Another common reason assigned for their retention, and against exclusive reliance on the new arms, is the unfitness of the ignorant rank and file to wield those new arms with effect. This reason may be accepted as, in part, well founded in relation to such ranks, for experience in the use of the new arms, in the schools of musketry, proves that success with them is very generally proportioned to the intelligence of those who wield them. This is, indeed, a special gain and an important element, as it takes power from ignorant ruffianism and gives it to education and intelligence in the ranks.

It may be permitted to an educationist, anxious for the military drill in our schools, to observe that it will be of peculiar interest to note, in the coming conflict, the working of education in the rank and file, as it will now be found in the ranks—at all events, in the Prussian ranks—to a greater extent than has perhaps ever obtained in any previous great war. It was observed in the last war, that maps of the country, with printed instructions, were put into the hands of privates as well as of non-commissioned officers of the Prussian army, so that they knew almost as well what they had to do as their superior officers; and thus an economy of command was effected. In the Prussian army, the officers are as 1 to 40 of the ranks; in ours, they are as about 1 to 20. The first Napoleon's well-known military saying was—"Prétendez vous defendre une frontière par un cordon? Vous etes faible partout, car enfin tout ce qui est humain, bons officers, bons généraux, tout cela n'est pas infini, et si vous êtes obligé de dissémenir partout, vous n'etes fort nul part." To the extent to which sound training and education is carried to the ranks, and there is interest and zeal in the work, it was shown in the last war that the reverse is very much the case. It must be remembered that the Duke of Wellington declared emphatically of the uneducated rank and file, very much the sweepings of the streets—the British roughs—under his command that their conduct, in everything except fighting, was detestable, and that they could neither bear properly

* It is stated that Marshal McMahon has recently directed exercises in forming shelter pits by the French army.

success nor failure. It is due to the educated rank and file of the Prussian army to state that, distinguished as was their behaviour in battle, their conduct after battle was attested to have been even more brilliant, in their self-restraint, their sobriety, their kindliness to the vanquished, and conciliation of the people of the country through which they passed. The general result of the moral force given by an improved quality of education, beyond our common elementary education, is now displayed in the surprising absence of manifestations of enmity on the part of the conquered populations, and the great gain of military force by their general and zealous co-operation. The strongest display of resentful passion on the part of the conquerers, I was told, was upon the Frankforters, who for insults and provocations for which the first Napoleon would have given the city up to be sacked *pour egayer les soldats*, as he spoke of those things, were subjected to a requisition of twelve cigars daily; and there the citizens said that the privates—the educated rank and file—really behaved like gentlemen, whilst their officers, in inflicting this requisition, behaved like snobs.

With these prefatory observations, and encouraged by the notice taken by publicists abroad of what I have previously said, I beg to recal attention to the following statement of facts made before the United Service Institution, in the hope that more practical attention may yet be gained to them for the mitigation of the great scourge to which Europe is now subject.

Mr. Edwin Chadwick, C.B.—"I have paid special attention to the military testimony on the question dealt with in the paper read, which involves a very large politico-economical question, as to the relative economy of defensive as compared with offensive armies, which weigh so heavily on European nations. And as far as I have consulted that military testimony, which has been of a high order, I believe the conclusions from it are more decisive, as to the gain on the side of the defence, than has been stated in the paper read. It is some eight or ten years ago since I discussed the subject with the late Captain Fowke, of the Royal Engineers, whose mastery of his profession, and clear, comprehensive view of it, were attested by high military authorities; and his general conclusion then was, that the new arms of precision, even in their then state, while they gave one to offence, gave two to defence. But since his time science has made large strides, and if the position taken by Captain Fowke were sound then, it may now be established in further evidence than that contained in the paper, that whilst science gives one to offence, it gives at least three to defence. I believe that I was the means of recommending Mr. Whitworth for consultation, as the first mechanic of the time, for the improvement of the manufacture of small arms; and I have watched the progress of the manufacture of large as well as small arms with interest in its economical aspect. When he had achieved his smallest rifled gun, which has a longer range than the heaviest old field-piece in the service—his 3-pr. having a point blank range of a mile, and at 20 degrees a range of 5,500 metres, or more than three miles, as against the best French 12-pounder field gun, which had only a range of 3,500 metres, and at 35 degrees of elevation of a range of five miles with the Boxer shell—I sent an account of this implement to the late General Shaw Kennedy, of whose repute as a tactician I need not speak; and I asked him what would have been the result if we had had a sufficient number of those guns at Waterloo? The General's answer was, that as against that gun, that battle could not have been fought, because Bonaparte's front line was half a mile off, and his reserves were a mile off;—but as against such a weapon, he must have had them more than three miles off, and he could not have brought them up over that field under the fire of that weapon. How could he advance in the open against guns so easily put under cover, and with power of converging fire, of shell as well as shot, from one end of the field to the other, upon any force attempting to cross it in the open? Now, this is the gain by one gun, of which no particular notice has been taken in the paper.* How would it have been with Bonaparte's close and heavy columns, in coming up against another arm—which Captain Schaw has not mentioned—the "Snider?" I give the answer of a French military authority, as to the "Chassepot." On the 27th of December, 1867, Captain Regius, one of the veterans of the first Empire, said, in a discussion in the Legislative Assembly, on Army Organisation,—"When the range of the musket was 250 metres, and it discharged one ball a minute, the time it took a column to attack in traversing that distance in a charge, was four or five minutes. Although we lost men in doing it, we did it. But now, with the new arms of precision, the range is 1,000 metres, and the rate of discharge is seven or eight a minute. A column of attack will be exposed for fifteen or twenty minutes to the fire of the enemy in getting over that distance. The column must be annihilated before it could get at the enemy." The common practice in France, with the Chassepot, by the rank and file is, as it has been stated to me, that, at 1,000 metres, one out of five shots hits; at 400 metres, nearly two out of five; at 200 metres, more than three out of five hit. So that the nearer his heavy columns approached, the more sure would have been their destruction from small arms alone; and their approach would be not as against the "thin red line" upstanding, but against men of the colour of the earth, down lying, with no more than the head, or a ninth of the surface, exposed; and putting the infantry soldier, who advanced upstanding, or "offence," to a disadvantage of nine to one. How would it have been with charges of cavalry? A French experiment will answer. In a simulated charge by 100 of the Guides, against 80 of the foot Guard, armed with the Chassepot, the distance of the charge was 400 metres. The Guides got over that distance in 32 seconds, during which time the foot soldiers fired 326 balls, of which 150 hit the target, or one and a-half hits for each horse soldier, so that the cavalry would have been annihilated in 32 seconds, without having reached the enemy. A friend who is conversant with the subject, and who has recently spent some six or seven weeks at Chalons, with the scientific and other French officers there, reports as their general conclusion, and the opinion of the army there, that there is an end of charges of infantry and of cavalry—that there is an end of all systematic combats with *l'arme blanche*. It is said by cavalry men, that there will yet be use for them, for pursuing the enemy when disordered by artillery fire. But men are taking revolvers with them for their individual protection against surprises, and surely he who flourishes a lance or a sword, flourishes a folly against an Adams' revolver, which discharges shots almost in seconds, and puts an average of shot in a space less than a man's skull at 60 yards distance. Skirmishing advances with great skill; dodges and sudden surprises are, however, the only work now conceived in the French army, at Chalons. The pomp and circumstance of war is gone. The Colours are death to those who carry them, and advances must be made crouching

---

* This gun and carriage, with 100 rounds of ammunition, weighs about 700 lbs., the weight of a Hansom cab. It may be taken to pieces, and transported like a mountain gun. It fires long shot and case shot, and may be charged to the muzzle with round shot. It fires a Boxer shell, which opens out into nearly as many pieces as the *mitrailleur*, which has only a musketry range, and which is apparently so far inferior. Describing this Whitworth gun to Lord Clyde, he said to me, "If I had had that gun in India, what would I not have done with it!" With due diligence at the War Office he might have had it there. Some years ago, Sir Charles Shaw urged the introduction of a gun on the principle of the mitrailleur, but with the barrels arranged differently. With this gun about three men would do the work of a company of the line, only more accurately. The improved musketry would change position on the field with the rapidity of light field artillery or of cavalry, and the men being spadesmen, would rapidly put it under cover. But it appears plain that the Whitworth, with the Boxer shell, would do all this and more, and, far out of the range of the best mitrailleur musketry fire, would silence it.

or crawling. In short, the conclusion at Chalons is, that the future of war will be "a war of serpents."* But it is just the sort of war that will give the greatest advantage to alert defenders, like our Volunteers, who know and possess every part of the country, and can make the most of every wall, or building, or hedge. Particular instances may be adduced to establish fully my general conclusion, although tho trial of the new arms, large and small, has been very incomplete; they have been applied only partially. In some instances, the small arms, and those not the best, have only been used sparsely, and in others, and those few, the new artillery, without support from the new small arms. I am unaware of one instance of an entire battle array, and of a complete instance of the application of all the new arms, as an exemplification of what they will do; and we have by no means got to the end of what science will do with all arms, large and small. My friend Sir Joseph Whitworth will not die happy until he has provided the means of destroying life and property at seven miles distance, for then he considers he will have provided the means of ensuring peace between civilized nations; and that men will not be got to go out and fight those they can no longer see. The range of heavy ordnance is spoken of in the Professor's paper as being now between four and five miles; but with Sir Joseph's 9-inch gun it is between six and seven miles. He has obtained with it a range of six miles and one-third. Indeed, he has not tried the extreme ranges, and may now have obtained his desideratum of seven. He is a man, from my observation of him—and I have known him a long time—who always does more than he says he will do. He says he will now throw a 1,500 lb. shell six miles and a third, which will go through twelve inches of armour-plate. In the accounts of recent Prussian field exercises, it is said that the enemy were "seen massing in the distance," but if an enemy were "seen massing" within the range of such a gun as this, or even within the range of his smallest 3-pr., which puts an average of shot and shell within a a square of five hundred yards, at five miles distance, they would be massing for destruction. The artillery practice, as recently made near Portsmouth, was reported as demonstrative of a large gain to the defence, by earthwork, from the new arms. Under such conditions I must, then, submit it as established conclusively, that whilst the new arms of precision give one to offence, they give at least three to defence. An American General, of experience in the late war, on a visit to England, treated the notion of an invasion of it, with its ditches and hedges, with its walls and raised and sunk roads, and means of covering infantry, and other means of protection, as a benighted absurdity, and he did so on the last experience of the recent war in America, when it was found that neither side made way against each other in such a cultivated country, even with their less perfect arms than those now proposed; and that later experience led very much to the conclusion that he who attacks in such country is defeated. On such grounds I must submit that the military testimony, as far as I have heard it, goes farther, and with more certainty as to the gain of defence over offence, particularly in France, than Captain Schaw has stated in his paper. In only one instance have I heard of an apparent gain to the attack over the coast defence, and that is the very case of Sir Joseph Whitworth's, with his large shell gun. If he is enabled to throw a shell of the enormous magnitude of three-quarters of a ton six miles and a third, a boat with that gun would, at that distance, be a mere speck—and the shifting speck would easily hit the large fortification, Portsmouth or Cherbourg, whilst, I suppose, artillerists would find it a difficult task from that distance to hit the shifting speck. I imagine the coast defence must be, not in the now helpless great fortification, but in quick-going scout-boats, in large gun-boats, to go out and have their heavy gun duels in the distance, to keep off the mischief. Some foolish people, or interested people, exclaim against the expense of experiments, and the trial of new arms. I consider that those trials ought to be encouraged and carried to the uttermost, as means of immense eventual economy of war force and expenditure. I took part in a congress of statists and economists, civilians, and civil servants of the chief states of Europe, as also of the United States, held at the Hague, last autumn, when I brought the question under consideration, as a great question of international as well as of national economy. I was enabled to state, upon French military authority, that little Belgium was now enabled, if she were so minded, to withstand great France, and so might little Holland of itself alone. There is a very able treatise by an officer of the *Corps du Genie* of the French service, which I have shown to various military friends here of the scientific corps, proving that France, with 100,000 men, could stop an invasion by tho force that such a power as Prussia could bring into the field. This being so, the people of France—the taxpayers of France—may ask why they continue subjected to the burthen of 400,000 or 500,000 of an offensive force, and that a force which not Prussia only, but even Belgium or Holland could withstand; and the peoples of surrounding nations may and ought to make the like remonstrances.

The Chairman—Perhaps you would now like, Captain Schaw, to make some observations upon what Mr. Chadwick has said.

Captain Schaw—I can only thank Mr. Chadwick for his testimony in support of what I have brought forward. I have the idea that the defence has gained over the attack. He holds the same view, in fact more strongly than I do. I think, however, as, indeed, he has observed, that the very long range of modern artillery (six miles and a quarter, which Mr. Whitworth claims), is rather an advantage to the attack than to the defence in some cases. If we had had rifled guns at the battle of Waterloo, it would not have prevented the French from attacking us, for the French would probably have been furnished with the same class of guns, and would have used them with equally destructive effects against ourselves. As regards infantry tactics, some interesting publications have lately appeared, entitled "Conférences Militaires Belges," one of which refers to this subject. It is proposed that in future attacks the infantry should advance, masked by skirmishers in front, who should take advantage of any cover that may present itself, and that, under cover of the smoke produced by these skirmishers, the main body should work up, until they are near enough to make the final advance. Those seem to have been the tactics of the Prussians in their last war; but as Mr. Chadwick has observed, there has been no example where modern improvements in fire-arms, on both sides, have been tested on equal terms. The Prussians had an immense advantage in the last war, therefore that can hardly be taken as a fair criterion. In the case of a cultivated country like our own, I cannot say that I feel perfect security on account of the cover given by fences, hedgerows, &c. It appears to me that war is now, more than ever, a question of

* M. Zavier Raymond, a French military writer, in an article in the *Revue des deux Mondes*, referring to the order of the day of General Benedek to the Austrian soldiers, not to mind the Prussian needle-gun, but to rush in upon the enemy with "cold steel," observes that "such a course is easier directed than taken. The range of the needle-gun is at least 500 yards, which is a great distance to cross under a shower of balls such as the Prussians discharged with their weapon. General Benedek was at Solferino, where he displayed uncommon talent as well as bravery, and he ought to have known that at that battle there was neither Austrian nor French cavalry which could get at the infantry to use cold steel. On both sides the rapidity of the infantry fire disorganised all the cavalry charges before they could get up, despite the valour with which they were urged. Horses move quicker than men, and on both sides then only the common percussion muskets were used." Since then, the defensive power of the Chassepot was displayed, in a small French force, armed with it, throwing back with slaughter a large Garibaldian force, at Mentana; and the power of the needle-gun was displayed by a small Prussian force throwing back a large Danish force, at Düppel.

manœuvring, a "war of serpents;" and those who are the wisest serpents, and can manœuvre the best, will have the best of it. And more particularly is this the case in a close country, where you cannot get the advantage of long ranges, and the movements of your adversary are concealed. You must be prepared to take advantage of openings, and those who can take advantge of them most quickly will win.

CORRESPONDENCE.

BREAKAGE OF RAILWAY AXLES.

Sir,—Mr. Bridges Adams has favoured the public, in your issue of July 8th, with a most interesting and instructive paper upon the forces which are at work in all our railway trains, and more especially in goods trains, tending to fracture the axles, and thereby cause a repetition of that lamentable Newark accident.

Agreeing, as I do most cordially, with all he has advanced, I venture to think that, while he mentions it in the article headed "Longitudinal Shocks," he has omitted to give one very active source of danger the prominence and value which it deserves. Mr. Adams says:—"In wagons without traction springs, or buffing springs, the haulage by loose couplings is a succession of violent jerks, frequently breaking the couplings and causing accidents." No doubt about it; but, inasmuch as these violent jerkings or blows are also transmitted directly in their full force to the necks of the axles, they, in my humble opinion, put a more severe and trying strain upon them than the direct load with which they are weighted. Along all our main lines of railway may be seen coal trains, consisting of 30 or 40 wagons, without buffers or traction springs, and with very loose couplings, stopping and starting with shocks of the most violent character. These loose couplings are, under existing circumstances, necessary, for the driver could never start a train were the wagons all coupled up tight, for reasons which Mr. Adams has most fully given. It is with these coal trains the great danger to the public lies; and what mail or passenger train does not in its journey meet numbers of such trains? The wagons composing them are very seldom the property of the railway company. but of colliery-owners and coal-merchants, whose interest it is to construct their wagons as cheaply, and repair them as seldom as possible. A certain amount of inspection by the railway company over whose lines they run is no doubt established, to secure these wagons being kept in proper repair, but it frequently happens that the wagon, from the pit's mouth to its destination, runs over several lines of railway, dividing the responsibility and opportunity for inspection; and further, the evidence given on the Newark inquiry shows how difficult a thing it is to detect flaws which exist, and which at any moment may cause a break-down.

Pending the universal introduction of Mr. Adams's radial waggons, with their close couplings, the danger to the travelling public would be much decreased by the Board of Trade insisting upon spring buffers and spring traction-bars being a necessary appendage to every wagon running upon our railways. If this precaution is not taken, I venture to predict that, as this class of rolling-stock deteriorates by age and use, we shall have more Newark tragedies.—I am, &c.,

John Brunton, M. Inst. C.E.

13a, Great George-street, Westminster, 27th July, 1870.

DECLINE OF MANUFACTURES IN TURKEY.

Sir,—The heading of the paragraph in the *Journal*, although slightly corrected by the concluding observations, is calculated to create misunderstanding as to the economical conditions of Turkey. That country, like India and like England, has not been able to maintain hand-loom weaving in this day, and the consequence has been a displacement of the old manufactures, but not a decline of the industry of the country. If unable to compete with Manchester in textile manufactures, Turkey, like India, has profited by the progress of the world. Her trade in raw materials has vastly increased, and cotton cultivation is restored, and, after having for so long a period succumbed to American competition, has become a great source of wealth. Cotton growing factories, with English machinery, now cover the cotton districts. If the silk looms have diminished, the silk filatures of Broussa and Smyrna have attained a high reputation, and give employment to many hands. For each old art that has decayed from English competition, some new art has been introduced, which is contributing to the progress of the country.

As improved means of communication extend, so will the remaining manufactures of the inland cities disappear, but to a greater degree will agriculture be developed, by opening wider markets for the produce. Under such circumstances, changes and displacement will take place, but this does not indicate decline, but progress. Turkey, however, like India, has still much to do, to place its administration on a level with England and the United States. There is, however, the disposition and the determination of a people whose perseverance is proverbial.

So much misconception prevails with regard to the real condition of Turkey in its period of transition, that some explanation is desirable. Everything is eagerly seized upon as a proof of decadence, and particularly the incidents of change. There was a time when the decayed condition of inns and posting-stations on turnpike roads here was received as evidence of our decline; and the like occurs in Turkey. The diminished splendour of the feudal princes and lords and their retainers is always pointed out, while no heed is paid to the consequences of their suppression. The improved condition of the Christians, naturally to be expected under a freer government, is another argument used against the Turks, who sought to produce this very result of greater prosperity. The efforts made by Turkey to improve and maintain the public credit, and to provide funds for the development of the country, are also turned to her disadvantage. No immediate effort can restore the hand-loom in Turkey, nor has she any reason to regret its suppression. As intimated in the parliamentary report, the returns of commerce have concurrently greatly increased.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W.

NEW BOOKS.

The Manufacture of Beet-root Sugar in England and Ireland. Illustrated. By W. Crookes. Price 8s. 6d. (Longman and Co.)

The Application of Cast and Wrought Iron to Building Purposes. By Sir W. Fairbairn. Fourth edition. Price 16s. Longman and Co.)

Manual of Colours and Dye Wares. By J. W. Slater. Price 7s. 6d. (Lockwood.)

Microscopical Manipulation. By W. T. Suffolk. Price 6s. (*Chemical News* Office.)

The Cotton Manufacturer's Assistant. By E. D. Foley. Price 1s. 6d. (Simpkin, Marshall, and Co.)

Notes on Agricultural Chemistry. By W. Groome. Price 1s. 6d. (Simpkin, Marshall, and Co.)

Physical, Historical, and Military Geography. From the French of Th. Lavallée. Edited, with additions and corrections, by Capt. Lendy, F.G.S., F.L.S., &c. Price 10s. (Stanford, Charing-cross.)

Public Health. A Popular Introduction to Sanitary Science. By W. A. Guy, M.B. Cantab., F.R.S., F.R.C.P. Price 2s. 6d. (Renshaw, Strand.)

Researches on the Action of the Blast-Furnace. By Charles Schinz. Translated from the German, with the special permission of the author, by W. H. Maw and M. Müller. (E. and F. N. Spon.)

Perpetuum Mobile; or, History of the Search for Self Motive-power from the Thirteenth to the Nineteenth Century. With an introductory essay by Henry Dircks, C.E., LL.D., &c. Price 10s. 6d. (E. and F. N. Spon.)

Earth Closets and Earth Sewage. By George E. Waring, jun. Price 3s. (E. and F. N. Spon.)

Link Motion and Expansion Gear practically considered. By N. P. Burgh, engineer. Price £2 2s. (E. and F. N. Spon.)
Illustrations of Ancient Buildings in Kashmir, prepared at the India Museum, under the authority of the Secretary of State for India in Council, from photographs, plans, and drawings taken by order of the Government of India. By Henry Hardy Cole, Lieut. R.E., Superintendent Archæological Survey of India, North West Provinces. One vol. Half-bound, Quarto. Fifty-eight plates. £3 10s. (W. H. Allen and Co.)

In the Press.

Good Words' Lectures in Science. Reprinted from *Good Words*. (Strahan and Co.)
The Carpenter, Joiner, and Hand-railer. By R. Riddell. Price 30s. (Jack, Edinburgh; Simpkin, Marshall, and Co.)

GENERAL NOTES.

Pauper Children.—The "boarding out" of pauper children is to have a trial in Liverpool, the Industrial Schools Committee in that town having agreed to recommend that, as an experiment, orphan children shall be placed out in families, at a cost of 3s. a week each, exclusive of clothing and schooling, every case to be considered on its merits by the select vestry.

The Grosvenor Gallery.—The Marquess of Westminster has allowed the authorities of the South Kensington Museum to select for exhibition any pictures from the Grosvenor Gallery for which space can be found. Many of the finest works have been accordingly removed, and will be exhibited in a few days.

The New York Industrial Exhibition.—In a former number of *The Technologist* we alluded to this enterprise, and endeavoured to impress our readers with the advantages that might be derived from it in an educational point of view. We are happy to state that, under the energetic management of President McMurdy and his colleagues, the project is assuming a tangible shape, and active steps are being taken to bring it to completion. The company was organised on the 12th of May, E. McMurdy being elected president; Joseph S. Decker, vice-president; and James Turner (of Turner Brothers, bankers), treasurer. A committee to report upon a site for the building was appointed, the first assessment of the capital stock was paid in, and other preliminary business transacted. The names of the directors, and of such other officers as shall be appointed, will soon be published. The company is fairly under way, and we shall be able to report rapid progress during the season. It is expected that the Exhibition will be opened in the spring of 1872, it being impossible to erect such a building as the directors contemplate in season for opening in 1871. Manifestly, many of the details of the Exhibition, such as terms of admission, rent or sales of spaces for exhibition or sale, the exact kind or number of prizes to be awarded, the division into classes of articles entered, &c., cannot yet be announced, for there is a vast amount of labour to be performed before any minute description of the plan can be given. The plan of the building itself cannot be determined upon until the ground for its erection has been obtained, in order that the architects may secure a proper harmony between the structure and its surroundings. Madison-square has been strenuously urged upon the attention of the committee on site, and if it were not for its limited extent, there is no doubt but that it would be altogether the most eligible location. Under any circumstances, however, the building should be erected in New York, and, while it is desirable that it should be as near to the centre of business as possible, it is at the same time absolutely indispensable that abundant room should be allowed it. Such being the case, we cannot see a finer location for it than some portion of the Central-park, to which it would add a notable attraction, and one entirely in keeping with the educational influences already existing there in the shape of geological, zoological, and other collections.—*The Technologist.*

The American Wheat Crop is estimated, according to the Government Agricultural Report, at 210,000,000 bushels, a decrease of 48,000,000 bushels, compared with that of last year. The Indian corn crop promises better than last year, and will be one of the best ever raised.

Hill Settlement in India.—Among the new hill settlements, or sanitaria, is Tarraghur, near Nusseerabad (Bombay Presidency), very small. Toorumnull, a hill in Khandeish, 101 miles from Mhow, was favourably reported on some years ago by Major Probyn, but has not yet been occupied.

The Proposed Hans Holbein Exhibition.—Owing to the disturbed state of the Continent, it has been decided to postpone the exhibition at Dresden of the works of Hans Holbein, the younger, till next year. Her Majesty the Queen had graciously promised to contribute a number of original paintings and drawings from the collection at Windsor Castle; and other possessors of genuine works of Holbein, in England, had also signified their willingness to lend them.

Natural History Museum.—In the House of Commons, on Tuesday night, on the vote of £6,000 towards the erection of a natural history museum, the Chancellor of the Exchequer said the British Museum had long been suffering from repletion, and there were no means of exhibiting the valuable articles which, from time to time, were bought for the national collection. Five years ago the trustees resolved in favour of separating the collections, and it had been determined to separate the natural history department from the books and antiquities. For the natural history collection the typical mode of exhibition had been decided on, and the building required must cover at least four acres. Even the present collection would pretty well fill a building of those dimensions, and provision must be made for further extension. The question was, where should this building be situated? It had been proposed to place the museum on the Embankment, between Charing-cross and Waterloo-bridge, but then it would be necessary to take land destined for public gardens, and, if even this were permitted, it would be also necessary to buy the land from the Metropolitan Board of Works, no doubt, at a high price. That proposal was, therefore, untenable. Then, it was suggested that there should be an addition to the British Museum. But land sold there for £50,000 an acre, and the expense of such a site would be quite out of the question. Another proposal was for placing the museum between the Admiralty and the War-office, but sufficient land could not be obtained in that position. This being so, the thoughts of the government naturally turned to Brompton. The Commissioners of the Exhibition of 1851 sold to the government 16½ acres of land, at £7,000 an acre. It therefore cost £120,000, but was now worth £100,000 more. The sale was coupled with the condition that any buildings erected upon the land must be for purposes of science and art. For seven years the land had remained waste, a sort of potter's field, and a scandal to that part of the metropolis. The government now proposed to place on that piece of land the museum required for the natural history collection. It would occupy four acres; there would be room for wings, and the outside estimate for the building was £350,000, not an unreasonable price, considering its extent. For the present, however, the government merely asked for a small vote to enable them to clear the ground, and in order to take the opinion of the House. Railway communication had now made South Kensington easily accessible, and unless a more eligible, a more accessible, and a cheaper site could be suggested, he hoped the committee would agree to the proposal. He might add that, if it were hereafter thought desirable to do so, there would be room enough on the same site for the Patent Museum, the necessity of which had been much insisted on. After some discussion the vote was agreed to.

Sale of Preserved Meats at Melbourne.—The first public sale by auction of colonial preserved meats recently took place at the stores of Messrs. Goldsborough and Co. The lots offered were 2,000 packages of meat, each package or case containing twelve 6 lb. tins, the production of the Echuca Meat Preserving Company. This company, it may not be out of place to mention, says the *Melbourne Daily Telegraph*, has only been established a few months, by local enterprise, and with a nominal capital of £10,000. Since commencing meat-preserving operations, the company have used over 80,000 sheep and 200 head of cattle. A very large portion of these have, however, been converted into tallow, which the shareholders consider is as profitable to them as the meat-preserving. The primest portions of the carcase are kept for preserving, and the company are determined to maintain all their future consignments up to the standard of excellence they displayed in their various productions on the day of their first sale. The Echuca Company employ about 120 hands, and they assert that they aro able to prepare and make ready for market over 12,000 lb. of meat daily. An adjunct to the meat-preserving, of the most valuable kind, is the price received for wool and tallow. About 40 bales of wool and over 100 casks of tallow are turned out weekly. The establishment is altogether a most complete one—fellmongery, tanning, tin-making, and coopering being all carried on there. The greatest part of the work—except, of course, the meat-preserving—is done by contract, thus, to a certain extent, binding each branch to the interests of the company. Messrs. Goldsborough and Company introduced their first sale with a luncheon, and no meat except that of the Echuca Company found a place in the bill of fare. This consisted of kidney soup, spiced beef, boiled mutton and caper sauce, ox-tongue and sauce piquante, tripe and onion sauce, sheep's tongues and tomato sauce, Irish stew, and boiled beef and carrots. The cold meats, as turned out of the tins, were sweet and nutritious. The contents, prepared without bone, came out in compact masses, surrounded and permeated with gelatine. The crucial test, the eating of it, proved to be in every way equal to fresh meat newly cooked. The ox and sheep tongues were in most demand; champagne and other drinks were added to the feast. But, apart from these accessories, the meats in themselves were of a particularly excellent character, and, if they could only be placed cheaply in the English market, a boon would be conferred upon the labouring classes of that country; and it is reasonable to apprehend that large quantities will be consumed by our own population. Mr. Edward Row officiated as auctioneer, and submitted the meat in lots, the largest purchase made being 500 cases of mutton, which realised $3\frac{3}{4}$d. per lb. From the report of Messrs. Goldsborough and Co., which is appended, it will be seen what were the nature of the transactions and the prices realised:—"Messrs. R. Goldsborough and Co. have to report having held, this day, the first of a series of sales of preserved meats, under instructions received from the Echuca Meat-Preserving Company (limited), and are glad to say that all lots offered met with ready sale, at prices meeting with the approval of the company. A report having reached us to the effect that some lots, although knocked down to apparent customers, were not legitimate sales, wo beg to state, on behalf of ourselves and the vendors, that every line was absolutely sold. Mutton sold, say 900 cases, each 12 tins of 6 lb., 4d.; 500 do., $3\frac{7}{8}$d.; 500 do., $3\frac{3}{4}$d.; and we have inquiries for more at about these prices, at which we can effect ready sales; and, as the company now are in full work, we expect to do a large business in this, wo might say, hitherto new trade, and we have no doubt a large colonial demand will set in for this article of export. Sheep's tongues—Only a limited quantity to hand, which were readily competed for; theso cases contained 48 tins, each of 2 lb. weight, and were all sold at tho following prices:—5 cases, $7\frac{1}{2}$d. per lb.; 10 do., $7\frac{5}{8}$d. do.; 13 do. $7\frac{3}{4}$d. do. Kidney soup—We beg to state that all of this produce offered to-day met with ready response from buyers, one purchaser having secured all now on hand, at 7d. per lb. Beef—We catalogued a quantity of corned and boiled beef for to-day's sale, but on account of the wet weather at Echuca, and other delays, which must be excused (this being an initiatory sale) were not to hand, so had to be withdrawn, but will be offered at our next sale, when we expect to see other companies compete, to show the public what this colony can really produce, and we hope in time to see this article become a valuable export."

The Leading Wheat-growing States.—The following statement is taken from an official circular, issued by the Agricultural Department at Washington, under date of June 17th. Forty years ago, New York was the great wheat-producing state. As the Western States became settled, and more especially after the means of cheap transportation were provided for the products of the west to the east, the farmers of New York found it, to a considerable extent, best for them gradually to change their course of husbandry, and to adapt their systems to the altered condition of affairs. Twenty years have wrought changes in the list of wheat-producing states. Pennsylvania stood at the head of the list in 1849; she was sixth in 1859; and, in 1869, of nine leading states, she stood ninth and last. In 1859, nine states produced less than 70 per cent. of an aggregate of 173,000,000 bushels; in 1869, nine states yielded 191,000,000 bushels, or 70 per per cent. of our 260,000,000 bushels; and California, which is fourth in 1869, was not found among the leading nine of ten years ago; while Minnesota, the seventh, was scarcely in existence as a state. The first list is as follows:—

States—1849.	Bush.		Bush. per capita.
Pennsylvania	15,367,691	..	6·64
Ohio	14,487,351	..	7·31
New York	13,121,498	..	4·23
Virginia	11,212,616	..	7·88
Illinois	9,414,575	..	11·05
Indiana	6,214,458	..	6·28
Michigan	4,225,889	..	12·36
Maryland	4,494,680	..	7·70
Wisconsin	4,286,131	..	14·00

Illinois, fifth in 1849, becomes first in 1859:—

States—1859.	Bush.		Bush. per capita.
Illinois	23,837,023	..	13·92
Indiana	16,848,267	..	12·47
Wisconsin	15,637,458	..	20·18
Ohio	15,119,047	..	6·46
Virginia	15,130,977	..	8·54
Pennsylvania........	13,042,165	..	4·48
New York	8,681,105	..	2·23
Iowa	8,449,403	..	12·51
Michigan	8,336,368	..	11·12

The figures for the leading states of 1869 are estimates in round numbers. Representing, in tho proportion of production to population, California occupies the first place, and Minnesota the second:—

States—1869.	Bush.		Bush. per capita.
Illinois	27,000,200	..	11·
Iowa	25,000,000	..	20·
Wisconsin	24,000,000	..	19·
California	21,500,000	..	39·
Indiana	20,600,000	..	12·
Ohio	20,400,000	..	9·
Minnesota	19,000,000	..	35·
Michigan	16,800,000	..	13·5
Pennsylvania........	16,500,000	..	5·5

With these facts before us, it is not difficult to anticipate the time when tho larger portion of our wheat crop will bo produced west of tho Mississippi. Facts showing the decrease of yield in each stato would be equally striking, and moro sadly suggestive.—*Albany Cultivator.*

Journal of the Society of Arts.

FRIDAY, AUGUST 12, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

EXAMINATIONS, 1871.

The Programme of Examinations for 1871 is now in the press, and will be ready for issue in a few days, when it may be had, gratis, on application to the Secretary. It differs but slightly from that for the present year.

It will be remembered that, in the Programme for 1870, the Council decided to omit those subjects in which the Science and Art Department holds examinations, which, it appears, are now largely taken advantage of by the same class of persons (and very often by the same individuals) as those who sit at the Society's examinations, and this arrangement still continues.

At the Annual Conference of the representatives of Institutions and Local Boards with the Council, held in June last, various modifications were suggested, some of which have been adopted. It was objected that the subject of Mental Science was added to that of Logic, and the subject of Civil Government to that of Political Economy. This has now been remedied, and papers will be set in Logic and in Political Economy without including the other subjects named. The paper formerly set in "The English Language and Literature," will now be confined to the "English Language" exclusively.

Two new subjects have been added, viz., "French Commercial Correspondence" and "German Commercial Correspondence." The papers set will be intended to test the capacity of candidates to fill the office of foreign correspondent in a house of business, and the certificates will be first-class only. No prizes are offered in these subjects, nor will the certificates be counted for the Prince Consort's Prize.

It having been represented, by various speakers at the Conference, that the recognition by the Society of teachers of classes, who send up successful candidates, would act as an important encouragement to them in their valuable labours, it has been decided to grant certificates to any teachers of classes who may desire to have them, stating the number of their students who may have obtained first-class certificates in the subjects taught by them.

The Final Examinations, in 1871, will be held on the evenings of the 18th, 19th, 20th, and 21st April. These dates have been fixed in order to avoid clashing with the Examinations of the Science and Art Department. The Time Table has been arranged as follows:—

Tuesday, 18th April, From 7 to 10 p.m.	Wednesday, 19th April, From 7 to 10 p.m.	Thursday, 20th April, From 7 to 10 p.m.	Friday, 21st April, From 7 to 10 p.m.
Arithmetic. Logic. German. Floriculture. Musical Composition. (Tonic Sol-fa.)	Book-keeping. Theory of Music. Domestic Economy. English History. Italian. *Commercial German.*	Metrical System. Mensuration. Political Economy. French. English Language.	Geography. Latin. Spanish. Fruit and Vegetable Culture. *Commercial French.*

Friday, 21st April, 6 to 7 p.m.—Dictation.

Attention may be drawn to the prizes offered by Mr. Henry Cole, a Vice-President of the Society, with the view to encourage an improved style of writing and manuscript printing. The writing is to consist of Roman and Italic letters, from one-eighth to three-fourths of an inch in height, done entirely by the hand, without the use of instruments. Lithographed specimens, for the instruction of candidates, are in preparation, and may be obtained on application.

Special attention may also be drawn to the scheme for holding *vivâ-voce* examinations in Modern Languages, explained in a memorandum kindly furnished by Mr. Hyde Clarke, a member of the Council. It is earnestly hoped that this will be more extensively carried into operation next year.

The Elementary Examinations, held by the District Unions and Local Boards, for which papers are furnished by the Society, are fixed for the 14th, 15th, and 16th March.

Full details in reference to the Examinations are given in the Programme, copies of which should be applied for to the Secretary of the Society of Arts, by all intending to come forward as candidates, or otherwise interested in the Examinations.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON FERMENTATION.

By Professor A. W. Williamson, F.R.S.

Lecture III.—Delivered Monday, May 9, 1870.

In referring, at our last meeting, to the place in nature which ought to be assigned to these little organisms of which we have been speaking—the ferments—I stated one ground which appeared to me conclusive, or very nearly

so, in favour of placing them in the animal and not in the vegetable kingdom. That ground was a chemical one, viz., that these organisms assimilate, or, to use a homely phrase, they feed upon very complex substances, and they give off, during their vital functions, less complex substances. That circumstance appears chemically conclusive in favour of their being rather animals than plants, for plants build up complex substances, and animals assimilate the products which plants have formed, and break them up into simpler ones. There are, however, two other considerations which I think are of such importance that it would be undesirable to pass them over, which tend in the same direction, and are striking confirmations of the conclusion to which we then came. The one is, that whereas plants require for their growth the light of the sun—in fact, their very growth is a process of absorption of heat by their leaves from the rays of the sun—and plants by doing so render heat latent, as we sometimes express it, that is, they cause an apparent disappearance of heat, and lower the temperature of the surrounding space; animals, on the contrary, give off heat during the exercise of their vital functions, and do not need to be exposed to heat or to continuous light for their growth. Now, in both these respects, as in the other respects, these little cells, the ferments, appear to be distinctly animals. I do not know of one case of a ferment requiring or using for its vital processes the light of the sun; they usually grow, and they seem to thrive quite well, in the dark. Again, there are well-known cases in which, during their vital functions, they evolve or give off heat, so that I think these are very overwhelming reasons for not considering them as vegetables in their functions, but rather as animals or animal atoms. I have on the table here three or four liquids, which are in states of fermentation, of which I have already had occasion to speak several times. This first carboy contains an extract of malt, to which common cane sugar has been added, and some brisk, thriving yeast was then introduced. Effervescence is now rapidly going on, as you may hear by the gas—carbonic acid—which is escaping through the bent tube into the vessel containing lime water. This liquid contains little soft, nearly round particles, which I was just speaking of as animals, though they certainly do not look like animals. The second flask contains another substance, of which I also spoke the other evening. There is here what I might call gastric juice—it is a mixture made for the purpose of getting lactic acid from sugar. Some pepsine was made to digest a certain quantity of white of egg, and that mixture, whilst still acid, I mixed with some common cane sugar, and put into it some alcoholic ferment, or common yeast. A good deal of the yeast was digested, it disappeared, and was dissolved. I thereupon put in more and more, until there was an excess of it left in the flask. It was then kept for upwards of a week in a box, which I have been using for the purpose of these fermentations—a metallic box, which is kept, by means of a regulated gas-burner, at a temperature of about 30° centigrade, or a little above blood heat. During that time, the substance has been gradually undergoing a change or fermentation. It became strongly acid, and I then added a base, at one time potash, and afterwards powdered marble or carbonate of lime, which was dissolved by the acid, and thus a quantity of lactic acid was formed. Here also there are little cells, which, under the microscope, can be seen to be different from those in the first mixture. They are smaller in their dimensions, but yet they present no very marked individual characteristics by which they can be identified. Indeed, the chief, or, I may almost say, the only thing by which we can certainly identify any one of these organisms is, by setting it to work, and by seeing what work it performs. In the third carboy I have a mixture which had gone through the phase I have just been speaking of; it contained some sugar with lactic ferment, but when all the sugar had disappeared, and was transformed into lactic acid, I left the carboy in the same warm chamber, and another fermentation has set in, and there is already a considerable quantity of the substance called butyric acid present, and the greater part, if not the whole, of the lactic acid has already passed over into this butyric acid. Here, in this glass dish, there is another ferment still, although, unfortunately, it has got disturbed in coming here. It contained a decoction of yeast, with which was put about two per cent. of pure vinegar, and about four per cent. of alcohol, and I then touched the surface of the liquid, which was perfectly clear, with a glass rod which had been in contact with the vinegar-plant, and left some little particles floating on the surface of the liquid. These little particles, in the course of a day or two, spread over the liquid, and when this vessel came from University College this morning, it was covered with a perfectly uniform film, consisting of little cells, different from each of the others to which I have called your attention, and quite distinguishable under the microscope. I should state that, after the mixture was first made, and after the vinegar cells were put into it and allowed to grow on it, I supplied them with some additional food twice. On one occasion, I added a somewhat larger quantity of alcohol than was intended, and the effect was that the cells were most injuriously affected. They constituted a dense, smooth, white film, and this seemed almost to disappear, and on examination under the microscope it was found that they had shrunk—in fact, they had been killed by a too strong dose of alcohol. This was then allowed to evaporate, and the vinegar cells very soon again spread over the liquid. I will now commence, in another dish, a similar experiment. I have in this bottle a mixture of yeast-water and alcohol, with a few drops of acetic acid in it. I will pour this into the glass dish, and then put on to the surface some of these little ferments, which I have here, and I have no doubt that, if we allow this mixture to stand, we shall find, by our next meeting, that it will be covered over with a smooth film, consisting of vinegar cells, which will be transforming the alcohol into acetic acid. I may show you the strength of the acid in this last instance by putting into it a slip of blue test-paper, which you see is immediately coloured a deep red.

With regard to the process by which these cells are propagated, some exceedingly interesting experiments have been made under the microscope. Professor Mitcherlich and various others, Pasteur among them, have put little alcohol cells under the microscope, putting them first into a liquid upon which they could feed, and they have noticed that the cells, or some of them, gradually swelled out at one side—that a little wart, if I may use the expression, made its appearance on one side; that this increased in size until it became as large as the original cell, and then it became detached. The propagation of the alcohol cells, the wine ferment, has been seen by several observers to take place by a process of budding. I will show you the growing cells, by throwing on the screen, by means of an oxy-hydrogen lantern, a photograph of the wine ferment, some of which will, I believe, show a little excrescence at the side, and the general arrangement of the cells will be easily detected. This is a photograph from a plate of M. Pasteur's, and conveys an exact representation of the appearance which the alcohol cells ordinarily present. I will now show you the photograph of the acetic ferments, and the difference in the general appearance is very striking. When examined carefully, it will be found that these little vinegar cells are in couples, little masses about twice as long as they are broad, and by degrees they become strangulated at the waist, and ultimately separate. With a considerable magnifying power, it has been found that the wine cells contain granulated particles, but exceedingly little is yet known of their structure. Certainly one of the most promising directions for investigation in the phenomena of life is presented by the study of these various little organisms, which we have so completely under our control.

With regard to the processes by which these cells are propagated, I have mentioned already, that when certain liquids, capable of undergoing decomposition, are exposed to the air, that little cells gradually make their appearance in what was at first quite an unaccountable manner. It was long supposed, and on very good authority, that the oxygen of the air was the active agent in transforming a fermentible substance into these little cells; and Gay-Lussac, one of the ablest of French chemists, who died some little time ago, made some very careful experiments with a view to decide that point. They led him to the conclusion that oxygen was all that was needed in order to initiate the process of fermentation in the juice of grapes, which by itself does not ferment. It is worth while to state, in general terms, the nature of these experiments. He put into a glass vessel, closed by mercury, a small quantity of grape juice, which was expressed under mercury, so that it did not come in contact with air on its way into the glass jar intended to receive it. This was then kept closed for some time without change. He then introduced oxygen, sometimes from the atmosphere—I am now giving you an account partly of what was done by Gay-Lussac, and partly what was done by others—and sometimes the oxygen was derived from potassic chlorate. Air was used which had been passed through red-hot tubes, so that any vital organisms in it must have been destroyed before reaching the grape-juice; and it was found that, in these cases, the access of the air to the substance did induce the formation of yeast cells, and did induce a process of alcoholic fermentation in the liquid by their growth. The conclusion, therefore, appeared to be established that oxygen was all that was needed for the process. Since that time, however, other experiments have been made, with precautions which were not observed by Gay-Lussac; and I must especially quote a truly masterly investigator, Pasteur, whose extraordinary researches in this subject have certainly constituted an important era in our knowledge of it. Pasteur has made a great number of experiments, partly such as those which had been made before, and partly fresh ones, of which I will describe a few characteristic samples. For instance, he took little glass bulbs, with a long neck bent in several places, like the one I hold in my hand. This little bulb contains some yeast-water, and also about 10 per cent. of sugar, a mixture which is peculiarly susceptible of undergoing fermentation and decompositions of various kinds. When this was introduced into such a bulb, Pasteur boiled the liquid for some time, so that any little living particles which might have entered the bulb with the liquid, by being exposed to the temperature of boiling water, might be killed, and also that any particles which might be lodged in the neck of the flask would be similarly treated and killed. Some of these bulbs he closed, sealing up the tubes whilst still full of steam, and he then put them by in a warm chamber, similar to that which I just now alluded to as being of the temperature of 30° centigrade, so that they should be under the conditions most favourable to the development of any little living organisms, if such could develop themselves. He so kept them for days, weeks, and months, and I am not sure that he did not keep some for years, and at the end of the whole time he found that in no case was there the production of these vital organisms. I told you that when the tube was closed the vessel was full of steam; of course that steam was condensed on cooling, and left a partial vacuum above the liquid, and when Pasteur opened the tube by breaking off the point, the air rushed in violently to fill the vacant space. He found that in almost every case, although not in all, after this air had rushed in, a process of decomposition commenced, and in some cases he found little animalcules, and various kinds of mould in others, and he has described a considerable number of different organisms which he got in different bulbs in that manner. It so happened, also, that in one case the tube, I think accidentally, at first remained unsealed, that it was not kept from contact with the air as the others were; still, to his amazement, Pasteur found that even in this one which remained open there were no organisms, that it remained as unchanged as those which were sealed up. Finding this, he repeated the experiment many times, making a great number of bulbs similar to the first, putting some of that same liquid into them, and boiling the liquid for some time, so as to destroy any organisms; but, when they had been killed, he left the bulbs open, and he found that the contents were as effectually protected by the conditions there present as if the tubes had been sealed. He submitted the results to several members of the French Academy; the experiment was repeated by other persons, and the results showed—if there were any exceptions I do not remember hearing of them—that no organisms were produced. You will notice that the liquid which had been boiled was separated by a long, thin tube from the outer air, and the air only had access to it through this long, narrow, tortuous passage, which, moreover, was at first wet inside, because of the condensed steam. Pasteur then cut off some of the tubes, so as to allow free access of air to the contents, without having to pass through this long, narrow tube, and soon after that was done the process of decomposition set in, and he got various organisms formed in his mixture, which developed themselves in the way yeast, mould, and such like organisms generally do.

I will now leave these experiments for the present, in order that I may tell you of some other discoveries, which will afford a key to them. One of the most important observations was made, at an early stage of the investigations, on the subject of ferments, by Dr. Schwann. He passed air through a red-hot tube, and he asserted, as the result of his observations, that air which had been so heated was incapable of producing the effects, which I mentioned just now as having been noticed by other observers, as produced by common air; that whereas ordinary air starts fermentation, air which has been passed through a red hot tube does not. That was what he said, and in some of his observations he was quite correct, but in some others he must have been misled. Shortly after his observations, another German philosopher thought of using cotton-wool as a strainer. He passed air through a glass tube fitted up somewhat in the same manner as the one I have here, with a tolerably compact plug of cotton-wool, which allowed the air to pass through it, but at the same time acted as a strainer, and collected a quantity of dirt at the side where the air entered it; and he found that the air which had been thus strained was no longer capable of producing the phenomena of decomposition, which air in the unstrained or unheated state does. Since then, Pasteur has done the same thing in a more accurate and more decisive manner; and he has repeated the experiment with heated air, with precautions which leave nothing to be desired. One novelty in Pasteur's process is the use of a kind of cotton which is soluble—cotton which has been in contact with strong nitric acid, which is called gun-cotton. It retains the structure and appearance of ordinary cotton, but has this peculiarity, that it dissolves easily in a mixture of alcohol and ether. He put into a tube a plug of this gun-cotton, and then, by means of an aspirator, he drew air through this strainer for a long time, until he had collected quite a quantity of dust. He then took this gun-cotton with the dust upon it, and put it into a tube, where he poured alcohol and ether upon it, until the cotton was dissolved, and nothing left but the dust. In that manner he got the lightest portions of the dust and the heavier portions by themselves, as they very soon subsided in the liquid in which the gun-cotton had been dissolved. He then poured fresh alcohol upon them, so as to thoroughly cleanse them, and then put them under the microscope, in order to examine the particles of which they consisted. He found in this dust a great many particles of sand, calcic carbonate, and other mineral particles, as would naturally be expected, and

also a great quantity of organic matter—little particles of cotton, wool, wood, and so on, and mixed with these he found some little spherical or oblong particles of very different sizes, and of some considerable varieties of shape. Some of these little round particles he found consisted of mere starch, and many of you are, no doubt, aware that starch consists of little spheroidal masses of different sizes. These he got rid of by a solvent, and others were then left, which resembled in their appearance so closely the germs of various fungi and organisms of those kinds and eggs of animalcules that they were, to outward appearance, undistinguishable from them. He then took a liquid which had been boiled, but which was capable of decomposing—such a one as I mentioned here—by the action of any of these substances, and he put it into a flask, with precautions which I will not detain you by mentioning now, more than to say that he slid into this liquid, which had not got anything present to induce the formation of organisms, some of the gun-cotton with the dust yet in it. It was the same thing as I mentioned before, only that the substance had got some of this dust from the air added to it; and he found that he also got the formation of organisms very readily and abundantly. He found that these little particles, which were to the eye undistinguishable from germs and spores, behave towards liquids of this kind just as if they were so. In various other ways the same form of experiment has been repeated, and uniformly with the same result, viz., that when little particles collected from the air, particles of extreme tenuity, are put into a liquid susceptible of undergoing decomposition, a great variety of organisms will make their appearance, just as if their seed had been sown in the liquid. This circumstance is one which, I think, will justify us in going back to what I told you of Pasteur's previous observations. I told you that he opened a number of the little bulbs which had contained yeast-water and sugar, so as to allow the air to rush into them. He found that, in some cases, he got one kind of organism produced, and in others another; in fact he got a great variety. But if, instead of allowing the air to go into these bulbs in this way, he poured the liquid out into an open vessel, he always got the same sort of organisms; there was no variety. The appearance of the particles which resembled germs is, as I said, exceedingly various, and there are many reasons to suppose that if there are the germs of these organisms in the air, there must be an immense variety of them, a variety so great that we could not even venture to guess at its extent at present. When the liquid had free access to all of them, it is found, for reasons which would easily suggest themselves, on reflection, to anybody, that some of them, those which can thrive best upon the particular substance, develop themselves to the exclusion of the rest. I will give you one or two examples of the influence of food upon the development of ferments, instances which are well known, and are of some importance, as serving to prove the point which I have just mentioned. You are aware that the mixture which I have been speaking of, yeast-water with sugar, can be made to undergo alcoholic fermentation. I have already referred to it repeatedly in that point of view. We can make it undergo alcoholic fermentation if we put some alcoholic ferment into it, and keep it at a proper temperature; but if, instead of putting some number of cells—and even a few grains weight consist of an enormous number of cells—if, instead of that, we were merely to leave some of this liquid in contact with the air, we should have no alcoholic fermentation set up in it. That particular mixture of yeast-water and sugar does not, when exposed to all these germs, get yeast cells developed in it, at all events not to any perceptible extent. Instead of that, it gets cells formed which are similar to those in the second bottle I showed you, which is forming lactic acid, that is to say, the lactic fermentation will set in. The fact is, that the liquid is unwholesome for these particular cells; and does not agree with the alcohol cells, or yeast cells, so that if a great number of various germs are thrown into these particular substances, those which can thrive better, which are the lactic acid cells, develop themselves, and the alcohol cells do not. Again, if instead of taking this decoction of yeast and sugar, you were to take some grape juice, you would have alcoholic fermentation at once. That is the way it is done. If I were to leave a decoction of malt in contact with the air, in the same manner you would get the same thing set in as a rule. Again, if some of the liquid which I have in the glass dish here—some of the yeast-water with a little alcohol and acetic acid—be left in an open vessel, it gets an organism formed upon it; in fact, that is a process which Pasteur recommends for getting vinegar cells, if you want any. He says the air will, if you give it time, and supply the requisite conditions, start these cells in that mixture, but no alcohol cells, nor lactic acid cells, can be grown in it. It does not suit them; it is a substance which suits vinegar cells, and them only. Whatever may be the variety of the cells present in the air, it only developes those of that particular kind.

I stated that exposure to a red heat was found by Pasteur to act effectually in destroying the vitality of these little particles, and in every case in which he used air which had been subjected to that heat, he found that the air was incapable of sowing any of these organisms in liquids even the most favourable to them. There was, however, still one remarkable exception, which was presented by the experiment of Gay-Lussac, to which I alluded some time ago. He found that when he used a mercury trough, which he selected as giving him the best condition for the purpose, he got these little cells produced from the air which had been calcined. Now, Pasteur found that mercury exposed to the air, as it is in these operations, has adhering to it a number of these little germs, and that when no more than the ordinary precautions are taken for cleansing the mercury, that it has got with it a considerable variety of such little organisms, which, if placed in a suitable material, develop themselves and grow quite well. He proved this in various ways. For instance, some of the little bulbs which had been sealed up whilst full of fermentable liquor and steam, and which had been kept for some time in a warm chamber, so as to be certainly free from vital organisms, were opened under mercury, so as to allow the ends of the tubes to be filled with mercury. He then lifted it up, so that nothing came into contact with the liquid but mercury, and passed into them sometimes air which had been passed through a red-hot platinum tube, and sometimes oxygen gas given off from molten chlorate, where certainly there would be nothing of organic life present, and in almost all these cases he found that organisms developed themselves. He attributed this entirely to the mercury, because when that was absent the result was the opposite. In order to prove this point more decisively, he took a liquid which was capable of decomposing, kept it for some time in a quiescent state, and then allowed a drop of mercury, in the state in which he had been using it before, to flow into it, and put the mixture into his warm chamber. He soon found that the mercury had carried in the germs of these organisms, and that they developed themselves quite well in it. Certainly anyone unaccustomed to such accurate precautions could hardly have anticipated such a result as that, and a result which is, I think, most instructive, as showing what extraordinary precautions are needed, in order to prevent the entrance of these excessively small particles into the materials which we are working with. Side by side with this, I must mention another result of Pasteur's, for it was, perhaps, hardly less startling, and that was, that when, instead of taking the liquid which I mentioned to you just now, yeast-water and sugar, he took common cow's milk, or, at all events, the mixture which is sold by that name, and boiled it, with a view of destroying any organisms that might be in it, and then he sealed up the bulb while still full of steam, so that no air

could get into it, and when he kept such sealed up bulbs for some time in a warm chamber, he found clear evidences of decomposition; he found a turbidity in the substance, a curdling of the nitrogenised materials of the milk; and on taking out some of it, he found it was swarming with little animalculæ; and yet he had boiled the milk for a considerable time, and had closed the vessel whilst the ebullition was still going on, so that no air could have carried the germs into it before it was closed. Still, there were the little organisms unmistakably present. He then modified his experiment in this manner. He boiled his milk at a higher temperature. I need hardly tell you how that can be done. You are, of course, aware that the temperatures at which water, or milk, or any liquid boils are different, according to the pressure which the air exerts upon it; that is to say, if you were to boil water here, and then if you were to carry it to the top of St. Paul's, and notice the temperature in each case, you would find that at the greater height it would boil at a lower temperature. If, in like manner, you carried it down to the bottom of a deep mine, and boiled it there, you would find the temperature would be higher; the greater the pressure of the superincumbent air, the higher the temperature at which any liquid boils. Pasteur wanted to make his milk boil at a higher temperature, and for that purpose he resorted to a very simple device. He had a long tube attached to the vessel in which his milk was boiling, bent over at the top, and brought down into a glass jar containing mercury to the depth of fifteen inches, or more. Of course, under these circumstances, the steam, which was being formed in the vessel, has to force its way up against the pressure of this mercury; the pressure of these fifteen inches of mercury was added to the pressure of air, and a total pressure was obtained, about half as much again as the pressure of the atmosphere amounted to. Of course, the milk had to boil at a higher temperature, corresponding to this higher pressure; and what did he find then? He proceeded, as before, with the experiment, closing the vessel while it was boiling, and not letting any air into it. He then kept it, and he found that no organisms appeared, even on keeping it a very long time; and he was, therefore, led to conclude that the milk must have contained in it some germs which could withstand the temperature at which the milk was boiling at first, but the vitality of which was destroyed by exposure to the higher temperature to which he exposed it in the subsequent experiment. He had reason for that, for other experiments had been made by himself, and by various other philosophers, which proved that many species of organisms can withstand a very high temperature without losing their vitality. In that respect, there are great differences amongst these little organisms which are remarkable and interesting, and will, no doubt, be of value to future investigations. To give you an idea of the great variety presented by them in their power of withstanding heat, I may mention, that if I were to heat the contents of this carboy, in which the alcoholic fermentation is going on, to 60 centigrade (100° being boiling point centigrade), which is rather more than half, the fermentation would be completely arrested, and the yeast cells would be killed. On the other hand, the particles in milk are capable of withstanding 100°. Pasteur connected that fact with the circumstance that milk is alkaline, whilst this liquid is acid, and, as a rule, acid liquids destroy the vitality of these organisms at a lower temperature than alkaline liquids. That is not all. There are in the particles themselves great differences in their power of withstanding heat. Amongst the experiments which are particularly remarkable in that point of view, I ought to mention some with regard to the the little spores of mould, and such-like things; for instance, the *Penicillium glaucum*, and some others. M. Pasteur collected some of these; and after taking a little piece of asbestos, or mineral flax, as it is sometimes called, and heating it in a flame, so as to destroy anything adhering to it, he put it carefully into a vessel in which some of this mould was growing, and moved it about, so that a number of particles of the seed of the mould might adhere to it. He then heated the asbestos thus coated with dust to 120°C., a higher temperature than that to which the milk had been exposed; but after putting it into a liquid capable of feeding mould, he found that the mould made its appearance in considerable quantity, so that the germs of that particular organism were not destroyed by 120° of temperature. He even went higher, as far as 125°, and found that that was not enough, but a little over 125° killed them; 130° they cannot stand, so that, according to these observations, the limit appears to be between 125° and 130°.

In all the cases of which I have been speaking, the ferments (because all these organisms are in their nature and functions analogous to the common ferments) were removed from the substances which were employed before the air and such like materials carrying the germs, were brought in contact with them.

With regard to processes for arresting fermentations and decomposition in liquids in which they are taking place, a number of observations have been made which are of considerable practical as well as theoretical importance, in relation to the results which I have been stating. Of course, mere heating, carried to a sufficient intensity, will arrest any process of fermentation or putrefaction which may be going on in a substance, and the applications of that process are, of course, exceedingly numerous and important. The only thing is, that we do not know, and it would be most hazardous to suppose that, in any particular case, we can name beforehand the temperature requisite to destroy a particular organism. If any observer were to say that he has exposed a mixture to 100°, and, therefore, the organism must be destroyed, experience would refute him; if he said he had exposed it to 110°, or even 120°, experience again would refute him; but if he had exposed it to 150°, and asserted that he must have destroyed them, it is quite possible that experience might show that there are organisms which will resist even that temperature. It would have been almost impossible, some time ago, to admit, and we could not have admitted, that these organisms would have withstood the temperature which they have been found to withstand; and, therefore, what temperature is sufficient to destroy the organism in any case must be found by experiment, and that alone. Amongst other conditions for arresting the process of decomposition or putrefaction, which are in their nature like those of fermentation, I ought to mention the process of drying. All the processes of fermentation which I have been speaking of, and all others which I could tell you of, are accompanied by moisture. Moisture is present, and is essential to them; in fact, these little organisms are exceedingly soft, wet things; moisture constitutes a great part of their substance, and in a dry medium they cannot live, or if the substance were dried, they would be destroyed by it. Applications, therefore, of a mere drying process are amongst the most important and interesting of this class of agencies. Many of them are well known. For instance, the ordinary process of preserving fruit by means of drying it. Germs of putrefaction or decomposition may be present in the fruit; but if you merely take away the greater part of the moisture, you render the substance incapable of decomposing. Among the agents which serve for that purpose, there are some which abstract the water, not in a state of vapour, but in the liquid state; for instance, common salt. If you put a piece of fresh meat in contact with salt, or rub it over with the salt, the salt gradually absorbs the water, and draws the water out of the meat. The action is truly a drying action upon the meat, and it is effectual by a perfectly similar process to that which would go on if you exposed tho meal in a dry chamber to a current of warm air. In like manner, of course, it is known to many persons that sugar is used just as salt is, to remove water from substances containing it in any

quantity. If you were to rub any fruit or animal substance with a sufficient quantity of dry sugar, you would get the sugar dissolved by the water which would be removed from the materials; and amongst the observations which are made in common life, there are some which bear, in an interesting and instructive way, upon what I have been saying to you. For instance, I have heard it said that ordinary jam—fruit and sugar, which have been boiled together for some time—keep better if the pots into which it is poured are tied up whilst hot. The observation has been so frequently made that one was inclined to think that there must be some truth in it; and I think if we admit that the paper can act as a strainer in the same way as the cotton wool, you will see at once that it must be as people suppose. Take two cases. Suppose one pot of jam, allowed to cool before it is tied down, little germs will fall upon it from the air, and they will retain their vitality because they fall upon a cool substance; they will be shut in by the paper and will soon fall to work decomposing the fruit. If you take another pot, perfectly similar, filled with a boiling hot mixture, immediately cover it over, though, of course some of the outside air must be shut in, any germs which are floating in it will be scalded, and in all probability destroyed, so that no decomposition can take place.

Amongst other materials which serve to arrest fermentation, there are several chemical agents of considerable energy, which are frequently employed for that purpose. Amongst the foremost, I ought to mention creosote, the active material of smoke; and I have no doubt that the antiseptic action which smoke is said to exert upon ourselves—because it is said that smoke is very wholesome, although I do not lean to that view myself—is due to the presence of this creosote or carbolic acid. Everyone is aware that one process for preserving meat, which has long been in use, is to suspend it in a chimney in which the smoke of wood is present. The smoke of wood, like that of coal, contains this substance, or one nearly allied to it, and amongst antiseptic agents it is one of the most energetic. A small quantity of this carbolic acid thrown into that fermenting liquid would completely kill the organisms. In the same way, if I were to introduce a little sulphurous acid into any of these mixtures, I should immediately kill the organisms and arrest the fermentation. Sulphurous acid is now largely used for this purpose, being employed, in combination with lime and water, to saturate the casks in which beer is to be stored, so that the wood being impregnated with it, any germs which might find their way from the atmosphere, and set up a process of decomposition, are arrested and destroyed. Another very powerful antiseptic agent is prussic acid, one of the most powerful of poisons to all animal organisms, and it is particularly powerful in stopping the action of these ferments. Another substance which I think is worthy of consideration, in the same point of view, is a mixture which is, to a great extent, of unknown composition. I refer to the poisonous matter which is given off in tobacco smoke. It must, I think, when present in the air, exert a very powerful antiseptic action upon these organisms. It has been shown, by the experiments of Professor Tyndall, that in the lower vessel of the lungs there are considerable deposits of the dust which floats about in the air; and we are, of course, exposed in that manner to the action of a number of the seeds of these ferments, and, for aught we know, of diseases, because many malignant diseases are attributed to processes of decomposition analogous to those which we have been considering; and they may be, and, as some persons think, are carried by germs in the air, in the same way as those I have been mentioning. Now, any powerful substance which would kill these germs must of course exert a beneficial action, and when persons are exposed to the smoke of tobacco, there is no doubt that some of it enters the lung with the air which is vitiated, and that some of the smoke must be deposited in the lower passages of the lungs with these little mischievous germs, and must certainly somewhat astonish them.

I have here several little apparatus, all alike in their general arrangement; each consist of two little tables, connected together in such a way that air may be made to pass through both of them in one direction, but not in the other. A tube goes from the top of one into the liquid in the second, and the tube from this second passes on into the air; and these bottles can, by means of an aspirator, be supplied with air which has been strained through cotton wool, and no other air can pass into them. The bottles contain the same mixture which I have been talking about so much, yeast-water and sugar, a liquid which decomposes in almost any way you like, for almost all these germs live in it more or less vigorously. After the liquid was put in, it was kept boiling for a considerable time, so that there is, I trust, in the bottles no living organism whatever; in fact, I have reason to believe that any organisms which may have been there have been destroyed by the high temperature to which they were exposed. I might draw hundreds of cubic feet of air through that apparatus, and it would remain entirely unchanged. Next Monday we will resume this again. We will also examine this particular apparatus, which is exactly the same, with this exception, that after the whole had been filled in the manner I have stated, a little mould was introduced by a separate tube into the first bottle. The apparatus will be taken back to University College, where it will be put into the warm chamber, where the organisms will be developed; and I have no doubt the liquid in the first bottle will be in a state of active decomposition before the day is over. Then next week, we will draw purified air, which, by itself, has no action on the liquid, and see whether it will carry any germs into the second bottle. I have no doubt that, by Monday next, there will be enough mould upon it to enable us to perform the experiment; and I shall then also have the pleasure of telling you of some applications which M. Pasteur has made of his theoretical results to practical purposes, such as the preservation of wines and such-like matters.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

His Serene Highness the Prince of Teck presided on Wednesday, the 10th of August, at the Council-room of the Royal Horticultural Society, over a meeting of the General Purposes Committee, appointed by her Majesty's Commissioners for the Exhibition of 1851 to carry out the series of Annual International Exhibitions, the first of which is to be held in 1871. There were also present—Sir Francis Sandford, Mr. Edgar Bowring, Mr. Cole, Mr. Gibson, Mr. Thring, and Lieut.-Colonel Scott, Secretary.

A meeting of the "Publications Committee" was held at Mr. Murray's, 50, Albemarle-street, on Wednesday, the 3rd instant. There were present, Mr. Murray (in the chair), Mr. Cole, Mr. Grove, Mr. Longman, Mr. P. C. Owen, and Colonel Scott, R.E.

A meeting of the Committee on Educational Works and Appliances (Sub-Section Music) was held in the Board-room of the South Kensington Museum on Friday, the 5th of August; there were present—Sir Michael Costa, in the chair; Mr. A. S. Cole, Rev. John Curwen, Captain Donnelly, R.E., Mr. John Hullah, Mr. G. A. Macfarren, and Mr. Le Neve Foster, Secretary.

DR. CLARK'S SPELLING REFORM.

By Professor Bain.

The late Dr. Thomas Clark, Professor of Chemistry in Marischal College, and author of important discoveries in chemistry, occupied himself for a considerable time with experiments on the amendment of our spelling. He tried various methods of supplying the deficiency in vowel characters, as well as of attaining uniformity in their use; and his final result was to retain the present characters, and to vary them by means of a few familiar marks, acute and grave—the marks for long and short quantity, and, on rare occasions, the circumflex. He took care to signalise the most frequent use of the several letters by the absence of any mark.

Setting aside minor irregularities, we find that the five vowel characters, *a*, *e*, *i*, *o*, *u*, have each two principal sounds, as may be seen in the examples, *lay*, *lad ; be*, *bet ; sigh*, *sit ; no*, *not ; rule*, *rut*. These are ten distinct vowel sounds; while, besides their distinction in vowel quality, they are also different in length. In the first of each pair, *lay*, *be*, *sigh*, *no*, *rule*, the voice is exerted in lengthening the vowel; in the second, *lad*, *bet*, *sit*, *not*, *rut*, the stress of the voice is carried upon the consonant. Now, to express this primary distinction among the vowel sounds, Dr. Clark employs the acute and grave accents, the acute for the long vowel, the grave for the short—*lay* (lá), *lad* (làd); *bé*, *bèt ; sígh*, *sìt ; nó*, *nòt ; rúle*, *rùt*. The selection of the accent is intended to be suggestive; the long vowels are indicated as if by an index hand pointing to the vowel, *lá*, *bé*, *sígh*, which directs the speaker to protract the voice upon the vowel. For the short vowels, the grave accent is like an index hand pointing to the consonant, to show that the voice, instead of expending itself on the vowel, should rush with emphasis on the consonant.

We are thus provided with vowel characters for ten sounds, which are our qualitatively distinct vowel sounds. There is, however, attached to each of the five letters a third sound, arising out of alterations of length in five of the proper vowel sounds.

First, as regards *e*, *i*, *u*, the following distinction occurs. In some words, the long sounds of these characters are pronounced with force (the quality of the vowel remaining), so as to rush upon the consonant in the same manner as the short vowel sounds. Compare *be* with *been ; seene* with *seen*. The vowel sound, as regards quality, is the same in both, but in one the voice is prolonged and exhausted on the vowel, in the other it includes the consonant in the vowel effort. The first case is what is signified by the mark already given for long vowels, *bé*, *sén ;* for the second case, Dr. Clark would employ the circumflex, *bên*, *sên*, a double mark, combining the two others, and suggesting both the character or quality of the vowel, and also tho emphatic rush upon the consonant. So with *i* and *u ;* as *pried*, *pride*, the one symbolised *príd*, the other *prîd ; pool*, *pull* —*púl*, *pûl*. No mark had ever been proposed for this discrimination.

As regards *a* and *o*, the third variety comes out, not by shortening a long vowel, but by lengthening a short one. The sound *am* (àm) is protracted in *palm*, *father*, which are symbolised by help of the mark of long quantity, *pām*, *fāther*.

Of far greater frequency and importance is the corresponding modification of the short *o*. By protracting *not* (nòt), *sot* (sòt), we have *naught*, *saught*, a sound the same in vowel quality as the other. It is a leading vowel sound in our language, and is peculiar to English. Dr. Clark uses the same accent as for the lengthened *a*, *naught* (nōt), *saught* (sōt). In this instance alone does the scheme interfere greatly with familiar usage, for although the short vowel *not* is nearly always signified by *o*, the lengthened form, *naught*, is not spelt with *o*, but with *a*, *au*, *aw* (*eall*, *eause*, *law*), and occasionally with *ou*, as *ought*.

Thus is obtained a nomenclature for fifteen vowe sounds, all supposed to be pronounced as they are when in full accent. Dr. Clark's scheme, however, takes account of the unaccented vowels, by which he not merely makes tho eharacters a guide to the exact pronunciation of the words, but effects a signal economy in the employment of the marked letters.

An English word, unless very long, has but one accented syllable; consequently, the unaccented syllables are the most numerous, being, perhaps, two-thirds or three-fourths of the whole. Farther, we find that of these unaccented syllables by far the larger proportion are the unaccented forms of the short vowels, *at* (àt), *bet* (bèt), *it* (ìt), *not* (nòt), *nut* (nùt). Indeed unaccented forms of *lay* (lá), *be* (bé), *sigh* (sí), *no* (nó), *rule* (rúl), are of rare occurrence. Hence the maximum of economy in the use of marks is gained by appropriating the letters *a*, *e*, *i*, *o*, *u*, in their unmarked form, to the unaccented short vowels; thus the word *posterity* contains but one marked vowel, *postèriti*.

For the long vowels out of accent, recourse is had to the mark for short quantity, *ă*, *ĕ*, *ĭ*, *ŭ*. The case of *o* is exceptional, as will now be explained. The symbol ō expresses the sound *awe*. The first syllable of *autumn* contains this vowel accented, *ōtum*. The first syllable of *autumnal* contains the same vowel, out of accent, for which the symbol ŏ is to be used (it is rarely wanted), *ŏtùmnal*. So *author*, *authority ; ōther*, *ŏthòriti*. The same vowel ŏ is properly the unaccented vowel of ò (nòt); but, in English usage, when ò passes out of accent, the sound ŏ is hardly ever substituted—in place of it, the unaccented sound of ó (go), as heard in the first and last vowels of *potáto*. The first syllable of the word *opposite* (òposit) loses its accent in *oppose*, and then becomes not *ŏpóz* but *opóze*. Thus, then, the unmarked *o* represents both ó (go) and ò (got), when out of accent; there is no form ŏ, but only the rare mark ŏ, for the case above stated, that is, for ō.

The unaccented vowels are thus ten, marked *a*, *e*, *i*, *o*, *u*; *ă*, *ĕ*, *ĭ*, *ŏ*, *ŭ*. The vowel alphabet is now made up of twenty-five vowel characters.

One other explanation is needed. As our monosyllabic words, *an*, *and*, *to*, *for*, &c., are, in the greater number of instances, pronounced without accent, precisely as the unaccented vowels of words of more than one syllable, they may be marked accordingly. This is a great additional economy of marked letters. *Not a man*, is *nòt a màn ; for all that I can tell*, is *for ōl that I kan tèl*.

For the compound or diphthongal sound in *now*, *noun*, the combination *ou* is retained; the sound in *boy*, *boil*, may be expressed by *oi*.

The following usage is in the meantime observed as regards the ambiguous consonants. The hard sound of *s* in *runs* is given by *z* (runz); *C* is disused, although there could be no harm in retaining it in the soft meaning, in such familiar forms as *Cæsar*, *eìrkumstane*, *pláe*. The distinction of the sharp and flat *th* is not indicated; perhaps our best plan would be to retain the accustomed spelling to the flat as being the more frequent, *the*, *then*, *there*, &c., and find some other form for the sharp in *earth*. The letter *j* is a convenient contraction for *dzh*, as *jèst*, *vision* (vìjon).

The Lórdz Prár.

Our Fāther, hwitch ārt in hèvn, hàlod bé thí nám. Thí kìngdom kùm. Thí wìl bĕ dùn on èrth, az it iz dùn in hèvn. Gìv us this dá our dáli brèd. And forgìv us our dèts, az wé forgìv our dètorz. And léd us nòt intú temtáshon, but dĕlìver us frum évl. For thîn iz the kìngdom, and the pour, and the glóri for èver. A'mèn.

Sām CIII.

Blès the Lórd, O' mĭ sól, and ōl that iz withìn mĕ, blès his hóli nám. Blès the Lórd, O' mĭ sól, and forgèt not ōl hiz bènefitz. Hú forgìveth ōl thĭn inìquitiz; hú héleth ōl thĭ dizéziz; hú redémeth thĭ lîf frum destrùkshon; hú krouneth thĕ with lùving-kîndnes and tènder mèrciz. Hú sàtisfĭeth thĭ mouth with gûd thìngz, só that thĭ yûth iz renyúd lĭk the églz.

Vìjon uv Mìrza.

On the fìfth dá uv the mùnth, hwìtch, akòrding tŭ the kùstom uv mi fórfatherz, I′ ōlwăz kêp hóli, āfter hàving wòsht misèlf and òferd up mi mòrning devóshonz, I′ asènded the hí hìlz uv Bàgdad, in òrder tŭ pàs the rèst uv the dá in meditáshon and prár. Az I′ woz (or wöz) hér, áring misèlf on the tóps uv the mountănz, I′ fèl intú a profound kontempláshon on the vànitiz uv hyúman lîf, and, pàsing frum wùn thōt tŭ anùther, "Shúrli," sèd I′, "màn is bùt a shàdo, and lîf a drém." Hwîlst I′ woz thùs myúsing, I′ kàst mi íz tóurds the sùmit uv a ròk that woz nòt fār frùm mĕ, hwár I diskùvered wùn in the hàbit uv a shèperd, with a lìtl myúsikal ìnstrument in hiz hànd. Az I′ lûkt upòn him, he aplíd it tŭ hiz lìps, and begàn tŭ plá upòn it. The sound uv it wòz exédingli swêt, and rōt intú a varíeti uv tyûnz that wăr inexprèsibli melódyus, and ōltogèther dìferent frum áni thing I′ had èver hèrd. Thá pût mé in mînd uv thóz hèvnli árz that ār plád tŭ the depārted sólz uv gûd mèn, upòn thár fìrst arívàl in Pàradis, tŭ wár out the imprèshonz uv the lāst àgoniz, and kwòlifî them for the plèjurz uv thàt hàpi plás. Mi hārt mèlted awá in sékret ràptyŭrz.

The Destrùkshon uv the Asìrianz.

The Asìrian kăm down lĭk the wûlf on the fóld,
And hiz kóhorts wăr gléming in pùrpl and góld;
And the shên uv thăr spérz woz lĭk stārz on the sé,
Hwen the blú wăv rólz nîtli on dêp Galilé.

Lĭk the lévz uv the fòrest hwen sùmer iz grên
That hóst with its bànerz at sùnset woz sên;
Lĭk the lévz uv the fòrest hwen ōtum has blón
That hóst on the mòro lá wìtherd and strón.

NATIONAL EDUCATION.

On the 4th inst., the Lords' amendments to the Bill were considered by the House of Commons, and several of them were agreed to exactly as they stood, while others were adopted with slight alteration. An amendment having been made by the Lords, taking away the power of school boards to establish free schools in special cases, Mr. W. E. Forster proposed that it should be disagreed from, as it had been carried in the other House by a small majority only, and, as he thought it was only fair, when they were imposing the duty of providing education for the people on the school boards, that those bodies should have the power of opening free schools where special circumstances rendered that necessary. The amendment was disagreed from accordingly.

The Lords having inserted a provision requiring minutes issued by the Education Department to be laid on the table of both Houses of Parliament six weeks before they take effect, Mr. W. E. Forster proposed to agree to this provision as far as requiring the minutes to be laid on the table of both Houses went, but he suggested that the period should be limited to one month instead of six weeks, and this alteration was agreed to.

Mr. W. E. Forster having moved that the House do agree with the Lords' amendments in respect of the ballot at election for school boards, Mr. Harcourt said that, as the House of Commons had sat up till 5 o'clock to insert in the Bill the ballot plan of voting, he should have expected that the government would have insisted on retaining it; but Mr. W. E. Forster thought the honours of the battle remained with those who had fought for the ballot, because the election would be by ballot in the metropolis, and it was in the metropolis the most important elections would be held between this and the time when it would be necessary to have fresh legislation in respect of the mode of election. Mr. Mundella warmly eulogised the manner in which Mr. W. E. Forster had carried this Bill through the House, and after a few words from Mr. M. Chambers and Mr. Illingworth, the Lords' amendments respecting the ballot were agreed to.

The Royal assent was given to the Bill on the 9th inst., and in the Queen's speech proroguing Parliament, it is thus referred to by Her Majesty:—"It has given me pleasure to concur with you in the passage of the important law providing for national education in England. I perceive in it a new guarantee for the moral and social well-being of the nation, and for its prosperity and power."

A meeting of the Vice-Presidents and members of the National Education Union was held on the 4th inst. at the Palace Hotel, Westminster, as well to congratulate the friends and subscribers on the success of their agitation, as to take measures for obtaining returns of the deficiencies of public school accommodation, and for the preparation of a manual on the new Act, and thereafter to wind up the operations of the association. The Right Hon. W. F. Cowper-Temple, M.P., presided, and said this was, perhaps, the most interesting of all the meetings of the Union, because the main objects for which it had been formed had been achieved. They desired that the system of national education, which was demanded by public opinion, should extend the blessings of education to all our children, without destroying the existing machinery of schools, and this had been fully secured by the Bill. Another object was to prevent the secularist party from placing a prohibition upon religious teaching in any rate-aided school, and in the Bill ample provision was made for free religious teaching, in accordance with the opinion of school boards. Mr. Charles Buxton, M.P., moved, "That this meeting strenuously urges all friends of religious education carefully to note, without delay, such deficiencies in public school accommodation as may exist in their own neighbourhoods, and at once to set on foot active measures to supply what is needful, and that the executive committee be requested to circulate, for suggestion and general guidance, such information as may appear to them desirable." This was seconded by the Earl of Harrowby, and carried unanimously. Mr. F. Egerton, M.P., moved, "That inasmuch as the principle of the Elementary Education Bill is to place voluntary schools and rate-founded schools upon an equal footing, and to encourage an honourable spirit of emulation between them, it should be our earnest determination, and that of all who sympathise with us, that in this rivalry voluntary schools shall not suffer from any apathy or indifference, or any want of generous encouragement and support." This was seconded by Sir W. Denison, who said that he did not expect to hear so much eulogy of the existing Bill, with which he, individually was by no means satisfied. Mr. J. G. Talbot, M.P., said that he, like the last speaker, was not particularly satisfied with the Bill, and, in accepting the compromise, the Union had made great concessions. The resolution was carried. Mr. F. S. Powell moved the third resolution, which was seconded by Colonel Gray, M.P., and carried unanimously, "That the (projected) Manual on the Elementary Education Act, pointing out the bearing of the various clauses (1) upon existing schools, (2) upon the provision, maintenance, and management of new schools, whether (*a*) voluntary or (*b*) rate-provided, be published for general circulation, after revision and approval by the executive committee." A resolution for winding up the association was then carried.

The report of the Committee of Council, which has recently been issued, is interesting, as being the last which will relate entirely to the proceedings under the existing *régime*. It appears that the schools in England and Wales under inspection, and actually visited in the last three years, furnished accommodation, in 1867, for 7·46 per cent., in 1868, for 7·91 per cent., and, in 1869, for 8·34 per cent. of the whole estimated population. The average attendance, as compared with the same population, rose from 4·53 per cent. in 1867, to 4·85 per cent. in 1868, and to 5·24 per cent. in 1869. There were, it seems, last year, 9,563 day-schools in Great Britain to which annual grants were made.

These would accommodate over two million scholars; but there were on the register not more than 1,797,388 children, of whom 1,157,005 were between six and twelve years of age. Since 1859, the school accommodation as well as attendance has nearly doubled. There are 744 schools which, though under inspection, do not fulfil the conditions on which annual grants are made. The night schools form another important element in the system; numbering 2,307, and teaching 66,841 scholars. Various reasons are ascribed in the report for the low standard of instruction obtained in State-aided schools. Some refer it to the irregularity of attendance, others to the inefficiency of the teachers, while Mr. Matthew Arnold submits that much time is lost in the ordeal of preparation for examination—in cramming pupils with the details of some particular branch of knowledge, with a view to obtain the government grant, and mentions some absurd results obtained by teaching under these conditions. In one instance he says;—"I have known a class presented in English history to take the period from Cæsar's landing to the Norman Conquest, and to be acquainted in much detail with the Roman invasion of Anglesey; but Carnarvon, on the coast opposite Anglesey, being mentioned, they neither knew what Prince of Wales was born there, nor to whom the title of Prince of Wales belonged. Another class took the period of Cæsar's landing to the reign of Egbert, and knew the history of this period, or what passes for its history, minutely, but only one of them had heard of the battle of Waterloo." With regard to the quality of instruction given in the grant schools throughout England and Wales, it seems that, for every 100 children present on an average daily, 34·5 are disqualified either by age (under six) or by number of attendances (less than 200 in the year at the same school) for individual examination; and that of the remaining 65·5 the number actually presented for examination was 696,440, and of those who passed without failure in any one of the subjects, 470,346. Confining attention to scholars over ten years of age, it further appears that, out of every 100 of these older scholars examined, only 63·5 passed without failure, although 118,807, or 44·6 of the number, were examined in the three lower standards; while those who passed without failure in the three higher standards were only 32 out of the 100. As to the supply of trained teachers, the report states that the English normal schools, which furnish accommodation for 2,500 students, could turn out every year 1,250 teachers who had gone through a two years' course of training. This supply, if the school life of a teacher under a thoroughly organised system of public instruction is estimated at twenty years, would keep up a staff (when once established) of 25,000 trained teachers for elementary schools, without taking into account the number that enter the profession through other channels. The training-schools in Scotland, the committee assume, could, in like manner, maintain a body of 7,660 duly-trained teachers—a number somewhat in excess of the requirements of that part of the kingdom.

CORRESPONDENCE.

BREAKAGE OF RAILWAY AXLES.

Sir,—Mr. Brunton is quite right in his statement that the collisions of loose-coupled coal-trains damage axles as well as bodies. Many years back a train was constructed in which the arrangement of the bearing springs was such that the axles and boxes could recoil elastically in the direction of the wagon length about two inches, in case of collision. A number of these wagons stood in a siding, intermingled with others of the ordinary construction, in which the wheels and boxes were in fixed horn-plates, bolted to the wagon sole bars. The whole were at rest on the rails, when an engine ran into them. The result was, that the horn-plates were shorn off close to the timber by the inertia of the wheels, while the recoiling axles were all undamaged. It was a definite proof—if proof had been needed—of the necessity of elastic recoil in heavy bodies moving rapidly. Forty years have passed since the opening of the Liverpool and Manchester, and railway coal-wagons are still inferior in mechanical structure to the coal-wagons used on macadam and stone pavements. The former are sledges; the latter roll. Red tape holds its own as yet, but it will finally get into a scrape by the accumulation of known but disregarded evils.—I am, &c.,

W. Bridges Adams.

OBITUARY.

Sir John Thwaites.—The death, after a few days' illness, from biliary diarrhœa, of Sir John Thwaites, chairman of the Metropolitan Board of Works, and a deputy-lieutenant for the counties of Middlesex and Surrey, took place on Monday morning. Sir John (contrary to the advice of his medical attendant) made his last appearance in a public capacity at the opening of the new bridge over the Thames at Walton, on August 1st. He was very ill on the morning of that day, became worse while at Walton, and, on arriving home, took to his bed, from which he did not rise again. Sir John, who was in his 56th year, was born in the county of Westmoreland, where his father was well-known as a successful agriculturist. Sir John came early to London, and fought his way with the energy and, independence by which the northern yeomen are so eminently characterised. Entering the woollen trade, in the establishment of Bardwell, of Holborn-hill, and, after having obtained a partnership in business and the hand of his master's daughter, he devoted his leisure to assisting the younger members of his trade in their efforts to educate and improve themselves, and hence took an active part in the early-closing movement. Attracting the notice of eminent philanthropists and public men, he subsequently became an intelligent participator in local administration, zealously labouring wherever he could to elevate or improve his fellow citizens, and contributing to every social effort for the benefit of the less fortunate. The necessity for improved metropolitan administration having forced itself on the attention of the government, about fourteen years since, Sir John was nominated a member of the Sewers Commission, with whom originated the main drainage scheme, and, on the constitution of the Metropolitan Board of Works, he was the only member honoured with a double return, viz., Greenwich and St. Saviour's. His well-known aptitude for public business, and the attention he had devoted to metropolitan administration under the government commission, marked Sir John among his fellows as fittest to preside, and, in the year 1856, he was elected to fill that post, which he continued to fill with so much ability up to the day of his death. In 1865, in commemoration of the opening of the main drainage works, Sir John received the honour of knighthood.

NEW BOOKS.

Statics. By Hamblin Smith. Price 5s. 6d. (Rivingtons.)

Burgh's Modern Marine Engine. Reprinted from 1st edition, uncoloured plates. Price £2 5s. (E. and N. Spon.)

Report on the Economy of Road-maintenance and Horse-draught through Steam Road Rolling. By F. A. Paget, C.E. Price 2s. (E. and N. Spon.)

Carbolic Acid and Human Parasites. By T. A. Readwin. Price 6d. (E. and N. Spon.)

In the Press.

A History of the Gothic Revival; showing how far the taste for Mediæval Architecture was retained in England during the last two centuries, and has been re-developed in the present. By Charles L. Eastlake, F.R.I.B.A. (Longmans and Co.)

GENERAL NOTES.

Suez Canal.—The services of Mr. Daniel Adolphus Lange, in connection with the Suez Canal, have been recognised by her Majesty, who has conferred upon him the honour of knighthood.

Poor-law Medical Reform.—It is the intention of Mr. Brady, M.P., to introduce a Bill next session for the purpose of severing the existing relation between the medical service of the poor and boards of guardians, and to concentrate in a special medical staff those sanitary and social services which are now performed in Ireland by the dispensary staff. Mr. Brady will be thankful to receive from any gentleman statistics on the relation which exists between neglected sickness and excessive pauperism, or descriptions of the public medical service in foreign countries.

An Atmospheric Telegraph.—*Nature* gives a detailed description of an atmospheric telegraph, invented by Signor Guattari, which professes to effect by means of compressed air all that is performed by an electric battery. By an ingenious system of tubes and stopcocks, the inventor creates currents, or pulsations of air, which set in motion a lever connected with the writing apparatus. Any number of conducting tubes may be employed, and the machinery is so simple that it cannot get out of order. Of course, it has an advantage over the electric system, in being wholly unaffected by atmospheric influences, and in the requisite medium being always at hand. The Royal Scientific Institute at Naples has awarded to Signor Guattari a gold medal, in recognition of what they consider an important invention, adding a graceful tribute on its presentation, to the effect that it was the only gold medal which the institute had ever awarded. As experiments with the machine were successfully conducted only a few weeks ago, the system cannot be pronounced chimerical; and we hope the attention of our Post-office authorities will be directed to it.

The War.—The French iron trade is feeling more and more the effects of the war. In the Champagne district there is still a certain amount of business doing, but in the Moselle group matters have changed greatly for the worse. Thus, some of the Longwy ironmasters have decided on blowing out their furnaces; at Stiring, the forges and furnaces are stopped; and at Ars a furnace has also been stopped. The mineral workings of the Moselle are, it may be added, pretty well deserted. The French government has given out an order for a large quantity of bullets and cannon balls to Messrs. Petin, Gaudet, and Co., the order to be executed with the utmost possible despatch. Fresh orders for armour-plates are also spoken of. The imports of iron minerals into France in the first five months of this year amounted to 228,905 tons, of which 52,117 tons came from Belgium, 46,783 tons from the German Association, 41,580 tons from Spain, 70,243 tons from Algeria, &c. The Belgian iron trade is also beginning to suffer more and more from the war, scarcely any fresh orders having come to hand. The Luxemburg ironmasters propose, however, to make efforts to keep their blast furnaces going; the construction of some new works at Esch will also be continued. Official statistics, just issued, show that the export of rails from Belgium in the first five months of this year was 50,617 tons, against 41,895 tons in the corresponding period of 1869, and 27,597 tons in the corresponding period of 1868. The Belgian coal trade still displays considerable activity; thus orders have been received from Dutch undertakings which formerly used Prussian coal. The Eastern of France Railway Company, which has for some time received a large tonnage of coal from Saarbrück, is also about to use increased quantities of Belgian coal.

Whitworth Scholarships.—The practical examination of workmen and students for these scholarships has been fixed by Sir Joseph Whitworth to take place, at his works at Manchester, on the 30th August and 1st September next.

The Sheffield School.—This school, called after its liberal patron and founder, Mr. Sheffield, is the scientific department of the Yale University system. It is distinct from Yale College proper, having its own faculty, buildings, libraries, &c., while the two are combined in the general university system, which also includes the schools of law, medicine, theology, and the fine arts. The course of study embraced in this school may be included with two divisions of pure and applied science. Under the first are embraced the different physical sciences—general chemistry, organic chemistry, mineralogy, botany, zoology, palœontology, geology, mathematics, astronomy, &c.; under the second—civil, mechanical, and mining engineering, mechanics, metallurgy, agricultural chemistry, &c. Appropriate degrees are conferred on the graduates. This university system affords the opportunity, for those who have the leisure or inclination, to secure the thorough discipline of the classical college, and complete the work of practical preparation for their life business in the higher classes of the scientific school.

The Corn Crops in the United States.—The Agricultural Department at Washington has just issued a report, embracing a summary of intelligence on the subject of the crops, from its agents and observers in all parts of the country. The report is dated June 17, and states, with reference to the wheat crop, that, in 1869, the increase of acreage of wheat over 1868 was estimated at more than a million of acres, making the aggregate 19,098,000 acres. In 1870, the natural tendency of low prices has been apparent in a reduced acreage, though not to the amount threatened. The reduction of 1870, compared with 1869, is estimated at 900,000 acres, or about five per cent. The reduction is greatest in Illinois, 15 per cent. in winter wheat and 18 per cent. in spring wheat; in Indiana, 6 per cent. in winter and 20 per cent. in spring; Ohio, 4 per cent. in winter and 7 per cent. in spring; Wisconsin and Iowa, 8 per cent. reduction, chiefly in spring wheat; and Missouri, 7 per cent. In Minnesota, on the other hand, 2 per cent. increase of acreage is claimed; Kansas, 16 per cent. increase; and California, 5 per cent. There is also a gain in West Virginia and Kentucky. The South generally falls off, some of the cotton States to the extent of 20 per cent., although North Carolina claims a slight increase. New England has fallen off 2 per cent., and New York 4 per cent. The season has been tolerably propitious. There have been few showers and much sunshine, pushing the crops into early maturity, but promising a yield not equal to the 13 or 14 bushels per acre average of 1869, and scarcely equal to 1868. The average is estimated at 11 bushels per acre. In many places, however, the prospect was never better. Some localities complain of too little rain; others of too much. In May the rainfall was quite small in New England, New York, the West, and the cotton States; but, on the contrary, in the Atlantic States, south of New York, the rains have been excessive. In New York, much of the winter grain is not in average condition. In New Jersey, the crop is fine; in Pennsylvania it is excellent; Maryland promises well, and Virginia and South Carolina promises a good average crop. In the South, the crop is generally good, though light in some cases in consequence of drought. In the Red River region of Texas the weather has been cool, so that the crop is late, but unusually fine. In Illinois a reduction is feared of about 15 per cent. in the yield. The west generally reports more discouragements from feeble growth, drought, hail, rain, and rust, than for two years past, and the general result shown is that there will be a much smaller aggregate production than that of 1869, and very likely a smaller yield than in 1868.

The Cotton Crop in America is estimated at 3,500,000 bales, while, if the season should prove like that of 1869, it may reach 4,000,000 bales.

Diseased Fish.—During last month, no less than 54 tons of diseased fish were seized at Billingsgate and the Columbia Market as unfit for human food, by the meters appointed by the Fishmongers Company. Of this quantity, 4 tons only came from the latter market. The fish numbered 165,002, and of this large number but 14,635 arrived in London by water. They comprised 36 brills, 36 cod, 3,365 crabs, 720 dabs, 6,733 haddocks, 116,290 herrings, 959 lobsters, 14,269 mackerel, 20 mullets, 14,370 plaice, 203 salmon, 131 shads, 16 skate, 2,000 smelts, 1,150 soles, 1 sturgeon, 743 thornbacks, 109 trout, 251 turbot, and 3,600 whiting. There were, besides, 53 bushels of periwinkles and 160 of whelks, 1,938 gallons of shrimps, 640 lbs. of eels, and 9 lbs. of salmon. The whole of it had been destroyed in the usual way.

Cotton in Natal.—We have heard much of the famous cotton plantations in the valley of the Umkomas, and there we directed our steps, determined to put our readers in possession of the facts as they presented themselves to our searching observation. There is nothing to be seen on the road but mealies and grass. It is, however, startling to see what an immense breadth of land has been ploughed by the Kafirs, and planted with the ubiquitous mealie. From Kettle Fontein to the edge of the Umkomas, almost every ridge of land has its large mealie garden, and the edge of the spruits, wherever a piece of level land can be found, is covered with the same crop. Seven years ago we travelled that road for the first time, and have no hesitation in saying that there are now at least 50 acres under crop for every single acre that was planted then. But to the cotton which is now growing there. We had been led to believe that 50 lbs. per acre for plant-cotton was as much as might be reckoned on. But we were informed by Mr. Conyngham that he had already gathered nearly 100 lbs. per acre of clean cotton from a two-acre patch, which he planted in the first week of October last. And yet, on looking at it, which we did with much care, it looked as if it had not been touched, so laden was it with bolls. Mr. Conyngham assured us that he fully expected to obtain 300 lbs. of clean cotton per acre from it. We remarked that the bolls were larger on these bushes than on any we had previously seen, and learned that this excellent result was obtained by nipping off the top of the bushes when the bolls began to form. The ratoons on Mr. Conyngham's plantation are very heavily laden, so much so that the majority of the bushes have broken down entirely, so that every branch is lying on the ground. These ratoon plants are small this year, certainly not more than half the size they were in former years. This is undoubtedly owing to their having been frosted down to the ground last winter, and because of the very dry spring which prevented them making as much wood as they would otherwise have made. Time did not permit our crossing the river to visit the plantations on the south side, but we learned that picking was going on briskly, and that every one was thoroughly satisfied with his prospects. We could see, as we rode down in the valley, proofs of this, for the axe was at work clearing away the bush on all sides, in preparation for the next season. We were extremely glad to hear that Dr. Callaway had enclosed 30 acres and ploughed it up, to be ready to receive a plant of cotton in the spring. This is at Spring Vale, the mission station of this devoted and enterprising gentleman, who, in his double capacity of clergyman and physician, as well as in that of an ardent friend of the best interests of the colony, is of inestimable value to a district stretching from the sea to the Berg, and from the Illovo to St. John's River. As Spring Vale is on the high lands, 1,500 feet at least above the valley of the Umkomas, the experiment will be a valuable one, and may prove that cotton can be profitably grown over the entire district.—*Times of Natal.*

The Australian Trade.—The value of the exports made from the United Kingdom to the Australian Colonies has experienced a considerable contraction this year, having amounted, to May 31st, to £4,112,797, as compared with £5,359,391 in the corresponding period of 1869, and £4,251,144 in the corresponding period of 1868. The only Australian colony to which our exports have increased, this year, has been New Zealand. Western Australia, South Australia, Victoria, New South Wales, Queensland, and Tasmania have all consumed smaller quantities of our produce and manufactures.

Postage Stamps.—In the year 1859, 469,768,629 postage stamps were issued or sold; in the year 1869 no less than 866,959,167. The numbers are constituted thus:—In 1859, the Post-office sold 336,562,000 labels, and 8,730,960 stamped envelopes, and the Inland Revenue Department, 114,299,704 labels, and 10,175,965 envelopes. But in 1869, the Post-office sold 721,211,380 labels, and 8,267,280 envelopes, and the Inland Revenue Department sold 123,072,928 labels, and 14,407,579 envelopes. The produce of all these stamps was £2,219,494 in 1859, and £4,236,560 in 1869. The number of penny labels issued was 432,119,497 in 1859, and 804,711,136 in 1869; and nearly 19,000,000 envelopes with impressed penny stamps were issued in 1859, and above 22,000,000 in 1869.

The Production of Cheese.—It is estimated that there are in the United States and Canada 1,000 factories, whose average weekly production is equal to 117,250 boxes. The cheese made in the United States and Canada, in 1867, reached 215,000,000, and in Great Britain 179,000,000 lbs. The consumption in America during the same period amounted to 160,000,000 lbs., and in Great Britain to 400,000,000 lbs., leaving a deficiency over the joint production of the two countries of 75,000,000 lbs. This deficiency was supplied by Holland and Belgium. The principal States engaged in the manufacture of cheese in this country are New York, Vermont, Massachussetts, Pennsylvania, Illinois, Ohio, Michigan, and Wisconsin. Western New York, the Western Reserve, and some sections of Illinois and Michigan, enjoy a deservedly high reputation for the excellent qualities of the products of their dairies. England has long been justly celebrated for the abundance and the superior quality of its cheese. Cheshire, Stilton, Derbyshire, Suffolk, and Cheddar are the best known varieties. Gouda cheese, the best made in Holland, is very pungent, which preserves it from mites, and this pungency is attributed to the fact that muriatic acid is used in curdling the milk instead of rennet. Parmesan cheese, made at Parma, in Italy, owes its rich flavour to the fine, sweet herbage of the meadow along the Po, where the cows are pastured. The best Parmesan cheese is kept several years, and none is sold until it is at least six months old. Swiss cheese is made, in part, of skim-milk, and is flavoured with fragrant herbs. They usually weigh from 40 to 60 lbs. each, and are exported in casks, each of which contains ten cheeses. Westphalia cheese derives its flavour from the curd being allowed to become soured before it is compressed. Dutch and Swiss cheese contains, according to chemical investigation, from 26 to 40 per cent. of nitrogenised matter, considered the most nutritive constituent of food. Tho best cheese is from 25 to 100 per cent. more nutritious than bread and meat, which contains about 22 per cent. of nitrogen. The superior qualities of cheese have been repeatedly proved by the experience of labourers in these countries, where it forms one of the principal articles of food. To delicate stomachs cheese is objectionable, on account of its slow and difficult digestion; but to individuals of great physical strength, it is a healthful and agreeable article of consumption. In combustible or heating qualities, cheese is only exceeded by oil, butter, and like unctuous substances.—*New York Mercantile Journal.*

Wheat Harvest of South Australia.—The government returns of the wheat product of the season 1869-70, in South Australia, show how deeply the farmer has had to suffer, though the gloomy prophecies of the present year have not been realised. The general average for the province is $3\frac{3}{4}$ bushels per acre, against $9\frac{2}{3}$, in 1868; the total yield is 3,052,320 bushels, against 5,173,970 bushels; and the quantity of land reaped is 532,135 acres, against 533,035, being a reduction of 900 acres. The quantity of flour available for export is small, as compared with the surplus following upon the harvest of 1868-9. Local consumption will absorb something like 1,050,000 bushels, while seed for 540,000 acres will make away with about 810,000 bushels more. This will leave 1,200,000 bushels or thereabouts unappropriated, which, at 45 bushels to the ton, will leave 26,000 tons for exportation.

Cost of Raising Corn.—The *Boston Journal of Chemistry* has some remarks on this subject worthy of notice. The editor says he has devoted six years of careful attention to this crop. It has been cultivated under every disadvantage—with hired labour, in wet and cold, and in hot and dry seasons, but the cost has averaged less than fifty cents per bushel. He adds that "a crop of corn that gives only twenty or thirty bushels per acre does not pay; but one that gives seventy, or eighty, or a hundred, does pay. We have never raised less than seventy bushels to the acre, although our farm was exhausted when we took hold of it." He ploughs in autumn, and spreads the fresh manure in spring. It is harrowed well, and the soil thoroughly pulverised. Each hill has a handful of the enriching mixture of ground bones and ashes, thrown around the hill and scattered over it before planting. In our own experience, manure spread in autumn, and diffused intimately through the soil by solution, is worth twice as much as when applied in the common way in spring; but any manure, fresh or rotted, if thoroughly broken and worked into the soil by repeated harrowings, is far more effective than when left in lumps, or but partly intermixed. If planting in hills gives the editor of the *Journal* seventy bushels per acre, drill culture would yield not less than eighty-five or ninety, other things being equal. There is one of his practices which we would not recommend. The top stalks are removed in a green state, and the corn is allowed to ripen on the lower stalks in the field. After husking, the "butts" are harvested, salted, pitched over, and placed in alternating layers with wheat straw. These are eaten with avidity by the cattle, and but a small part rejected. We object to "topping" the corn, on the ground of added labour and diminished crop. The removal of necessary leaves before the ripening process is completed, as every one knows, deprives the grain of a portion of its food. Grape culturists understand this principle, the lopping of branches immediately above the bunches checking the growth and destroying the flavonr. Experiments with cutting off the upper stalks, side by side, with cutting up the ground at a later period, have given the latter the advantage of several more bushels per acre. These experiments have, however, furnished varying results, according to the time each operation was performed. Some farmers have told us they have found no perceptible difference in the product; but, on inquiry, we learned that a few days only have intervened between the two operations. But cut the tops while the corn is yet quite soft, as is commonly done, and leave the cutting at the ground until it is thoroughly glazed, and the difference will be great. The ash and bone fertiliser, mentioned by the *Journal*, and which is pronounced double in value to any commercial fertiliser, is made by mixing equal measured parts of finely-ground bone with wood ashes, adding gradually, while mixing, enough water to moisten it, but not to make a paste. It will be ready for use in a week. The potash acts on the gelatine, and makes an enriching soap, which, with the bone, forms a fertiliser of great value. It must, of course, be used as sparingly as superphosphate.—*The Farmer.*

Cotton Statistics Act, 1868.—Return of the quantities of cotton imported and exported at the various ports of the United Kingdom during the week ending 4th August 1870:—Imported—American, 19,674 bales; Brazilian, 7,062 bales; East Indian, 5,661 bales; Egyptian, 131 bales; Miscellaneous, 1,587 bales; total, 34,115 bales. Exported—American, 2,883 bales; Brazilian, 20 bales; East Indian, 6,274 bales; Egyptian, 10 bales; miscellaneous, 160 bales; total, 9,347 bales.—C. Cecil Trevor, Assistant Secretary to the Board of Trade.—August 5.

Vehicular Traffic over the Principal Paris and London Roads.—Over the Boulevards de la Madeleine, des Italiens, and de Montmartre there passed, in 1863, within twenty-four hours, not less than 18,682 vehicles, drawn by 24,099 horses; over the Rue Royale, 16,088 carriages, drawn by 20,883 horses; over the Boulevard de Strasbourg, 10,969 carriages, with 14,348 horses; the Boulevard de Sebastopol, on the right side of the Seine, 9,313 carriages and 12,178 horses; the Place de la Bastille, 11,045 carriages and 15,612 horses; the Rue de Rivoli, from the Place de la Concorde to the Rue St. Denis, 11,645 carriages and 15,457 horses. Within the time from January, 1860, to 1863, the vehicular traffic in Paris had increased by about one-quarter. In London, the following are the figures showing the totals of the vehicular traffic, of every description, passing both ways, during the twelve hours between 8 a.m. and 8 p.m. of a day in July, 1865:—At Whitehall, by the Chapel Royal, with a width of roadway of 85 ft. 6 in., there passed 11,793 vehicles; Parliament-street, Westminster, with a 39 ft. 2 in. width of carriage-way at point of observation, 9,276 vehicles; at Regent-street, south of Princes-street, with 52 ft. carriage-way, 11,343 vehicles; over Westminster-bridge, with a 56 ft. 8 in. carriage-way, 11,609 vehicles; and over Piccadilly, west of Half Moon-street, 8,220 vehicles, at a width of carriage-way of 50 ft. 8 in.; and at Oxford-street, east of Duke-street (paved), 8,597 vehicles, at a width of carriage-way of 51 ft. 9 in.

Civil List Pensions.—The following are included in the list of pensions granted during the year, and charged upon the Civil List:—Mr. Augustus de Morgan, late an Examiner of the Society, in consideration of his distinguished merits as a mathematician, £100. Mrs. Thompson, in consideration of the labours of her late husband, Mr. Thurston Thompson, as official photographer to the Science and Art Department, and of his personal services to the late Prince Consort, £40. Demetrius Count Carnso, of the Island of Cephalonia, in recognition of his long and faithful services to the British Protectorate in the Ionian Islands, £100. Mrs. Brodie, in recognition of the historical researches and writings of her late husband, Mr. George Brodie, Historiographer Royal of Scotland, £80. Mr. Robert William Buchanan, in consideration of his literary merits as a poet, £100. Mrs. Baden Powell, in consideration of the valuable services to science rendered by her husband during the 33 years he held the Savillian Professorship of Geometry and Astronomy at Oxford, £150. Miss Margaret Catherine Ffennell, Miss Elizabeth Mark Ffennell, and Mrs. Charlotte Carlisle, formerly Ffennell, wife of Captain Thomas Carlisle, jointly, and the survivors or survivor of them, £30. Miss Margaret Catherine Ffennell, £10. Miss Elizabeth Mark Ffennell, £10. Mrs. Charlotte Carlisle, £10, in recognition of the labours of their father in connexion with the salmon fisheries of tho United Kingdom. Mrs. Dargan, in recognition of the services of her lato husband, Mr. William Dargan, in connection with the Dublin Exhibition of 1853, and other works of public importance in Ireland, £100. Mrs. Sturt, in consideration of the services rendered by her late husband, Captain Charles Sturt, by his geographical researches in Australia. William Henry Emmanuel Bleek, Doctor of Philosophy, in recognition of his literary services and in aid of his labours in the department of philology, especially in the study of the South African languages, £150. Total, £1,200.

Journal of the Society of Arts.

FRIDAY, AUGUST 19, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF THE SOCIETY.

CANTOR LECTURES.

ON FERMENTATION.

By Professor A. W. Williamson, F.R.S.

LECTURE IV.—DELIVERED MONDAY, MAY 16TH, 1870.

We had occasion, last week, to notice the effect of the atmosphere on processes of fermentation in several instances. I mentioned, among other things bearing on that question, an experiment of Gay-Lussac, in which he squeezed some very ripe berries of the grape under mercury, and kept them, with due precautions for the exclusion, as far as he knew, of everything except the grape-juice; he kept this expressed juice for some time quiescent, and then introduced a bubble of air, or a bubble of oxygen, the active substance of air, but he subjected the air or the oxygen, before introducing it into this juice, to various strong influences, which must have destroyed any vital organism in it; and he found that the mere addition of the air to the quiescent juice caused a process of fermentation to commence, and a formation of organisms to begin, that they developed themselves, and that the liquid fermented in the usual way. The fact of the fermentation commencing is, if we bear in mind the general results of M. Pasteur's researches, to be attributed to the presence in the mercury or in the grape juice, or somewhere or other in the substances present, of bodies which, by the mere access of oxygen, were stimulated so as to develop themselves into these little vital cells. It is now known, I may say, that there are in mercury, unless it is purified with extraordinary precautions, always present some such organisms, capable of developing themselves under such influences; and it is probable, I will not say more than that, for I do not know, that in the grape-juice there may also be similar germs present. The functions of oxygen appear from that experiment—which has since been confirmed by other observers—to be essential, at all events, to the initiation of the process, and there is, in that respect, a remarkable analogy, which I think is interesting to recall to mind, with the action of oxygen on other bodies, as shown by an experiment made by Humboldt many years ago. He got some grains of wheat from Egyptian mummies, which had been so long at rest that they were not inclined to grow, in fact, they could not be got to grow in the ordinary way. However, he stimulated them to activity by immersing them in a little chlorine water. It is well known to chemists that chlorine in the presence of water does oxidise, or cause the oxygen to separate and pass over to common organic substances capable of combining with it. Humboldt actually stimulated these sleepy wheat grains to life, so that they grew and germinated, and their descendants are still in existence, by the mere action of oxygen developed in that way.

In the processes of wine-making and wine-keeping, the presence of air is one of the most important matters which have to be considered, and there has prevailed, and I ought to say there still prevails, to a certain extent, a difference of opinion regarding the functions of oxygen in these processes. On the one hand, it is known, as a matter of fact, that processes of fermentation are performed under conditions such as that air has access to the substance. No actual wine or beer-making has yet been performed on a large scale on such conditions as to exclude oxygen. On the other hand, the experiments of Gay-Lussac established clearly that it is necessary. In some cases, however, in wine-making, it has been thought desirable to facilitate the access of air to the substance; while other wine-makers think, on the contrary, that in the first process as little air should be present as possible; but there has always been some. The juice first expressed from the grapes has been very carefully examined with regard to to the gases contained in it. If air has access to it, it is always necessary to know, in order to judge whether the air acts upon it, whether the air is dissolved by it, and whether, if dissolved by it, it is still to be found in the grape juice as such, or whether it has undergone combination. Now, every case of the examination of must, or fresh grape juice, which is not fermented, has shown that it contains a considerable quantity of gas, but no case has been established of free axygen being present in it. Carbonic acid gas is present in it in a considerable quantity, and also nitrogen, in proof that air had had access to it, but the oxygen which was taken up at the samo time with the nitrogen from the air, was not to be got out from that must again. It had been taken up, and it had entered into combination with the substance, so that all the oxygen present was actually combined chemically with it. In that respect a good many observations have been made by various chemists, but I ought especially to quote those of M. Pasteur, which are exceedingly careful and valuable. He has shown that this substance not only eats oxygen, but digests it. The oxygen is not to be found in it as such. It is only present in the form of a compound, which is formed by its action on the organic matters there present. Then, when the wine juice has been expressed, and when it has been allowed to remain some time in a suitable place, so as to undergo fermentation, with a considerable variety of treatment in different places with regard to air, for in some places it is thought desirable that the fermentation should be allowed to take place in open vessels, or in vessels to which the air can have access as freely as possible, whereas in other cases special care is taken to cover as completely as possible the vessels in which the fermentation is taking place, so that the air may have as little access as possible to the fermenting substance—and I believe it is impossiblo to give any one general rule with regard to the best process for all cases of fermentation, because the materials which are subjected to fermentation vary so considerably. They differ from one another in their composition so materially, and there are also other circumstances which are different. For instance, the temperature, which has an important influence. Not only is the temperature in some localities higher than in others, but other circumstances are also different, and it would not be right to say, because air is found to be perfectly useless in some well established cases during fermentation, that, for that reason, it ought to be excluded, or even that it may be excluded, in all other cases of apparently similar fermentation. As far as a general rule can be laid down from present experience. I think it does appear certain that oxygen plays no part in the process after the first expression of the juice,

Once the fermentation has commenced, it appears to go on as well if air is excluded from the substance as if air has access to it. There is, however, one circumstance which is considered by persons of considerable experience to be important in this matter, and which I ought therefore to mention, viz., that when fermentation takes place at a low temperature—and some fermentations are, with great care, kept at a low temperature—the products are found to be superior if the whole process is carried on, the temperature being kept exceedingly low, and in those cases it appears that an open vessel is certainly not in any degree detrimental. It is customary, in fact, to use an open tub when the temperature is low; and, on the contrary, it is usual to use a partially closed vessel, of course allowing for the escape of carbonic acid, when the temperature is comparatively high. When the first vinous fermentation has completed itself, it is customary, in the wine-growing countries, to put the still active liquid into casks, and the slower process of fermentation then goes on, which lasts a considerable time. During this second fermentation, there is very much the same kind of condition present as in the first, and there is always formed, in this subsequent fermentation, a considerable quantity of deposit, which is afterwards removed with much care; either the supernatant liquid is carefully decanted, or, in some cases, it is removed by a process of rough filtration. The subsequent treatment of the wine, I mean the keeping of it in casks or cellars, and the subsequent keeping in bottles—and these two processes of keeping it in casks and keeping it in bottles are quite distinct—these are not usually considered as forming part of the process of wine-making. It appears, however, from the investigations of M. Pasteur, that changes take place in the composition and the materials by these processes which really are as essential to the composition of the product as any other part of it, and that they ought to be considered as later parts of the process of wine-making. In fact, the process of wine-keeping is, in theory, not to be separated from the process of wine making, the keeping being a process making it more perfect than it was when first turned out of the fermenting vessels. Common experience corroborates that in a very remarkable way. Everybody knows the difference there is between new and old wine, and the changes which take place when the wine is being kept constitute certainly one of the most important parts of the general subject of wine-making. Wine, when its fermentation has been completed, is found to absorb air with considerable rapidity and avidity, and when endeavours are made to get out from this wine again the air which has been dissolved in it, it is found that some kinds of wine allow it to go, or part with it again, whilst other wines do not; and in this respect, a distinctive test is found between the qualities of tho wine; for by observing this difference in the facility with which they give up the air which they have dissolved, and by comparing that with the qualities of wines in each case, a remarkable generalisation has been arrived at. In this matter I speak upon the authority of others, for I have not confirmed it by my own observations. But all that I do know fully corroborates it. The rule is this, that whereas low class wines, which people will not pay much for, give up again almost completely the air which they have dissolved, superior kinds of wine do not give it up again, they only give up tho nitrogen, and hold the oxygen fast. The oxygen, which is dissolved in both cases, is held firmly, or is digested by the high class wines; but it is not digested, but simply eaten by low class wines. Observations have been made in this direction by a great many observers, especially Berthelot and Pasteur, to whom we owe most decisive results in this respect.

In the process of making wine, there are a considerable number of operations which are occasionally considered rather extraneous to normal wine-making, and are by many persons classed amongst frauds. Materials are sometimes used in aid of the natural constituents of the grape juice, materials which contribute to the quality of of the product; some of them by adding materials to it, but others simply removing from the substances bodies which are not wanted in it. And I must say that it does appear to me a great error to object to the introduction of any new conditions which may be found to effect an improvement in the product. I do not think it is reasonable to suppose, because wine is only known by the vulgar as fermented grape-juice, that for that reason nothing but grape-juice ought ever to be used in the manufacture. I think it would be desirable, in fact, it ought to be almost compulsory, that persons should state what materials are present in substances which they sell to the public; but, I think, with that safeguard, it would be right to leave manufacturers perfectly free to employ whatever materials they might find most conducive to the elaboration of their products. In some countries, grape-juice is exceedingly rich in acid and poor in sugar (and I think a good deal of wine is rather of that class), and wine-makers in such districts find that their stuff is more drinkable if some of the acid present in it can be removed before it is sent out. They, therefore, put into the must, in fermenting the wine, some chalk, and the lime which is present in the chalk combines with the tartaric acid, and takes it out of the liquid. Thus, the sour liquid is rendered less sour, and certainly that is not in any degree, or to any extent whatever, a fraudulent admixture. Nothing is added, but only an unpleasant substance is taken from it. It also happens in precisely the same districts, that from the paucity of sugar which is present in the grape-juice, the wine is too weak in alcohol; and that to meet the requirements of consumers, many wine-makers now add sugar in the process. Now, sugar is one of the natural and proper constituents of grape-juice, and if the grapes contain too little of it, it does seem quite proper and desirable that more should be added. However, in the subsequent making of wine, there are several other processes which are less natural than these, and about which some greater difference of opinion may possibly prevail; and one of the commonest, not only amongst wine-makers, but also amongst wine-consumers, is the process of fining. In order to establish the effect and the meaning of this process, I think we must trace back the history of wine from the time in which it is first put into casks by those who produce it, to the time at which it gets into the hands of consumers. It is customary—I cannot say whether it is universal or not, but I believe it to be so almost—to put new wine into new casks; and in the better districts oak casks are used. New wood is far more porous than old wood, when used for such a purpose; and of course the wine, when put into tho cask, sinks into the wood, so that the outer surface is moistened, and allows some of the water and alcohol, and the various volatile materials to evaporate. In fact, the wine diminishes during the first year of keeping in wood very rapidly, by a process of evaporation. But this is not all. Whilst the water and alcohols are evaporating from the outer surface, air is dissolved by the liquid which is in the wood. Air actually diffuses itself through the wet wood into the body of the wine in the cask; and what is more than this, the water and alcohol which go out are replaced by something. The cask does not collapse, nor is there a vacuum produced above the liquid. The wood is always sufficiently leaky for air to come into it, and there is always a space left above the wine. Wine-makers are, therefore, in the habit of filling up their wine-casks periodically. In some districts in France, they are filled up in the first year three times, at three different periods; and, in the second year, they are filled up only twice, but only at perfectly definite periods or seasons, which have been found, for those particular wines, to be most advantageous. But each time the wine, if examined carefully, is found to have undergone, not only what we chemists should call a process of concentration, the solid substances dissolved in the liquid of course

always remaining behind, the proportion of liquid being diminished, but, at the same time, it has undergone other changes, that is, there is a deposit formed from it. Some of the bodies present in it, either by themselves or by forming compounds with others, added to them, form a sediment, and in the wine-growing districts it is customary, and I have no doubt necessary, to decant the wine and pour it off carefully from the deposit many times, for the presence of the deposit, if continued in the wine, would be injurious to the future changes which it has to undergo. When this comes into the hands of the consumer, there is suspended in the substance of the wine some of this deposit—some solid particles which might be got to settle down, but which could not easily be removed completely by any process of mere subsidence, and the processes of fining, which are exceedingly various, have for their object the more complete removal of these solid particles by forming compounds with them. In some cases, the process consists in forming what I might call a sort of mordant, or something like a process of dyeing in which a gelatinous compound is formed in the body of the liquid, which carries down with it a good deal of colouring matter, which it encloses, and which does, while going down, take with it a number of little filaments and cells which were floating in the liquid, and which were so exceedingly light that they would not have settled, and could not have been removed otherwise. This point is particularly important in relation to a process which I shall presently mention. In some cases, it has been thought the wine contained too much albuminous matter. The theory of fermentation which was held for a long time, and which we considered at one of our previous meetings, consisted in attributing the process to the decomposition of the albuminous matter which is present in the fermenting liquid. It was supposed that there was too much of this albuminous matter present, and that it remained and was inclined to do further work. One process which has been adopted to a considerable extent in the Champagne districts, where that was supposed to occur, consisted in adding tannin, a substance which I have already spoken of, which carries down a good many albuminous bodies, forming a precipitate with them, and with these no doubt carries down the solids which may be in suspension. Then another process, which really bears a considerable resemblance to this one in principle, although not in form, is that of sulphuring, using sulphur in the casks, which, of course, you would understand at once, exerts an antiseptic action. It is, in fact, a process which consists in producing a material which is, in plain English, a poison to any germs which may happen to be present, whose action must consist, as far as it goes, in arresting the vitality—in stopping any work which they were doing. M. Berthelot, who has made many accurate experiments regarding the composition of wine and the changes which it undergoes, subjected some wine to the action of a known quantity of air, and by examining the wine afterwards he was led to to the conclusion that air is an unmixed evil to wine when once it is fully made. There are certainly many general observations which everybody must have had occasion to make which agree with that. If we open a bottle of wine and use half of it, especially if we leave a bottle of light wine open for some little time, everybody knows that it deteriorates in quality, and becomes flat, or even sour. In a great many cases, it is found that there is a development on the surface of the wine, and if you were to examine it carefully you would easily see, especially in light French or German wines, a pellicle—in fact, the vinegar cells; and their presence must have the effect of promoting the oxidation of the wine. M. Berthelot's experiments confirm the general observation, which everybody makes more or less definitely, that air is noxious to wine when present in any quantity. But M. Pasteur has arrived at precisely the opposite result. I do not mean to say that he says air cannot do harm, but that what is hurtful in air is the excess of it, or the too rapid rate of its action. He lays down the principle that every ripening of wine, or the process by which young and crude wine is changed into good old wine, consists in a process of slow oxidation; that is its very essence, and that without that, a crude young wine cannot be mellowed or transformed into a good old wine. The evidence which he gives for his conclusion is exceedingly simple, and I must say it appears to me exceedingly conclusive. He has, for the purpose of keeping wine with air, and for the purpose of keeping it without air, resorted to appliances which are far more effectual than those generally resorted to in common life. You may be aware that a cork, even what we should consider a good cork, does not completely prevent the communication of external air with liquids in a bottle. I do not suppose many people can know how much air passes in and through a cork, but the quantity is very great. M. Pasteur sealed up some young green wine, by putting it into a glass vessel, and then he melted up the neck, so that he had no air present with it. He then kept it for a considerable time, and he found that this wine, even after years' keeping, was as green and as young as at first; that wine kept under conditions such as that air could have no access to it did not undergo, to any extent, the change which was wanting, and that it did not improve by keeping. He then sealed up, in a similar vessel, some wine with air, and he subjected the wine, with a known quantity of air, to various influences which were calculated to accelerate the action of the air upon it, and amongst these I ought specially to mention that of light. He took some small vessels made of perfectly clear glass, and sealed up his wine, various qualities of it, in these little vessels with air, and then exposed them to the sunshine in the south of France. He found that the oxygen of the air was totally dissolved, and that, when he examined the air, the oxygen had gone, but he found that his wine then did pass over rapidly into a state exceedingly like that into which it passes by the ordinary process of keeping in bottle. It lost its harshness, and became like old wine, which it resembled very greatly in its quality, and also in its composition the older kind of wines. At the same time, he found that there was formed in such quality of wine a considerable amount of deposit, and his explanation of the way in which oxygen acts in this way, to improve the quality of wine, is this, that it serves gradually to take away from the wine various substances which are present in it, and that the deposit is due to an oxidation of the colouring matters present, which have an unpleasant, astringent, harsh taste, and it also consists in acting upon the alcohol of the wine, and upon the various organic liquids in it in a similar manner. This result is certainly one of very great importance, for if the process of improving wine requires the action of oxygen, and if, on the other hand, the action of oxygen may do much harm—I mean if all the good has to come from the oxygen, and if all the worst evils come from oxygen—and that really is the position in which the question stands upon our present evidence, it must be of the greatest importance to ascertain what are the conditions under which the beneficial action can be exercised, and what are those under which its detrimental influence occurs. In that respect, both of the observers I have mentioned, and others also, have established some remarkable facts, but in order to appreciate them duly, it will be necessary for you to know something of the general character of compounds to which I must now make allusion. When we were examining the process of oxidation, I spoke to you of alcohol as a substance eminently capable of undergoing oxidation, and showed you how readily it could be burnt to a much smaller extent than that to which we are in the habit of burning it. I had to mention ordinary acetic acid as being a product of a shorter combustion. Here is a vinegar-plant which is oxidising under alcohol, and there is an intermediate body which I have not yet spoken to you about

specially. Here in this, I have some of it dissolved in alcohol. It is a substance which, in the strong state in which I have it here, has rather a sickly odour, and it was named by Liebig, to whom we owe some of the first and most accurate facts in relation to it, aldehyde, a name serving to recall one of the most important facts about it, viz., that it is alcohol from which hydrogen has been taken away. If you were to take away from alcohol some of its hydrogen, you would have aldehyde — it is alcohol minus one-third of hydrogen, and it is, therefore, alcohol de-hydrogenised, and that is the origin of the term. When wines are undergoing very slow oxidation, it appears that aldehyde and other bodies analogous to it are formed. A great deal of evidence has been adduced of this, but I ought to mention that, as yet, one link in the chain of evidence is wanting, which chemists are always anxious to get in proof of their conclusions, that is, the substance itself, in a pure state, has not been got out from wine. Still, the proof is so far conclusive that we are prepared to admit it provisionally. One fact which I mentioned to you just now is very remarkable, as part of the evidence, viz., that wines which are particularly good, either by keeping or by their own composition, combine with oxygen which is dissolved in them. Now, aldehyde is particularly greedy of oxygen. If you were to dissolve in the aldehyde in this bottle some air, and if you were to try to get the air out of the alcohol again, you would find that you could get the nitrogen of the air out again completely if you went properly to work, but you could not get the oxygen out. The oxygen is laid hold of and digested so rapidly by the aldehyde that it is no longer to be recovered, after even a very short interval of time.

I might show you one case of the avidity with which this aldehyde absorbs oxygen. On putting into a glass a solution of nitrate of silver, and then adding a little ammonia, we should find, on pouring into it a little of this aldehyde dissolved in oxygen, there would be a deposit of metallic silver around the inside of the glass. This is a very common and easy way of ascertaining whether in a mixture any body of this class is present. The ammonia liberates the oxide of silver from the nitrate, and the aldehyde acts by taking away the oxygen and precipitating the silver, and in this way we get evidence of the greediness with which aldehyde takes up oxygen. There are several other interesting reactions of this aldehyde, and amongst them I ought specially to mention one which was discovered some few years ago by some very distinguished Italian chemists, the action of which is most exact and clear for removing aldehydes from any substance in which they are present; that is, their combination with alkaline bisulphites. This common aldehyde, and every body of the same class, combines with bisulphite, and forms very definite crystalline compounds, by which they are very easily detected and removed.

When we oxydise alcohol very slowly and gradually, we are able to get aldehyde formed from it; and, in the ordinary process of keeping wine, when it undergoes that slow oxidisation which Pasteur affirms to be the proper process, aldehydes are proved to be present in it, but, together with them, there are a considerable number of other bodies, which we are in the habit of calling ethers. I have spoken to you already about some ethers; for instance, the compound which sulphuric acid forms with alcohol, that is a kind of ether, although it is not one of the bodies we are commonly in the habit of so describing. Ethers represent a class of bodies which are certainly amongst the most pleasant of chemistry. I have a good many here; one is the commonest of all; it is the ether which is, I believe, present, to judge by the flavour, at any rate, in the celebrated *Lachryma Christi.* It is a body which I might describe as a salt. It is a salt formed whenever hydric acetate, the hydrogen salt of acetic acid, is present for a sufficiently long time in alcohol. Whilst the alcohol of the wine is becoming oxidised, and whilst aldehydes are being formed from it, there is also formed some acetic acid, and also probably some valerianic acid, butyric acid, and others analogous, which are formed by the oxidation of the bodies present with the alcohol. All these acids, while undergoing the process by which they are formed, combine with the alcohol and bodies like it and form these ethers, and it has been already shown that, at all events, in some cases the aroma of the wine is dependent upon the presence of bodies of this kind. One of the most remarkable processes of manufacture of bodies of the kind which has been successfully performed of late, is the process of preparing artificial ether, for the purpose of imparting to alcoholic liquids the same flavour, aroma, or bouquet which they are found to possess when made from the same natural substances; for instance, oil of brandy is got from the skins and seeds of the grape which are left when the grape juice has been pressed out. They are fermented, and a quantity of alcohol and aromatic substances are formed by the fermentation, and this forms the so-called oil of brandy, which is used for making brandy artificially, that is, common corn spirit is flavoured with it, and sold as genuine cognac. In like manner, various kinds of these acids have been made, and there is now in Germany a manufactory for making butyric acid on a large scale from sugar; it is then made into this ether, which is a very fragrant substance, and then in small quantities it is used for flavouring various alcoholic liquids, in imitation of natural products which naturally would possess the same substance or a similar one in them.

Amongst the processes which are detrimental to the quality of wine, I have already mentioned the excess of air having access to it. That is the one which is most known, and against which people least need to be cautioned, but it has been found by wine-growers and wine-makers, especially in the case of higher-class wines, like those of Burgundy and some other districts, are liable to particular maladies which produce evils, each one quite peculiar and different from the others. Amongst these maladies, the first, and simplest of all, is acetification, or the transformation of the alcohol into acetic acid. That is one which is so well known now, and so well understood, that, I think, wine-growers are well able to guard against it with tolerable completeness. By the use of a microscope, these little acetic cells on the surface of the liquid would at once be seen, and you would know, of course, that there would then be a tendency in the wine to pass over into acetic acid, and that, unless those cells cells are removed, or if they are present, unless oxygen be excluded—because the presence of the cells does not of itself make the wine into vinegar, it is necessary that they should be present with a continuous supply of air—so that if they are removed, or if you prevent a supply of air, that malady is arrested or cured. But there is another malady which is well known, and frequently spoken of amongst wine-growers as the "turning" of wine. It is a process which is, in its general features, something analogous to acetification, but chemically it is very different. When the wine is put into casks, it begins to give off gas, and in French they call it *La pousse;* it pushes out the ends of the casks, and, if a hole were made, the wine would be ejected with considerable force. M. Pasteur has examined not only the wine itself when undergoing this process, but also the deposit, the little solid particles which are present in it, and he has found two things which are correlative to one another,—in the first place, that there is always present in wine which is suffering from this malady certain little films, which can be seen quite distinctly by the microscope, and which are different from any particles found under any other conditions, and which he therefore believes to be little organic bodies, just as much as in the alcoholic ferment or acetic ferment, and he calls them the ferment of the turning, or *La pousse.* That is one fact which is established. These little particles are compared in their

structure to little bamboos, as they consist of little straight joints one at the end of the other, the length being considerably greater than the diameter; they are not little spherical matters, like the wine ferment, and their diameter is exceedingly small, being about the one-thousandth part of a millimetre. That is one fact which M. Pasteur has established, and the other is this, that while this process is going on, lactic acid is present; and his explanation of the malady consists in attributing it to the presence of this particular parasite in the wine, which is transforming the materials of it into lactic acid, with no doubt some other product, at the same time. Another malady which not unfrequently occurs in wine, is ropiness; and it is said that wine suffering acutely from this malady might almost be mistaken for oil, when poured from one vessel to another, so thickly does it flow. That peculiarity is attributed solely to the presence in it of a number of little films peculiar to it; but they are very different to the eye, and very different also in their functions from the films which constitute the active agency of the process I have just mentioned, that of turning. These little films are like little strings of beads, little spherical particles, a great number of them joined end to end. The particular nature of the transformation which the wine undergoes has not been investigated, but, as far as M. Pasteur's observations go, and they are very numerous and accurate, these little strings of beads are really active agents in that particular transformation which constitutes ropyness, and which destroys wine; for, if it cannot be arrested, the wine ceases to be drinkable, and becomes worthless. The fourth malady, which is also one of frequent occurrence, is one which produces a bitterness, and it is said that this malady is one to which wine is subject in its youth and also in its old age; that it sometimes occurs when wine is two or three years old, and sometimes, though in a less acute form, when it is very old. Here, also, a particular parasite is present, little organised particles, which have been minutely described and depicted, and they are found in various states, some differing very much from the others. Some pictures of the parasites which constitute the bitter ferment are like little branches with a number of little knobs or warts upon them, and some of them are clear and transparent, whilst others are coated with an incrustation. M. Pasteur, however, has already shown that the little knobs or warts upon them, and the incrustation which frequently occurs, are nothing else than foreign matter deposited upon them, that when the parasite dies it is liable to be encrusted, but that in a pure state it is clear and transparent. This parasite, when it occurs in young wine, renders it completely worthless, but when it occurs in old wine, it only gives such an amount of bitterness as is not fatal to the wine, and is, to a certain extent, exceedingly common, so that it is considered almost a natural accompaniment of old wine. Amongst the remedies for these processes is sulphurous acid, which, of course, would destroy parasites when they are present. We can quite understand that wine which has got germs of these little organic beings present in it is liable to undergo these injurious changes if the germs are allowed to develop themselves, but that it would be free from all such tendency if, by any poisonous material, the little germs or organisms were destroyed. We can also understand that any mechanical process of filtration, or of forming in the liquid a gelatinous mass which will subside and carry down with it any fine particle which may be present in suspension, but which are too light to settle of themselves, would effect the same object, and accordingly it is quite intelligible, that if Pasteur's view, that these little solid particles are the active agents of those transformations, the proceeses which have commonly been in use for preventing the detriment of wine by such changes should be effectual; we can quite see why they ought and indeed must be effectual, but, at the same time, we cannot help seeing that they would be very liable to be incomplete. Of course, it is a matter of chance whether, if you form a precipitate in the liquid, the little light particles would all happen to be caught by some of this precipitate when going down, and we should expect that any such process would be efficacious in diminishing the evil, but not in arresting it completely, and I believe that is exactly what is found by experience. M. Pasteur, however, has introduced a process which, I gather from his statements, has already been adopted by a considerable number of wine-growers and merchants, which goes to the root of the matter in such a way as to leave nothing to chance, for he has proceeded upon the knowledge previously acquired by his accurate and masterly experiments, regarding the nature of all these little organisms, and the conditions which are favourable to their development, and which are destructive of them. He finds that when wine is heated to near the boiling point, in any vessel in which it may be enclosed, and left in that vessel to cool, it may then be kept (provided the vessel be not opened) for any length of time without undergoing any of these deleterious changes. He finds also that so high a temperature as that I have named is not absolutely necessary, but that even if wine, which on keeping would be subject to the malady of acetification or ropiness, be heated to a temperature of 60° centigrade (that is about 140° in the clumsy and inconvenient scale which is still, I am sorry to say, in common use in this country), it will kill these organisms completely; and the experiment is so easily performed that any of you may do it with a very moderate amount of care. You ought to perform the experiment with several bottles at the same time, and to keep some similar bottles in the original state, in order to observe the difference. In the month of September, when I last saw M. Pasteur, he gave me several bottles of wine, some of which were in their original state, whilst the others had, after bottling, been heated to a temperature of 60°, or a little more. I have not yet opened any of them, but I have some of each sort here, and we will presently see what has been the result of the treatment. I ought to say that they have not been kept with proper precautions, for, on opening the case, I found that it had been left in such a position that the bottles had been standing with their necks upwards, which is not very favourable to the preservation of the wine. The experiment is so simple, that it is worth while for everybody to perform it. You should take some light wine, which you have reason to believe will not keep well; the bottles should not be too tightly corked, and there should be a little space left below the cork. You put several of these bottles into a vessel of water, cautiously if the water be warm, to avoid breaking them, and with them one bottle full of water, uncorked, you then warm the whole very gradually, until you find, by inserting a thermometer into the open bottle of water, that the temperature is up to 140° Fahrenheit; you then allow the whole to cool slowly. The corks are generally lifted a little by the expansion of the liquid and air within the bottles, and will require to be struck in again to their proper place. The same operation is performed on a large scale by wine-growers and merchants in France, in casks, and several contrivances have been described for the purpose. The simplest of all is to put a cask, with its bung upwards, into any convenient vessel of water, so placing it that the top of the cask is just above the water. The water surrounding the cask is then warmed gradually until it is found, by lifting the bung and inserting a thermometer, that the wine is of a temperature 60° or 70° centigrade. The bung is then closed, and the whole allowed to cool. Another form of apparatus has been figured in a late book of M. Pasteur's on acetification, which consists of a cask with one of its ends removed, and replaced by a sort of double bottom of metal. This cask is then put on the fire, so that the water in the false bottom may be heated, and raise the temperature of the wine in the cask above, without danger of burning it. M. Pasteur recommends that when the wine

has reached the right temperature it should be allowed to run, while still hot, into the cask into which it is to be kept, so that any little germs which may be present there may be as much heated as the wine which comes in contact with them. He heats the wine in this operation to about 65° or 70°, but he says there is reason to believe that even 50° is sufficient. Upon all occasions on which it has been tested it has been found that the little parasites which are present, and which are the seeds of the maladies of which we have been speaking—and, no doubt, other organisms—are changed in such a manner as to be practically dead. Whether they are susceptible of being revived is another thing. It is not known, and it is not affirmed that there are no germs which might not, by contact with oxygen, be afterwards brought into life; but practically there are no organisms in the wine, after that temperature has been applied to it, capable of growing in the closed vessel in which it is kept. M. Pasteur says that if the wine were, after that treatment, bottled, he would expect that some bottles would contain wine which would spoil, whereas the greater number probably would not, the reason being that the wine, on its passage from the cask to the bottle, would be liable to get some little germs from the air which possibly might retain some vitality, which would be stimulated by the oxygen. Therefore, all he affirms is, that when the wine is kept in the same vessel in which it was heated, it undergoes no further change whatever.

With regard to the ordinary process of aerating wine by keeping it in bottles, I should like to show you an experiment which illustrates, in a very simple way, what is a very familiar well-known fact. Everyone who has had occasion to keep wine knows what an immense difference there is if you keep a bottle standing upwards or lying down. The difference is of this kind. If it stands upwards, the cork is dry, and air has access at a very rapid rate to the contents of the bottle, and the wine gets oxidised and spoilt; whereas, when the bottle is left lying down, the cork is wet, and the air has access much less rapidly—in fact, only at such a low rate as is suitable for mellowing and improving the wine. I have here a couple of glass tubes, both open at one end, and closed at the upper end by a porous substance, which I may call a cork—it is, in fact, a cork made of plaster of Paris, a particularly porous substance—one cork being wetted, so that the pores are full of water, whilst the other has been carefully kept dry, and this one is covered for the present with a little cap to prevent the access of the air. Here, in another vessel, is a mixture which is giving off hydrogen gas, which is passing upwards into these two tubes, one with a wet cork and one with a dry one. After a minute or two, both tubes will be full of pretty nearly pure hydrogen, and then we will remove them, and put the lower ends into this jar containing a coloured liquid. Most of you know that this porous substance allows hydrogen to pass through it more rapidly even than the air which is now outside passes in, and therefore, as the hydrogen passes out of these tubes more rapidly than the air comes in, the liquid will be sucked up in the tubes, and we shall have a measure of the rate at which our gas passes through the wet cork and the dry cork, by noticing the difference in the rise of the liquid in the two tubes. If it passes quicker through the dry cork than the wet one, we shall find that the liquid will rise more rapidly in that tube, and I think you will find that the difference will be very great indeed. They are now both standing in the coloured liquid, and already there is a perceptible rise in the tube with the dry plug; but in the other one I cannot yet see the liquid at all. So it is in the simple case of a wine bottle. If the cork of a bottle is wetted, so as to allow an exceedingly slow diffusion of air through the contents, the wine gets very slowly oxidised, and undergoes only that gradual transformation which is wanted; whereas, in the other case, it is turned sour and spoilt by too rapid oxidation.

I could gladly have entered upon many other facts and considerations which belong to this subject, but one must stop somewhere. I cannot, however, part from you without expressing my very strong sense of the debt which we owe to that great investigator whom I have already quoted so many times. I think there are few precedents of research so fruitful as those of M. Pasteur, if we consider, not only the theoretical importance, I mean with regard to our knowledge of the processes of life, and the origin of life, of his investigations regarding germs in the air, and these processes of fermentation; but if we take into account also the fact that he has succeeded in working out one of the most complete practical applications of it in a process like wine-making and keeping, one cannot refrain from admiring the truly perfect adaptation of the highest science to a useful purpose. I will now proceed to open these two sets of bottles, some of which have been heated and some not, and I hope the result will be satisfactory.

The samples of wine were then tasted by the audience, the difference being most remarkable, not only in taste, but also in colour and general appearance.

At the conclusion of the lecture, Mr. Foster, the secretary, proposed a vote of thanks to Professor Williamson, which was carried with acclamation, and suitably acknowledged.

THE REVISED CODE AND ELEMENTARY SCHOOLS.

The following letter is taken from the *Birmingham Gazette*:—

Sir,—Among other changes which must follow the passing of the Education Bill, will be an extensive revision of the code of the Privy Council on Education.

One most important provision of that code relates of course to the annual inspection and examination of every school which receives government grants. That which was known formerly as an inspection of schools, which was always coupled with more or less of examination of the scholars, has of late years been succeeded by a more severe examination of each of the scholars in the elements of reading, writing, and arithmetic, with a corresponding diminution in those duties which were, for twenty years or more, strictly inspectorial.

Now, whilst the necessity of examination into the individual progress of scholars must be enforced by the government before it awards money to a school, it is nevertheless most true that the old work of inspection had an effect upon the tone of schools, upon the general character of the instruction therein imparted, and upon their sanitary and other arrangements, which cannot too soon be recalled, and which ought never to have been in any degree interfered with or hampered by other and certainly less important duties. The point is, to ascertain whether examination into school results and the duties of inspection cannot be to a great extent separated, to the promotion of a more thorough individual examination of scholars on the one hand, to the great comfort of inspectors in the performance of their proper duties on the other, and the consequent improvement of school life in all its higher phases, both mental and moral. The cost of inspection, too, including examination as it now does, is another matter of great importance. The country ought to see whether a separation of the duties of inspection from the work of examination cannot be made to promote economy in the expenditure of the education fund. With the large increase of schools which will soon come, this question of an economical inspection becomes one of great interest.

I venture to believe that the examination into the results of teaching in our elementary schools, and indeed in all other schools, may be most easily and accurately conducted throughout the country in one day, and without the presence of a single inspector, by properly

constituted bodies of managers, and by means of printed papers sent down from the Council Office.

This mode of examination has been adopted, for nearly twenty years, by the Society of Arts, all over the country; of late years the Science and Art Department of the Government has followed the example of the Society of Arts, and the code provides that evening schools may be examined in this way. On all these examinations thus conducted, certificates and prizes are awarded to the persons examined, and money grants to a large amount to teachers.

I would submit the following outline of a scheme, which might be made to answer the purpose; but really the very admirable examination scheme of the Society of Arts, which was, I believe, suggested and perfected by the late Mr. Harry Chester, formerly one of the assistant secretaries at the Privy Council Office, supplies all the main features of a scheme which, with some alterations in its details, could be made to serve the purpose very well.

1. The examination of all elementary schools in the country (both day and evening schools) in writing, spelling, and arithmetic, should be conducted on one day in each year, between certain hours, by means of papers sent down from the Privy Council Office.

2. The managers of schools, with perhaps one or two other persons associated with them, should be responsible for the proper conduct of the examination.

3. Girls and boys in the same standards should be examined in the same room. Two or more small schools might be grouped together for convenience.

4. The post-master of the nearest post-office should deliver to and receive from the managers, at specified times, the packets of papers.

5. To prevent the possibility of copying in the examination, every exercise in the same school should be different from every other. But every scholar throughout the country having the same number on his school register would have the same exercises.

6. Within a reasonable time after the annual examination a tabulated result of the position attained by every school in the country should be published in a cheap form.

7. Every school should be visited within three months of the examination, either before or after, by the inspector of the district. He should then examine the reading, and inquire into the fulfilment of all other conditions necessary before the awarding of the annual grants. The inspector should pay a second visit in each year to every school, and on this occasion his work should have reference chiefly to modes of instruction, plans of school arrangement, books, apparatus, maps, sanitary matters, &c.

Here, then, is a scheme for separating inspection to a very large extent from examination. This latter work, important as it is, is rather the work of clerks at their desks than of inspectors on their rounds. Again, it is really the only mode by which we can have a comparative view of the general results of the entire country. We do not know now whether one or many standards are in use, whether Yorkshire stands higher than Middlesex, or whether the inspector who passes only 65 per cent. of his scholars is not inflicting an injustice upon all the schools in his district. We want, too, a greater degree of elasticity in the code as to the number of standards. The boy who now attends 400 times in the year is kept down to the dead level of the one who attends only 200 times. Teachers ought to be encouraged to pass their regular and intelligent scholars through at least two standards, and ought not to be limited by the present number, the highest of which ought to be easily reached by such scholars at the age of ten.

This, Sir, is one of the points which ought to be looked into by our school managers and teachers, before the code comes on for revision.—I am, &c.,

A. Teacher.

THE SUBMARINE TUNNEL BETWEEN FRANCE AND ENGLAND.

This project has often been thought of, and public attention has been recalled to it in consequence of a recent edition of M. Thomé du Gamond's pamphlet, published in 1867, which contained an explanation of the plans exhibited by him at the Exhibition of 1867, and also an account of the works carried on by him since 1833, and a brief statement of his different projects. In 1833, he began his explorations of the soil of the Channel. In 1834, his first idea was to sink an iron tube in the Channel. This project necessitated extensive works at the bottom of the sea, at a cost of 460 million francs (18 millions sterling). It was followed by another contrivance, a submarine tunnel, by means of a moveable shield placed in the open sea. This shield, advancing at the rate of three millemetres per minute (*i.e.*, about one inch in eight minutes), would have taken thirty years to finish. It was abandoned, and another plan substituted by the persevering engineer, viz., a bridge, for which he had five different plans. That which, in 1836, seemed to meet with the greatest approval was a granite bridge of colossal size. It was, in plan, of the width of 120 metres (133 yards); the arches, of 150 metres (367 yards) span, were sustained on piles of 50 metres in longitudinal metres, and 120 of transverse breadth. All the arches raised 52 metres above the sea would allow of the passage through them of most ships. One arch has to be moveable, to allow of the occasional passage of extra-sized vessels. The expense of this bridge was estimated to be 4,000 million francs (160 million pounds sterling), which figures will explain why it was not carried into effect. A cheaper plan was then considered by M. Thomé de Gamond. It consisted of two piers of artificial rock, each of eight kilometres in length (about five miles and a half), advancing towards each other in the sea, and leaving between them a space of eighteen kilometres (about twelve miles). A very broad floating ferry, of the raft order, would communicate from one pier to the other. This plan, estimated to cost 250 million francs (ten million pounds sterling), shared the same fate as its predecessors. However, it led its author to the idea of constructing a complete isthmus, which, by means of artificial rocks, will unite the island to the continent, reserving three broad, open passages for navigation. This project was estimated to cost 840 million francs, and, not meeting with the approval of naval men, it was abandoned, and its projector returned to his first idea of a submarine passage. To make himself thoroughly acquainted with the submarine soil, he went down in a diving-bell. He gives an account of the perils he encountered in his experiments. The plan, exhibited in 1867, in the Champ de Mars, is the result of M. Thomé de Gamond's researches. The principal conditions are as follows:—It starts from Cape Point, near Folkestone, and is carried by the Bank de Varne, towards the coast of France, which it reaches to the east of Cape Grinez. It is 36,640 metres long (about 24 miles), divided into two sections; that under the British side of the Channel, from Cape Point to the Bank of Varne, 15,425 metres; and that under the French side of the Channel to Cape Grinez, 20,315 metres. The approaches to the tunnel consist, on *terra-firma*, of two cuttings, sunk at 40 metres (about 45 yards) below the level of the sea. The platform of the way is 10 metres broad, and rises by a gentle gradient through a passage of 4 kilometres, at the end of which the level of the sea is reached. It forms a junction with the lines of railway on each side. The Bank of Varne, raised higher, so as to allow of tunnelling the four sides at the same time, will form a sort of station at the bottom of shafts of 45 metres depth, where, by the aid of the lift, travellers will go through in twenty seconds. We cannot enter into all the details of the project; it is sufficient to say the cost would be 180 million francs (seven million

pounds sterling; and, even if begun at the four sides at once, it would take from eight to ten years to finish it. This project has the support of well-known men. The projector has perseverance which we must praise. He says, with reason, that to accomplish this work money from both nations will be required.

OUR RAILWAY SYSTEM IN INDIA.

It is now just twenty years ago since the first sod of an Indian railway was turned. At that time it was decided to confine operations to two small experimental lines, 150 miles in length—one of 120 miles in Bengal, the other of 30 in Bombay. In four years these were opened, but before that time arrived, Lord Dalhousie, then Governor-General, had proposed, and the home authorities had approved of the system of railways which is now approaching completion. India is now traversed by a net-work of lines nearly five thousand miles in length. During the present year an important event has occurred in the junction of the Great Indian Peninsular and the East Indian railways at Jubbulpore, whereby the whole breadth of the peninsula is spanned, and Bombay and Calcutta, as well as Bombay, Delhi, and Lahore, are brought into communication with each other. The ceremony of opening the Jubbulpore portion was performed by the Duke of Edinburgh and the Viceroy, on the 7th of March last. The distance from Bombay to Calcutta by the present route is 1,470 miles, and the journey occupies about seventy hours, by means of which line a saving of three or four days between England and Calcutta has been thus recently effected. No greater time is now occupied in reaching that city from London than it took formerly to get from one end of India to the other.

The report by Mr. Juland Danvers to the Secretary of State for India, just published, contains a complete and concise summary of all that has transpired in connection with railway construction since the commencement. It is also accompanied with a map that marks the course of the lines made and making, which clearly elucidates the subject so far as the report extends, up to the end of the year 1866. Since that time we find that 261 miles have been added, making the whole length opened as 4,628 miles; and there are still 1,519 miles unfinished, of the total length sanctioned by the government. But a small proportion (479 miles) of those constructed are laid with a double line. Respecting the gradual growth of each and all the different companies, a table is given, which shows that, in 1853, there were 21 miles in existence; in 1860, 836; in 1866, 3,568; and on 1st October, 1869, 4,238. Of these, the East Indian forms 1,353 miles; Great Indian Peninsular, 875; Madras, 707; and the remaining mileage distributed amongst eleven other companies.

The capital which, up to the 31st March, had been raised by the companies was £86,522,491, of which they had expended £83,444,147, and nearly two-thirds, or about fifty millions, had been used in India. Besides the cost of land granted by the government, and some differences in the value of exchange of the rupees, the total amount is reckoned at £90,000,000. Of the £86,522,491 raised, £71,590,846 consists of share capital, £13,605,685 debentures, and £1,325,960 debenture stock. The number of persons who hold shares and debentures was 56,417, being an excess of 2,918 over the previous return. For the ensuing year, it is estimated that a further sum of about £4,000,000 will probably be expended in India, and £2,400,000 in England, there being a balance of about £3,000,000 standing to the credit of the companies for this purpose. During the last twenty years, a sum of £15,864,300 has been drawn from the revenues of India, for the payment of the guaranteed interest; this gives an average of £793,000 a-year. While the State has been making this annual contribution, it must be borne in mind that it has for some years derived a direct pecuniary benefit, both by the conveyance of mails free of charge, and of troops, baggage, ammunition, &c., at the lowest rates chargeable for goods of that description.

The revenue of the railways for the year, ended 31st December, 1869, was £2,520,952, being £1,670 less than 1868. There was an increase in the gross receipts, which were £5,709,382, in 1869, compared with £5,320,723, in 1868; but the working expenses were £3,203,171, against £2,808,038. The guaranteed interest paid by government last year amounted to £4,013,871; in 1868, it was £3,704,388. There was a falling off in the net receipts of all the lines, with the exception of the East Indian and the Delhi, the depressed condition of trade and famine in certain districts having seriously checked the traffic. Strenuous efforts are making to reduce expenditure in every way, to bring the working and estimated charges as low as is compatible with efficiency.

The material shipped last year from this country for railway purposes was in weight 211,750 tons, valued at £1,432,784; and the number of ships employed was 455; and the amount of freight paid, £351,974. Since the commencement of operations, there has been in weight shipped 3,929,799 tons, valued at £26,484,919; and the number of ships employed, 6,158. The state of the rolling stock on the 1st January, 1870, shows the number of locomotives, 1,174; passenger carriages, 3,113; trucks and wagons, 22,393; total vehicles, 25,506.

The number of miles run by trains during the year was upwards of 12,000,000, the number of passengers carried is put down at 16,513,037. Out of these, 31, or 1·87 per million, lost their lives from causes beyond their control, and 4·78 per million were in like manner injured. Besides these, 17 were killed and 13 injured through their own negligence. With regard to the servants of the companies, 109 were killed. Trespassers, to the number of 48, were also run over and killed. No less than 132 passengers died whilst travelling, the most caused by cholera. The number of persons employed on the lines in Bengal and Madras, on the 1st October last, was 3,221 Europeans and 35,422 natives.

For the future, the terms entered into between the government and the railway companies will involve certain changes which, it is hoped, will work for the advantage of both parties. In making arrangements for the execution of new works, more definite power of control will be given to the government in the preparation of plans and estimates while the lines are in course of construction. Originally, in event of the guaranteed money being repaid with interest, the whole of the net profit should go to the shareholders. Now, the government engage to cancel the past debt, upon condition that any excess profits over 5 per cent. are to be equally divided. With regard to the "State Railways," which the government propose to undertake without the intervention of the companies, the experience gained warrants the expectation that, under a proper system of management, well-selected routes may be laid out at much less cost than the existing ones. The experiments made upon the Port Madoc and Festiniog railway in Wales, with a guage of two feet, and the double bogie engine, constructed on the plan designed by Mr. Fairlie, seem likely to assist in the introduction of railways into places where it has been hitherto impossible, owing to the expense. Another investigation, which is likely to be of service to the cause of Indian railways, was made during the past year by Major F. S. Taylor, R.E., who was commissioned to visit America, Belgium, and France, and to examine and report on the system of railway construction and management in those countries. The results of his observations have been given to the government, and go to show that in several respects India may learn something from Europe and America. With the view of bringing the experience of the latter to bear practically upon the operations now going on, two practical engineers from America have been engaged in the service of the government.

THE CLIMATE OF IRELAND.

In the science of nature, there is no chapter more interesting than that which treats of physical geography, which, properly understood, means the account of physical phenomena as they are modified by geographical position; and, at the present moment, the physical geography of green Erin, or its peculiarities of soil and climate, presents a theme of no slight importance. It has been stated in the House of Commons, as a proof of the retrograde condition of Ireland, that its production of cereals has of late years diminished, while its pasture lands have increased. To this it ought to have been answered that the decreased cultivation of cereals, and of wheat in particular, was a proof of improved knowledge. Years ago, at a meeting of the British Association in Cork, a communication was read, pointing out that agriculturists in general are governed wholly by example, their scanty science not allowing them to quit the beaten path. Hence, Irish farmers, when they aim at improvement, endeavour to imitate the farming of Norfolk or the Lothians, and in so doing fail miserably, owing to the wide difference between the climates of the western isle and of the eastern side of Great Britain. It is commonly stated that Ireland has a very wet climate. It has, undoubtedly, a humid atmosphere, owing, perhaps, in some measure, to a large extent of undrained surface. But the total quantity of rain that falls in Ireland, little, if at all, exceeds the rainfall of England. In its distribution through the year, however, it differs much from the latter. The vicinity of the Atlantic gives Ireland in the highest degree an oceanic, and, to some extent, an equatorial climate. Winter in the Green Isle is extremely mild. The southern and western coasts, though seldom free from wind and drizzling rain, never experience severe cold. Vegetation remains in mid-winter brilliantly green and undepressed. As spring advances, everything seems to flourish; crops of all kinds promise abundance, and already (in May) harvest seems to be close at hand. But now the scene changes—there is little or no dry summer. When the sun is highest in the meridian, there is a constantly clouded sky and no sunshine. Rain begins to fall in June. The rainfall of July is the heaviest in the year. In August, the rain begins to abate; but clear skies and bright sunshine cannot be reckoned on till September, when the shortened days and the sun's declination have much reduced the solar heat. The crops in the meantime, arrested in their progress, are not the better for two months' slumbering under the clouds. They have summer rain in excess, and too little sunshine. From this it will be seen that the character of the Irish climate is, that under it everything grows well, but that the process of ripening is painfully slow and uncertain. Now, to cultivators of cereals the success of this process is of the utmost importance. The corn harvest in Ireland falls late in the year, September and October, when the days are short and nocturnal frosts not unfrequent. The plains of Southern Russia, or of the Red River in Canada, with a comparatively rigorous climate, far excel Ireland as wheat-producing countries, because their short summer is one of uninterrupted fierce sunshine; their vegetation suffers no check, their grain is ripened all at once, and the harvest gathered without delay or difficulty. The deficiency of ripening power in the Irish climate produces a secondary defect, which meets with less attention than it deserves. The grain which lingers on the stem two or three months before it hardens is sure to be unequally ripened; some of it is immature, while more is tending to decay. Consequently, it is bad seed, and the Irish farmer habitually sows perhaps six or eight times as much as Mr. Mechi would deem requisite. Under these circumstances it is evident that the Irish farmer ought to cultivate cereals no further than is requisite for the economy of his farm, and to look to other productions for his profit. Fortunately, there is a husbandry for the pursuit of which he enjoys peculiar advantages. In green crops no country can compete with Ireland, where, nevertheless, they are still little known or esteemed by the multitude. From this it may be inferred that sheep and cattle ought to be the chief objects of Irish husbandry. In truth, the Green Isle, under proper management, could easily supply England with beef, mutton, poultry, milk, and butter, and grow rich by giving abundance at a cheap rate to her neighbours. But then this could be effected only under a system of large farms. The grazier and cattle-dealer, to make their business profitable, must do it on a large scale. Butter of the best quality cannot come from a small dairy. The improvement of Ireland, therefore, as dictated by climate and natural capability, can be effected only under a system of large farms. The popular wish, however, is for small holdings. It is thought that the country, when divided into potato gardens, and all covered with cottages, will be a paradise. But this poor man's paradise, beginning with a few years of felicity, will assuredly lead to the pauperism of ages. The legislature cannot countenance schemes opposed to the wholesome development of society, and which would make poverty an institution; neither can it prevent their diffusion; but it may counteract them by spreading enlightenment, and by presenting plain truths to the common sense of the community. This might be done by the publication of some statistics, showing the relative amount of cost and production of wheat and of green crops in England and Ireland, with some illustrations of the gain derivable from large farms and the use of machinery.—" W. D. C." in *Nature.*

GERMANY.

Among the reports from Germany, laid before Parliament this session, is one from Mr. Fenton, Secretary of Legation at Munich, showing the extension of the railways of Bavaria. At this time last year there were 1,606 (English) miles of railroad open in Bavaria; 286 miles more were being constructed; and bills had been passed for other 733 miles, among which were several lines on the left bank of the Rhine—one from Worth to Germersheim, one from Germersheim to Landau, and one from Landau to Saargemunde, on the French frontier. But Bavaria will now have to do other work than that of constructing railroads. The post-office returns of Bavaria show good progress. In the 15 months ending with December, 1867, more than 56,000,000 letters, home and foreign, passed through the post, and a still larger number of newspapers; and upwards of 5,000,000 of the letters bore a stamp of only one kreutzer, or one-third of a penny. In Bavaria, there was produced in 1867 7,160,175 Zoll. cwt. of stone coal and brown coal, equal to 352,420 tons, representing a value at the pit's mouth of £138,514; and nearly as large a quantity of coal is imported annually. Würtemburg has no coal mines. She imported, in the year 1867-68, 5,185,627 centners, or German cwts., almost all of it Saar and Ruhr coal. In another report, issued this session, Mr. Consul-General Crowe, of Leipsic, notices the improving condition of the Rhenish Provinces and Westphalia, but observed, in a run through them in 1868, that it could not be said that confidence existed; the manufacturers, however, had learnt to shut their eyes to political risks, and worked on in spite of their fears. The Ruhr collieries raised above 11,000,000 tons of fuel in that year. 5,434 vessels arrived at Cologne, carrying 159,715 tons of goods; and rafts came down stream with 297,503 centners of wood. Consul Kuchen, in an undated report from Frankfort, presented to Parliament in May last, on the trade of the Zollverein in 1868, states that anxiety and intense fear of fresh political conflicts kept back enterprises of a far-seeing character, and that there had been three successive harvests none of which could be called favourable. He states that there were 2,228 German miles of railroad

working in Germany in 1868. The population of the Customs Union amounted, according to the census of December, 1867, to 38,781,480 souls, 29,974,779 belonging to the North German Confederation, and 8,806,701 to the other German states. Of the former figures, Prussia claims a population of 24,061,210, while, of the latter figures, Bavaria counts 4,824,421; Würtemburg, 1,778,479; and Baden, 1,438,872 inhabitants. The population of the older provinces of the Kingdom of Prussia amounted to 19,729,447 (to 19,135,933, in 1866), while the provinces annexed in 1866 added a total of 4,313,414 to the population. The mining returns for 1867 show, in the Customs Union, a product of more than 474,000,000 cwts. of coal, 140,000,000 cwts. of peat, 7,378,000 cwts. of zinc ore, 3,577,000 cwts. of copper ore; and the year's return of smelting and founding operations shows a product of more than 20 million cwts. of raw iron, six million cwts. cast ware, nearly 11 million cwts. bar and rolled iron, 1,390,000 cwts. beaten iron plate, 2,452,000 cwts. of steel, 1,277,000 cwts. plate or bar zinc, 879,000 cwts. pig lead. In the north, our vice-consul at Lubeck reports a favourable harvest in 1869, and increased export trade. 1,775 sailing and steam vessels, of 122,209 lasts (about 244,400 tons), arrived in 1869; most of the merchandise, and particularly coals, were imported in German vessels. When he reported (in February, 1870) he pronounced the commercial prospect for 1870 favourable. From Kiel, the vice-consul sent a satisfactory report last year. Kiel had had a larger share than ever before in the commerce of the Baltic. The prosperity of the agricultural classes had a beneficial effect on the trade in British manufactured goods. The import of coals from Great Britain, in 1868, amounted to 29,500 tons. In 1868, 3,193 vessels, of 138,290 tons, entered the port of Kiel; two-thirds were German. From Stettin, we learn that the trade of 1869 shows an increase; nearly half the foreign trade is with England. The total tonnage of British vessels that arrived at Stettin, in 1869, was 164,010 tons, being 14,626 tons, or 9·79 per cent., more than in 1868, and 76,498 tons, or 87·41 per cent., more than the average of the preceding ten years. The Consul at Dantsic reports trade stagnant. 1,704 sea-going vessels, of 209,015 Prussian lasts (of 4,000lb. Prussian), arrived at Dantsic in 1868; more than half this shipping was German, and 322 vessels, of 52,278 lasts, were British. 74,026 barrels of herrings were imported from Scotland in 1868. The valley of the Vistula is supplying every year larger quantities of grain to the port of Dantsic. The consul at Konigsberg reports a certain political uneasiness, and a bad harvest in 1868.

MIRAGE IN THE CHANNEL.

The following letter is published in the *Meteorological Magazine* :—

"Sir,—The party on board my yacht *Hadassah*, on her passage from Alderney to Guernsey on Saturday, 21st May, witnessed a phenomenon so striking, and in these latitudes so rare, that I am tempted to send you a short account of it. The wind was light from E.N.E., the sky cloudless, the sun very hot, and the barometer steady at 30·21. There had been some signs of fog in the morning, but they had disappeared. At about half-past three in the afternoon we observed over the small island of Herm a peculiar hazy reflection, which became more and more defined until it presented an exact inverted image of the land beneath. A similar effect was soon visible round the whole horizon. The islands Alderney, Guernsey, Jersey, Sark, and Herm, seemed raised to more than twice their natural height; sharp pointed outlying rocks were capped with inverted images of themselves, apparently balanced upon them, point to point, like enormous rocking stones. The Ortach rocks, of which we had previously lost sight, were now to be seen with startling clearness in the air. The Casquets, with its three lighthouses, presented a most curious appearance: the lighthouses were drawn out into colossal pillars, on whose summits rested a huge mass of rock, clearer in outline than the real island beneath. Ships were seen sailing keel upwards through the air, every sail and spar distinct, and in some cases the images were reduplicated. Several of the vessels thus reflected were below the horizon, and invisible to us. The northern end of Guernsey, where the land runs low, was twice reflected in the air, so distinctly that even those who were familiar with the island, found it hard to recognise it. We seemed to be looking at some half-submerged country, where countless still lagoons were divided from each other by narrow strips of land. As we neared Guernsey, the picture became less distinct, but meanwhile the mirage was becoming more wonderful still over Alderney. Here the deeply-marked cliffs were magnified to an apparent height of many hundred feet, and no scene painter devising a grand transformation scene ever dreamed of more fantastic groups of basaltic columns, grottos, and rock arches, with the tide flowing beneath, than was exhibited by the island and the isolated stacks around it. Having remained visible for more than three hours, the panorama of wonders gradually faded away, and by seven o'clock the horizon was clear, save where a dark narrow line of cloud or mist hung low in the N.E. I may add, for the information of weather prophets, that this unusual state of the atmosphere was not the forerunner of high wind or any change in the weather.

"Thos. Waring.

"Schooner *Hadassah*, Queenstown, June 15th."

NOTICES OF PUBLICATIONS.

A Report on the Economy of Road Maintenance, by Frederick A. Paget, C.E., has been printed by order of the Metropolitan Board of Works. It contains a large amount of information on the subject, especially with regard to steam-rolling and the statistics of road-making. The following extracts will show the aim and manner of the report:—"But very small areas of the London roads are partially and imperfectly rolled by horses, and that only in the wealthier districts, such as Kensington. Still, regarded merely as a luxury for the rich, rolling by steam is practised in the Royal parks—certainly with the result of producing roads of a smoothness and beauty unequalled in the rest of the metropolis. In America, where road administration lacks centralisation, as with ourselves, steam road-rolling is also still mainly only used in the parks of New York and Brooklyn, and elsewhere. Such being the present stage of this question of road-rolling in Great Britain and America, it is proposed to prove—by reference to a multitude of authenticated facts, to a number of well-known authorities, to many mechanical reasons, gathered from the engineering experience of many others as well as the writer—that rolling roads is indubitably a powerful means of economy in their maintenance. Special reference will be made to the application of road-rolling to the roads of the metropolis, and the very high probability, amounting almost to certainty, will be shown that its universal employment in the metropolitan parishes would lead to an economy, in maintenance alone, of more than £140,000 per annum to the ratepayers. . . . . . Laying down paving stones, 9 in. deep by 4 in. wide, on a coarse gravel bed, costs about eighteen shillings per square yard. This high price, with the general tendency amongst the London surveyors to recommend paving, together, no doubt, with the general increase of the traffic, mainly account for the yearly increase in the sums spent on the London roads. According to returns published by the Roads' Department of the Home Office, the total sum

spent on all roads in the metropolis was £320,091, in 1861-2; £383,169, in 1862-3; £413,078, in 1863-4; £460,000, in 1864-5; £515,013, in 1865-6; £714,662, in 1866-7; and £781,000, in 1867-8. The money thus invested in paving is generally borrowed on interest, repaid by the diminution in cost of maintenance. . . . In order to obtain some further measure of the extent of the classes directly interested in the application of steam road-rolling, we will form an estimate of what an engineer would term the rolling stock of the London roads. According to recent fiscal arrangements, all horses whatsoever are taxed, and also all vehicles, with the sole exception of trade carts for burthens, on which are painted the name and address of the proprietor. This gives an easy means of getting at the number of horses and, approximately, the number of vehicles. The Honourable Commissioners of Inland Revenue have obligingly furnished us with figures, giving the number of horses and of taxed vehicles, within a circle of a radius of 4½ miles from Charing-cross, and hence covering the greater part of the metropolitan area. There are thus 71,903 horses in all, and 24,095 taxed carriages, within this space. On account of the untaxed trade carts, we may safely raise the number of vehicles to 30,000. In the absence of any exact data, there may probably be different opinions as to the relative numbers of the different kinds, but the following rough estimate will not be very far from exactitude, especially as we have verified the numbers we have estimated for the cabs and omnibuses by inquiry at Scotland-yard. Of light carts, vans, gigs, phaetons, 15,000, which, at the price of £30 each, would give a sum of £450,000; cabs, 7,000 at £35 each, give £245,000; omnibuses, 2,000 at £60, £160,000; heavy carts and wagons, 3,500 at £50 each, £175,000; carriages, broughams, etc., 2,500 at £120 each, £300,000. This would afford a total of £1,290,000 invested in vehicles; and harness may be estimated at 40,000 sets, at the rate of £4 each, or £160,000. The depreciation of this capital is very heavy, as experts estimate that vehicles, the first prices of which are £20 to £150, cost from £4 to £15 per annum in repairs; and the wear and tear of harness is always very considerable. Each of the 15,000 light carts, gigs, phaetons, or vans, we will take to require one horse, of the value of £20, or a total value of £300,000. Each of the 7,000 harder-worked cabs would require two horses, as a horse must be in stable at least three days a week, but their average value can only be taken as £15, or a total of £225,000. As few omnibus horses do more than one journey a day, and even then often rest one or two days a week, we probably have 30,000 horses to the 2,000 omnibuses, and, being of a somewhat superior kind, they must be estimated at the rate of £30 each, or a total of £900,000. Heavy cart or wagon horses, 7,000 at £60 each, and two per cart, will give £420,000; and carriage and brougham horses, two per vehicle, 5,000 at £100 each, will employ the sum of £500,000. On account of their inconsiderable number, especially in the centre of London —for we are only considering the area within a radius of 4½ miles from Charing-cross—we have left out the riding horses. The total capital thus invested in horse-flesh we may estimate at £2,345,000; and, adding to this £1,290,000 for vehicles, and £160,000 for harness, we have a total of £3,735,000, or of nearly four million of pounds sterling invested in the rolling stock of the metropolitan highways."

NEW BOOKS.

Abbeys, Castles, and Ancient Halls of England and Wales. By John Timbs, author of "Curiosities of London." 2 vols. Price 7s. (Warne and Co.)

Common British Moths. By Rev. J. G. Wood, M.A. Price 1s. (Routledge and Sons.)

Window Gardening. By Andrew Meikle. Price 1s. (Routledge and Sons.)

ANNUAL INTERNATIONAL EXHIBITIONS.

Her Majesty's Commissioners state that there is no foundation for the rumour that the International Exhibition, appointed for 1871, is to be postponed by reason of the war. The first of the series of Annual International Exhibitions of Selected Works of Fine and Industrial Art and Scientific Inventions will take place next year, as already announced.

GENERAL NOTES.

Tracings on Linen by Post.—In reply to an application made by Mr. Lloyd Wise, the post-office authorities have informed that gentleman that arrangements are now completed under which tracings on linen, of an architectural and mechanical nature, will be allowed to pass to Belgium at the book-rate of postage.

The Census.—The English census of 1871 is to show "the name, sex, age, rank, profession or occupation condition, relation to head of family, and birthplace of every living person who abode in every house on the night of Sunday, the 2nd day of April, 1871; and also whether any are blind, or deaf or dumb." Measures will also be taken for ascertaining the number of persons travelling, or for any other reason not abiding in any house. An account of houses will also be taken, occupied or uninhabited, or building. There will be a penalty for making a false return, or refusing to make any.

British North America.—Rupert's Land is now incorporated as a portion of the Dominion of Canada, by Her Majesty's proclamation. The authority of the Ottawa Government and Parliament extends from the Atlantic to the Rocky Mountains. A *Gazette Extraordinary*, published at Ottawa, on the 19th of July, contains the following despatch to the Governor-General of Canada:—"Downing-street, June 25, 1870.—Sir,—Having reference to your telegram of the 12th inst., in which you stated that the transfer of Rupert's Land to the Dominion of Canada might properly take place on the 15th of July, I have the honour to inform you that, on the 22nd inst., Her Majesty was pleased to accept from the Hudson's Bay Company the surrender of that territory, in pursuance of the Rupert's Land Act of 1868, and by the accompanying Order in Council, to unite Rupert's Land and the North-west Territory to the Dominion of Canada, from the 15th of July.—I have, &c., Granville." The Order in Council is also published. It recites the proceedings which have taken place, including the Addresses of the Parliament of Canada, and proceeds:—"It is hereby ordered and declared by Her Majesty, by and with the advice of the Privy Council, in pursuance and exercise of powers vested in Her Majesty by said Acts of Parliament, that from and after the 15th day of July, 1870, the said North-west Territory shall be admitted into and become part of the Dominion of Canada, upon the terms and conditions set forth in the hereinbefore recited address, and that the Parliament of Canada shall, from the day aforesaid, have full power and authority to legislate for the future welfare and good government of the said territory; and it is further ordered that without prejudice to any obligations arising from the aforesaid approved report, Rupert's Land shall, from and after the said date, be admitted into and become part of the Dominion of Canada, upon the following terms and conditions still remaining to be performed of those embodied in the said second address of the Parliament of Canada, and approved of by Her Majesty." The terms and conditions are set orth at length.

Miners.—The gross number of miners in the whole of Europe amounts to 1,275,000, of which there are in great Britain, 363,000; France, 206,500; Prussia, 184,800; Austria, 125,900; Belgium, 111,500; Russia, 80,000; Spain, 73,600; Italy, 36,000; Sweden and Norway, 29,000; Saxony, 23,300; Bavaria, 11,200; Switzerland, 5,100; Portugal, 4,200; Wurtemburg, 2,200; Baden, 2,100; Greece, 800; Netherlands, 800; and Denmark, 300. Reckoning the relatives of the miners and the furnace-men, the population which derives its living from mining amounts to 2,955,000 persons; of these, there are distributed in Great Britain 900,000 persons; France, 503,000; Prussia, 523,000; Austria, 260,000; Belgium, 218,000; Russia, 180,000; Spain, 167,000; Italy, 75,000; Sweden and Norway, 75,000; Saxony, 56,000; Bavaria, 24,000; Portugal, 9,000; Switzerland, 10,000; and the res t of Europe, 30,000 persons. The mining population of Europe, therefore, forms one per cent. of the whole.

Decrease in the Importation of Wool into Liverpool.—According to returns just made, it appears that during the month of July last, there were imported into Liverpool the following quantities of sheep's wool, namely:—From the East Indies, 1,969 bales; from Spain, 1 bale; from Portugal, 277 bales; from Peru and Chili, 5,191 bales; from the River Plate, 410 bales; from the Mediterranean, 2,196 bales; and sundries, 52 bales—making a total of 10,076 bales. There were also imported 200 bales of alpaca, and 2,373 bales of goats' wool. During the seven months ending July, there were imported from Australia 1,918 bales of sheep's wool; from the Cape of Good Hope, 34 bales; from the East Indies, 16,369 bales; from Spain, 82 bales; from Portugal, 4,494 bales; from Peru and Chili, 21,078 bales; from the River Plate, 4,871 bales; from the Mediterranean, 6,729 bales; from the United States, 53 bales; and sundries, 139 bales. There were also imported during the same period, 15,503 bales of alpaca, and 7,518 bales of goats' wool—making a total for the seven months of 78,788 bales, which, when compared with the corresponding period of last year, show a decrease of 20,042 bales.

Mussel Eating.—It is surprising the quantity of mussels imported into our manufacturing towns. The working man appears to feast upon this shell-fish with a marked preference, if we may judge by the large consumption of it. A visit to the markets of Manchester, and like towns, will reveal the fact, that mussels were largely sought after and eaten by the manufacturing class at the time of the year when some restriction should be placed upon their sale, for during the months of May, June, and July, they are a dangerous commodity, not having recovered from the effects of spawning, and in many instances produce serious mischief. We have lately observed the grave results which arise from a careless indulgence in mussels, from the general rash over the surface of the body—so characteristic of unwholesome fish—to the protracted and, in some cases, fatal diarrhœa. In France, where mussel farming is cultivated with the same care as that of oysters, and where they are placed under the operation of the fishery laws, we find, during four summer months, no mussels are sold for consumption in the markets or shops. Even if they were, they would not be so dangerous as the large, fat mussel to be found in our markets, and consumed with so much recklessness as to future suffering by the working man. Disease is engendered and propagated through the carelessness with which the dietary of our people is managed, and serious epidemics arise through incaution. Accordingly, we believe it should fall to the duty of inspectors of markets to prohibit the sale of unseasonable articles of food. How often do we see lobsters and crabs vended at a time when they are most baneful, and how frequently are our professional services required to minister to suffering arising from the injurious effects of stale or unseasonable shell-fish.—*Medical Press and Circular.*

Area of Great Cities.—The Registrar-General places the area of London at 77,997 acres, which exceeds the area of Philadelphia by less than 2,000 acres. Paris has only 7,802 acres, Vienna, 3,728 acres, and Berlin 6,253 acres. Birmingham is in excess of the acreage of Paris, having 7,831 acres. Birmingham must be healthy, for its rate of mortality is 16 per 1,000, the lowest of any city; the highest is Leeds, 24 in 1,000.

Export of Coal.—A considerable increase is shown in the exports of coal from the United Kingdom this year. In May the clearances reached 1,090,031 tons, as compared with 796,250 tons in May, 1869, and 987,802 tons in May, 1868. In these totals the exports to France figured for 193,312 tons, 160,475 tons, and 166,437 tons respectively. The coal exported in the five months ending May 31 this year amounted to 5,529,754 tons, as compared with 4,785,471 tons in the corresponding period of 1869, and 5,202,886 tons in the first five months of 1868. The exports to France in the five months of this year were 1,203,272 tons, against 993,710 tons in 1869, and 964,502 tons in 1868. There has been an increase this year in the exports to the United States, France, Russia, Sweden, Prussia, Holland, Italy, and Brazil; and a decrease to Denmark and British India. The value of the coal exported in May was £514,350, as compared with £374,261 in May, 1869, and £482,501 in May, 1868; and in the five months ending May 31, this year, £2,616,420, against £2,297,511 in the corresponding period of 1869, and £2,585,946 in 1868.

Price of Agricultural Labour in America and Europe.—A summary of returns from the Agricultural Department at Washington, shows the average of farm labour in the United States to be a fraction over 25 dols. per month, or very nearly 1 dol. per day, for the working time, perhaps over that, if due allowance were made for bad weather and other contingencies. "In striking contrast," says the *Albany Country Gentleman*, "are the returns recently published abroad as to the prices paid for agricultural labour in Europe. Thus in Belgium, the price reported is equal to 26 cents per day, gold, without food, the variation being from 18 cents to 40 cents in extreme cases. Day labourers in harvest get from 60 to 75 cents a day. One report from Prussia is at about the same rates; two others are much lower—one stating the wages in summer and harvest at the rate of 15 to 20 cents a day without victuals, the other at 36 cents for summer work in general. In Switzerland, prizes vary from 2 dols. to 4 dols. per month with board, and from 50 to 60 cents a day without. In Galicia, labourers receive 18 cents a day in summer, 12 cents a day in winter, 24 cents to 28 cents a day in harvest, with no rations. In Silesia, men get board and lodgings and 20 dols. a year. In Hungary, wages vary very much, but are mostly paid in provisions, generally about 14 dols. a year in money, 60 bushels of grain, food for a cow and pig, and fuel and lodging free. In France, one report says 38 cents a day in summer, and 30 cents a day in winter without provisions; another, 60 dols. to 70 dols. a year with board; another, from 4 dols. to 6 dols. a month; and another gives a table of rates paid for piece-work, in which we find—cutting hay, clover, lucerne, &c., first cut, per acre, 84 cents; second cut, 70 cents; cocking the same, 32 cents per acre; reaping oats, wheat, &c., with the hook, 1 dol. 30 cents per acre; putting in sheaves not bound, 32 cents per acre; binding, 16 cents per 100; hand sowing, cereals, 11 cents. per acre; spreading manures or lime, 35 cents per acre; hand-hoeing beetroot four times, per acre, 30 dols. 6c., and so on.—The returns from which we obtain the above are given in sterling money, which we convert into dollars and cents at the rate of 4 dols. 80 cents to the £, which is a fraction below the true value of gold. After allowing for this, however, and for depreciation in currency, it will be seen how vastly the proportion varies in the United States and in Europe, for the cost of labour in farming."

Journal of the Society of Arts.

FRIDAY, AUGUST 26, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

EXAMINATIONS, 1871.

The Programme of Examinations for 1871 is now ready, and may be had, gratis, on application to the Secretary. It differs but slightly from that for the present year.

It will be remembered that, in the Programme for 1870, the Council decided to omit those subjects in which the Science and Art Department holds examinations, and this arrangement still continues.

At the Annual Conference of the representatives of Institutions and Local Boards with the Council, held in June last, various modifications were suggested, some of which have been adopted. It was objected that the subject of Mental Science was added to that of Logic, and the subject of Civil Government to that of Political Economy. This has now been remedied, and papers will be set in Logic and in Political Economy without including the other subjects named. The paper formerly set in "The English Language and Literature," will now be confined to the "English Language" exclusively.

Two new subjects have been added, viz., "French Commercial Correspondence" and "German Commercial Correspondence." The papers set will be intended to test the capacity of candidates to fill the office of foreign correspondent in a house of business, and the certificates will be first-class only. No prizes are offered in these subjects, nor will the certificates be counted for the Prince Consort's Prize.

It having been represented, by various speakers at the Conference, that the recognition by the Society of teachers of classes, who send up successful candidates, would act as an important encouragement to them in their valuable labours, it has been decided to grant certificates to any teachers of classes who may desire to have them, stating the number of their students who may have obtained first-class certificates in the subjects taught by them.

The Final Examinations, in 1871, will be held on the evenings of the 18th, 19th, 20th, and 21st April. These dates have been fixed in order to allow an interval between the Society's Examinations and those of the Science and Art Department. The Time Table has been arranged as follows:—

Tuesday, 18th April, From 7 to 10 p.m.	Wednesday, 19th April, From 7 to 10 p.m.	Thursday, 20th April, From 7 to 10 p.m.	Friday, 21st April, From 7 to 10 p.m.
Arithmetic. Logic. German. Floriculture. Musical Composition. (Tonic Sol-fa.)	Book-keeping. Theory of Music. Domestic Economy. English History. Italian. *Commercial German.*	Metrical System. Mensuration. Political Economy. French. English Language.	Geography. Latin. Spanish. Fruit and Vegetable Culture. *Commercial French.*

Friday, 21st April, 6 to 7 p.m.—Dictation.

Attention may be drawn to the prizes offered by Mr. Henry Cole, a Vice-President of the Society, with the view to encourage an improved style of writing and manuscript printing. The writing is to consist of Roman and Italic letters, from one-eighth to three-fourths of an inch in height, done entirely by the hand, without the use of instruments. Lithographed specimens, for the instruction of candidates, are in preparation, and may be obtained on application.

Special attention may also be drawn to the scheme for holding *vivâ-voce* examinations in Modern Languages, explained in a memorandum kindly furnished by Mr. Hyde Clarke, a member of the Council. It is earnestly hoped that this will be more extensively carried into operation next year.

The Elementary Examinations, held by the District Unions and Local Boards, for which papers are furnished by the Society, are fixed for the 14th, 15th, and 16th March.

Full details in reference to the Examinations are given in the Programme, copies of which should be applied for to the Secretary of the Society of Arts, by all intending to come forward as candidates, or otherwise interested in the Examinations.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The following letter has been addressed, by her Majesty's Commissioners for the Exhibition of 1871, to the honorary secretary of the Royal Institute of British Architects, the Architectural Association, the Architectural Exhibition, and the Architectural Museum:—

(Copy.)

Upper Kensington-gore, London, W.,
August 18th, 1870.

Sir,—I am directed by her Majesty's Commissioners for the Exhibition of 1851, to inform you that, in their

opinion, the great interest at present felt in the question of national education, and the fact that educational works and appliances are intended to form a prominent feature of the approaching International Exhibition of 1871, seem to present a suitable occasion for the formation, at that exhibition, of a large and important collection of models, plans, and elevations of colleges, school buildings, and other edifices designed for educational purposes.

It is, therefore, the intention of her Majesty's Commissioners to request the Committee of Selection for Architecture to assist them in forming such a collection, by devoting their particular attention to the designs, drawings, and models relating to school buildings which may be submitted to them; and her Majesty's Commissioners have determined to place at their disposal on this occasion, in addition to the amount of space which will be regularly set apart for architectural works at these annual exhibitions, a supplementary allotment, to be especially devoted to plans, drawings, and models of school buildings.

Nothing then remains but to secure the co-operation of the architectural profession in this work, and I am, therefore, directed to ask you to have the kindness to make known to the members of your society the views and intentions of her Majesty's Commissioners on this subject.

I have the honour to be, &c.,
(Signed) Henry Y. D. Scott,
Lieut.-Colonel R.E., Secretary.

NATIONAL EDUCATION.

It will be remembered that the Elementary Education Bill received the Royal Assent, and became law, on the 9th instant. No time has been lost by the Education Department in taking steps in accordance with the provisions of the Act, and, on the 16th instant, a circular letter, signed by Sir Francis R. Sandford, the secretary, was addressed to the town clerk of every incorporated borough in England and Wales; and a similar circular is in course of being issued to each of the 14,000 parishes in the country, not included within the metropolitan limits or in municipal towns. This document calls the attention of the council of each borough to sections 67 to 72 of the Act. By them it is enacted that, on or before the 1st January, 1871, the local authorities shall send to the Education Department a return containing such particulars with respect to the elementary schools, and children requiring elementary education, in their district, as the Education Department may require; and for the purpose of obtaining such returns, the Department shall draw up forms, and supply to the local authority such number of forms as may be required; and the managers or principal teacher of every school required to be included in any such return shall fill up the form, and return the same to the local authority within the time specified in that behalf in the form. The returns are to be made in boroughs by the council, and in every parish, not situated in a borough or the metropolis, by persons appointed for the purpose, or by the overseers of the parish. Where a school board is formed under the Act, the returns are to be made by the school board within their district.

The persons appointed for the purpose may be appointed by the vestry, and they will constitute the local authority for the purpose of the returns under the Act.

The local authority may, with the sanction of the Education Department, employ persons to assist in making the returns, and may pay those persons such remuneration as the Treasury may sanction. That remuneration, and all such other reasonable expenses incurred by the local authority in making such returns as the Treasury may sanction, will be paid by the Education Department.

It is also provided that if any local authority fail to make the returns, the Department may appoint any person with full powers to do so; and may also appoint any persons to act as inspectors of returns, to inquire into their accuracy and completeness, and into the efficiency and suitability of any school mentioned in any return, or which ought to have been mentioned therein, and to inspect and examine the scholars in every such school. Where there is no return, the inspector may proceed as if there had been a defective return. If the managers or teacher of any school refuse or neglect to fill up the form required for the said return, or refuse to allow the inspector to inspect the school-house or examine any scholar, or examine the school books and registers or make copies or extracts therefrom, such school will not be taken into consideration among the schools giving efficient elementary education to the district.

The circular letter explains the nature of the required returns as follows:—

"These returns will have to be made on two forms. One of these, a general form, is intended to furnish certain information respecting the area contained within the municipal limits of the borough, which information the Education Department will have to take into consideration in deciding upon the school provision that will be required for the district. A copy of that form is enclosed (form No. 72).

"The other, a special form, will have to be filled up by the managers or teacher of every school, whether public or private, within the same limits, which answers to the definition of an elementary school given in the third section of the Act. That section runs as follows:—'The term "elementary school" means a school or a department of a school at which elementary education is the principal part of the education there given, and does not include any school or department of a school at which the ordinary payments in respect of the instruction, from each scholar, exceed 9d. a week.'

"Some time will, doubtless, be occupied in obtaining all the information required for insertion in the general form. But with the view of having the special form filled up for each school, and returned to you in due time for the completion of the general form, it will be necessary to make immediate arrangements for ascertaining how many of these special forms you will require for elementary schools as above defined.

"This is, therefore, the first point to be attended to; and my Lords earnestly beg that measures may be at once taken for ascertaining the number of elementary schools within the borough.

"Your council will bear in mind that the Education Department, in determining the amount of public school accommodation for any district, are required to take into account not only schools in operation, but also those which, when completed, are likely to be efficient and suitable for the population. The promoters of those schools, therefore, which, though commenced, may not be finished on the day when the general return is sent in, will have to fill up, so far as circumstances permit, the same returns as will be made by the schools actually at work. Your preliminary inquiries must accordingly be extended to all the schools within the borough which, at the date of your return, are either (1) in operation, or (2) in course of being supplied."

The form (No. 72) referred to is as follows:—

"Elementary Education Act, 1870.

"Municipal Borough of

"General Return with respect to the population, rating, and school provision within the municipal limits of the borough.

"N.B. This return is to be strictly confined to the area within the municipal limits of the borough.

"If any parish is divided by these limits, the part without the municipal area will be dealt with separately. This return is to include only the parts of such parishes within that area.

"1. This borough, by the census of 1861, contained inhabitants.

"2. It is estimated that the population now amounts to

"3 The rateable value of the borough is (i) by the last valuation list (dated) £ or, if there is no such list (ii) by the rate-book now in force (dated) £

"4. The number of ratepayers, duly rated under the provisions of the Poor Rate Assessment and Collection Act, 1869, is

"5. The number of elementary schools for which returns are herewith made to the Education Department is—

"(a) In operation

"(b) In course of being supplied

"N.B.—It will be very convenient if you can forward with the return a map of the borough, with the position of these schools marked upon it.

"6. The number of the schools to which forms of return were delivered, but which have omitted or refused to fill them up is

"A list of these schools is filed herewith."

This form is to be signed by the town clerk, and another form is also inclosed, merely for the purpose of furnishing the number of elementary schools within the borough, for which the special form above referred to will be required.

It will thus be seen that an important step has already been taken in furtherance of the provisions of the Act, and that, by the early part of next year, the Education Department will be in possession of all the preliminary information required.

With regard to the school board for the metropolis, the election will probably take place in October; and in reference to the importance of securing really efficient members, the *Daily Telegraph* says:—"The members of the board will be elected in the same way as the members of vestries. Each person thus chosen, however, will represent, not the parish or the district in which he lives, but the division or borough for which he may have been elected. In form, therefore, the contest will be Parliamentary rather than municipal. Consequently, the voters will see the wisdom, or rather the absolute necessity, of choosing candidates who are known beyond the petty boundaries of their own parish. Many a passable member of a vestry would be utterly out of place on the school board. We want men of education, men of broad views, men who can represent in all its phases the great nation of London. We want merchants, for they are at once keenly practical, and contemptuous of huckstering views; we want medical men, for they know the poor, and they keenly feel that poverty is the parent of ignorance, and ignorance of vice; we want clergymen of all denominations, for they, too, know what is meant by poverty, and by the squalor which comes of ignorance; we want thoughtful working men, for they can speak with authority in the name of their class, and fill that class with confidence in the board. The educated minority in each district will be able to elect at least one member, for the Act introduces the system of cumulative voting. If three members are to be elected, each ratepayer will have three votes, one of which he may give to each candidate, or all of which he may give to one. If four representatives have to be chosen, every ratepayer may give two votes to each of the two candidates whom he prefers. The board will probably consist of 30 or 35 members, whose duty it will be to ascertain the places in which schools are needed, and to determine what amount of aid they should obtain out of the education rate. The coming election of the school board will be singularly important for several reasons. It will educate 'the nation of London' into the idea that it may yet become one political entity, with a central government, with united aims, and with a common patriotism. Until that idea be implanted, it will be vain for Mr. Mill or Mr. Bruce to expect that a united government of London will work with the requisite lack of friction. The effects produced by the election of the school board, therefore, will extend far beyond the boundaries of popular education. The election will also afford a standard for the whole country. All the local boards will be more or less influenced by the example of London. They will copy its acts, and be animated by its spirit. Hence it is absolutely essential that able and cultivated men should offer themselves as candidates for election. Such men must push the ignorant, bigoted 'politicians of the parish' out of the field. Nor need they fear that they will lose caste by serving on the school board. The work is indescribably noble, being no less than the civilisation of the generation which is now springing into boyhood and girlhood, and which, recruiting the electoral forces of the future, will produce a corresponding effect on our practical legislation and our national progress."

The Birmingham Town Council have shown much alacrity in this movement, and the Mayor suggested that, in order to avoid delay, the report of Mr. Fitch (already noticed in the *Journal*) should be recommended to the Education Department as the basis of operations. In accordance with this recommendation, he proposed—"That the town-clerk be instructed to apply to the Education Department, on behalf of the council, to cause a school board to be formed for the borough of Birmingham at the earliest possible date." This was carried by 36 to 8.

BIOGRAPHY OF JAMES BARRY, R.A.

As the Society of Arts is the possessor of the great works of the late James Barry, R.A., I have thought that the following biography, published in a Dictionary of Painters, Sculptors, Architects, Engravers, &c., by Gale and Curtis, Paternoster-row, in 1810, might not be uninteresting. It is no doubt true that all that is here written was known to the members of the Society and the public sixty years ago; but, as I am now so frequently asked who was Barry, and am so constantly obliged to assure visitors that he was not the late Sir Charles Barry the architect, I have thought a short account might prove useful, and help to give fresh interest to such of his works as "Adam and Eve," now at the South Kensington Museum on loan from the Society, as well as to his large works now in the Society's House in the Adelphi. I may also state that, during the Exhibition of 1851, when the Society's name had been prominently brought before the public, and it had again become known that the Society was the possessor of Barry's greatest works, a series of copper plates, including etchings of the following subjects, were presented to the Society by Miss Barnett:—"The Temptation of Adam," "Satan and Death," "Satan's Address to the Fallen Angels Whether for War or Peace," "Fall of Satan," "Repose in Egypt," "The Holy Family," "Conversion of Polemon," "Job Reproved by his Friends," "Philoctates in the Island of Lemnos," "Birth of Venus," "Jupiter and Juno," "Group from the Elysium," "Resurrection of Freedom," "Pandora," "Portrait of Barry," "Portrait of W. Pitt."

"James Barry was born at Cork, in Ireland, October 11, 1741, and died in London, 1806, aged 65. This artist was the son of John Barry, a descendant of the same family as the Earls of Barrymore, and a coasting trader between England and Ireland. For this business his father intended him, but after making two or three voyages with disgust, and exhibiting considerable talents in drawing, he was permitted to follow his inclinations, and to receive such education as the schools of Cork afforded. He afterwards received instructions in the school of West, of Dublin, an artist who had studied under Boucher and Vanloo, and was reckoned a very able draughtsman of the human figure. As early as the age of 17, it is supposed he had attempted paintings in oil—at least it was between that age and 22 that he painted that extraordinary picture, founded on the traditions of the first arrival of St. Patrick on the shores of Cashel, who, in bap-

tising the sovereign of that district, had planted the sharp end of his crozier through the foot of the monarch, unperceived by himself, and unnoticed by his convert, who will not suffer the pain to interrupt the ceremony. One of the guards is elevating his battle-axe to revenge the injury, while he is restrained by another, who points to the unchanged aspect and demeanour of the sovereign, whose blood is flowing copiously from the wound. This picture procured him the acquaintance, patronage, and friendship of the patriotic Edmund Burke, with whom he came to England, and was introduced to Mr. Barrett, his countryman, who was then acquiring fame and honour in London. Under the protection and with the assistance of Mr. Burke, Barry went to Italy, in the autumn of 1766, first stopping at Paris, viewing and criticising with great ability the works of Le Suer, Pausin, Raphael, and others, in the Luxembourg and other collections, which patronage he handsomely acknowledges in his 'Account of a series of Pictures in the Great Room of the Society of Arts, Manufactures, and Commerce, at the Adelphi,' published in 1773. During his stay at Paris, he made an excellent copy of Le Suer's admirable picture of 'Alexander Drinking the Potion,' and looking on his physician reading the letter, wherein he is accused of an intention of poisoning his master; which he sent over to Mr. Burke, and which Sir Joshua Reynolds, on seeing, said he did not wish it other than it was, its excellence being so great. In the latter part of the year 1770 he returned to London, visiting Florence, Turin, Bologna, &c. On his way to the latter city, he was made a member of their Academy, and describes, with a painter's pen, the works of art he saw, in a letter to his friends; and, in 1771, exhibited in the Royal Academy, for the first time, a picture of 'Adam and Eve,' which he began at Rome shortly after his arrival, the figures rather smaller than life; and the next year produced his much-admired whole-length picture of 'Venus rising from the Sea.' At the suggestion of Mr. Burke, to show his skill and talent in the beautiful, his next work was an attempt at the grand style, in a picture of 'Jupiter and Juno,' in which he fully succeeded. About this time the death of General Wolfe becoming a popular subject, it was represented by Messrs. West, Penny, Romney, Mortimer, and others, and, in 1776, he also exhibited a picture from this melancholy though glorious national subject. This picture was not favourably received, for, probably to demonstrate his knowledge of the human form, he represented the human figures as nudities; and never afterwards exhibited with the Academy. Fresh, ardent, and undismayed in the cause of the art, he projected that patriotic and memorable scheme, in which he was warmly and cordially seconded by Sir Joshua Reynolds, Angelica Kauffman, Nathaniel Dance, and Mr. West, of painting a set of pictures gratuitously for the decoration of St. Paul's Cathedral, and thereby place the arts on a higher footing than they had ever been before in England. But, strange to relate, Dr. Terrick (a name that will be immortal as that of Erostatus, and for a similar reason) rejected this offer, and thus rendered one of the most liberal and patriotic schemes ever made in any country abortive. The subjects chosen were:—Barry, 'The Jews Rejecting Christ;' Reynolds, 'The Virgin and Child;' Dance, 'The Raising of Lazarus;' West, 'Christ Raising the Young Man from the Dead.' The two others are not known. This led, in 1774, the Society of Arts, &c., to make a proposal to the Academy, that a certain number of them (Sir Joshua Reynolds, Angelica Kauffman, Messrs. Barry, West, Cipriani, N. Dance, Mortimer, Wright, Romney, and Penny) should paint a suite of pictures to decorate their new room in John-street, Adelphi, proposing that, when the pictures were finished, a public exhibition should be made, the profits of which should remunerate the artists who painted the pictures: but this not being approved of (probably because they felt the difference between presenting a series of works to the country in a public building, being the property of the public, and giving away, for a begging and uncertain remuneration, a similar suite to a private society), they declined the proposal, which much mortified the mind of Barry, who burned to exhibit himself before the public, whose taste and genius he had defended by his pen in a large and grand work of his pencil. Barry possessed an ardent, an inquiring, a philosophical, and a patriotic mind, and was disgusted at the false philosophy and partial criticism of the Abbé Winckelman's endeavours to prove that the English are incapable of attaining any great excellence in art, both from their natural deficiencies in genius, as also from the unfavourable temperature of their native climate; he therefore took up the pen in defence of his country; and in his 'Enquiry into the Real and Imaginary Obstruction to the Acquisition of Arts in England, by James Barry, Royal Academician, and Member of the Clementine Academy at Bologna. London, T. Becket, 1775,' as well as by the exertion of his pencil, he combated with vigour and success the Abbé's futile remarks. In about three years after this unsuccessful proposal, Barry offered the Society, through the means of Mr. Valentine Green, the celebrated mezzotinto scraper, and keeper of the British Institution, to paint a series of pictures for their Great Room, on condition that the Society provided him with canvas, colours, and models proper to carry it into execution. This liberal and disinterested offer (for it should be considered that Barry was too poor to buy even those trivial appendages to the work, although his Creator had blessed him with the mind, the hand, and the enthusiasm of a painter) the Society accepted. He therefore began the work, and, unassisted, he alone finished the whole, nearly as they now stand, in about three years. At the completion of this noble work, an extraordinary meeting of the Society was held, to view the pictures, and they published in the newspapers their resolutions:—'That the series of pictures, illustrating in their design the progress of human knowledge, and the advancement of useful and elegant arts, from a very early period to the present, is a work of great execution and classical information, and must be deemed a national ornament as well as a monument of the talents and ingenuity of the artist.' The Society, therefore, desirous of giving the most ample testimony of his abilities, unanimously voted him their thanks, and permitted the pictures to be publicly exhibited for his benefit, by which he obtained the sum of £503 2s. . . . . Dr. Johnson also observes, 'There is a grasp of mind there you will find nowhere else.' During the time of this exhibition, he published an account of the pictures, in an octavo pamphlet, which was sold in the room, and of which a number of them, bound, now lay for reference on the tables; the title is, 'An Account of a Series of Pictures in the Great Room of the Society of Arts, Manufactures, and Commerce, at the Adelphi, by James Barry, R.A., Professor of Painting to the Royal Academy. London: Cadell, I. Walter. 1783.' At the same time he offered proposals for engraving and publishing, by subscription, a set of prints from these pictures, and, in his usual independent method, he boldly undertook and completed the work without any assistance, even to the writing and printing on copper, and finished them about the year 1793. The print of 'Elysium' somewhat differs from the picture, which he explained in his letter to the Society of Arts, &c., in the Adelphi. During the period in which he was engaged in this great work, Mr. Penny, then Professor of Painting in the Royal Academy, resigned his chair, and Barry, who was made Academician in 1777, was elected to the situation in 1782, and in the intermediate time painted two pictures for Boydell's Shakespere Gallery, but the length of time he took in preparing his lectures, the first being given in 1784, occasioned a dispute between him and Sir Joshua Reynolds, which afterwards, with other causes, as disputes with members, a natural turbulent disposition, and intemperance in his language, particularly in his lectures, led to his removal from the office of Professor of Painting, and his expulsion from the Academy, which was communicated to him in a letter, dated April 24th, 1799. A short time before this event, he published a letter to the Dilletanté Society, on improvement of taste, and for accomplishing the original views of the Royal Academy of Great Britain; and a little while after produced a second edition, with an appendix relative to that unpleasant event. His next and last literary work was a letter and petition, addressed to his Majesty, and published in the *Morning Herald*, December 3rd, 1799. In 1805, some friends of Barry, particularly the generous Earl of Buchan, supposing his circumstances uneasy, procured a subscription in the Society of Arts, for an annuity for his life, which was quickly raised, but he did not live to receive even the first payment of it. The last illness of this great artist was short; he was taken ill at a tavern where he usually dined, and was removed to the house of Mr. Bonomi, the architect, where he languished fifteen days, and expired on the 22nd of February, 1806. After his death, the body was laid in state in the Great Room at the Adelphi, which is surrounded by his grand series of pictures; and it may be truly applied to him, as to another great and neglected man (Sir Christopher Wren), '*Si monumentum requiris circumspice.*' His remains were interred in a vault in the substructure of St. Paul's Cathedral, near those of

Sir Christopher Wren and Sir Joshua Reynolds, covered with a flat stone, with the following inscription:—

The Great Historical Painter,
James Barry,
Died 22nd February, 1806,
Aged 65.

The funeral was attended from the Society's rooms to the Cathedral by the following gentlemen:—Dr. Fryer and Dr. Coombe, chief mourners; Sir Robert Peel, Bart; Richard Clark, Esq., Chamberlain of London, and one of the Vice-Presidents of the Society; General Watson; Caleb Whiteford, Esq.; Dr. Porvel, also a Vice-President; and Dr. Taylor, Secretary to the Society, as pall-bearers.

"The principal works of this great artist, in addition to the before-mentioned literary productions, are an edition of 'Pilkington's Dictionary of Painters.' His great pictures are in the Great Room at the Adelphi, which he terms a series of pictures on the human culture; the first of which is 'The Story of Orpheus;' the second, 'A Harvest Home, or Thanksgiving to Ceres and Bacchus;' the third, 'The Victors at Olympia;' the fourth, 'Navigation, or the Triumph of the Thames;' the fifth, 'The Distribution of Premiums in the Society of Arts;' and the sixth, 'The Elysium, or the State of Final Retribution,' making three of the subjects poetical, the others historical. 'The Elysium' and 'Victors at Olympia' are 42 ft. in length; the other four 15 ft. 6 in. long, and their heights equal—11 ft. 6 in. These pictures are best illustrated in the author's own words, in a descriptive pamphlet published by him, to which the reader is referred,* and to a view of them, without which it is impossible to conceive their grandeur of conception. His other best works are 'Job Reproved by his Friends,' engraved by himself, and dedicated to Mr. Burke; 'The Conversion of Palemon,' dedicated to Mr. Fox; an engraving from the 'Jonah' of Michael Angelo, dedicated to the late Duke of Bridgewater; 'King Lear,' for the Shakespeare Gallery; 'George III. delivering the Patent to the Judges of their office for life,' and 'The Queen and Princesses patronising Education at Windsor,' both intended as additional paintings in the Great Room of the Society of Arts, &c. 'Philoctetes in the Isle of Lemnos,' engraved by himself, and another plate by Rasaspina, from his picture executed at Bologna in 1770, and presented to the Clementine Academy in that city, for the honour of electing him a member; the 'Birth of Venus,' the 'Head of the late Earl of Chatham,' 'Jupiter and Juno,' from his own paintings; 'Rise of America and Decline of Europe,' etched by himself; the 'Archangel triumphing over Satan;' 'Satan rising from the fiery gulph, and hurling defiance at the vault of Heaven;' 'Battle of Satan and Death, Sin interfering;' 'Temptation of Adam,' 'Adam and Eve after the Fall,' 'Milton dictating to Elwood the Quaker,' and many small prints from the old masters; heads, &c., besides his series of characteristic engravings from his great works at the Society of Arts, before mentioned. His 'Jupiter and Juno' have been engraved by R. Smith, and his 'Venus' by Valentine Green.

"We cannot close our account of this most excellent artist, without presenting our readers with the following extract from one of his letters, to his admirable friends, the Burkes; it is so strongly characteristic of his lofty mind, that it should be read and remembered by all who would reach a high degree of perfection of art:—

"*From Rome, in* 1769 *or* 1770.

"'Oh! I could be happy, on my going home, to find some corner where I could sit down in the midst of my studies, books, and casts after the antique, to paint this work ("The Pandora") and others, where I might have models of nature when necessary, bread and soup, and a coat to cover me. I should not care what became of my work when it was done; but I reflect with horror upon such a fellow as I am, and with such a kind of art, in London, with house-rent to pay, duns to follow me, and employers to look for. Had I studied art in another manner"—meaning more accommodated to the low state of taste then in England—"there would be no dread of this; but Hussey's fate is before me.'"—*Life of Barry* (London: Cadell and Davis, 1809); *Edwards' British Public Characters*, vol. 4; and *European Magazine*.

S. T. Davenport.

* Re-published in the *Journal of the Society of Arts*, vol. xvi., page 604.

PROPOSED LAW RESPECTING SUPERIOR EDUCATION IN FRANCE.

The draft of an important Bill was laid before the Senate the other day, by the Imperial Government. This proposed law, to quote the expressions of the document, "establishes the principle of liberty in superior education; liberty as regards persons, subjects, and methods of instruction; liberty of examination, as regards diplomas, and, consequently, for the particular professions in the name of which the law at present demands guarantees, as, previous to 1789, it demanded the *chef-d'œuvre* of each member of an individual corporation."

It will be seen that the principle here named is entirely opposed to the system at present existing in France, where everything respecting professors, subjects and modes of instruction, examinations, diplomas, and professional degrees and licenses, is absolutely fixed and regulated down to the smallest detail, even to the hours of the day at which certain courses of instruction are to be given.

The next clause in the draft proposition explains the part reserved by the government:—

"But the State has also a right to enjoy the same liberty as is granted to individuals and associations. After having proclaimed tho principle that every person has the right to establish, according to his own ideas, schools of superior education, the State which cannot renounce its own is bound not to multiply them in order to create a check on liberty, but to strengthen them, and aid liberty itself, by showing to what level superior studies may and should be raised. Now, the best mode of giving the greatest scientific value to the schools of the State is to increase their means of action, and to excite the fruitful activity of their members by independence, which adds to the sentiment of dignity and duty, and by voluntary union, which increases power."

The proposed Bill does not touch the theological faculties, which are separated from general education, and placed under the *Ministre des Cultes*:—

"It creates faculties of economic and administrative science, such as Germany has possessed for a long time, which the interests of France demand, which men of the highest authority advocate, and a plan for which Cuvier drew up more than half a century since.

"It recognises the faculties and the schools of medicine, reforms demanded ever since 1811, and three times attempted to be carried out by deliberative assemblies.

"It gives fresh guarantees to the professors, by the composition of prizes for the competition, by the mode of nomination, and by such difficulties being placed in the way of removal or replacement that they amount to a declarative immovability.

"The liberty which a former project gave with regard to the University, this new one places in the bosom of faculties themselves, in order to create here also a more active emulation.

"After having endowed the faculties with self-government, the Bill makes them civil parties, and endows them with means which, independent of the State budget and self-renewing, will enable the faculties to follow all the progress of science, and to minister to all the wants of education.

"It forms, by means of a freely-elected council, these independent faculties into an academic body, which will represent our ancient provincial universities, and thus become a civil body.

"It fixes a limit of age for the laborious functions of the professional chair (with certain exceptions).

"In order to give the life which is wanting in what are called preparatory schools, and to transfer to them some of the pupils which crowd the great faculties uselessly or mischievously, it reconstructs the public schools of superior education founded by communes or departments, and, in assuring their rights, furnishes them with the means of proving that they are worthy of them.

"In order to stop the daily diminution in the number of our medical men, the Bill gives important advantages to students without fortune, who will undertake to establish themselves for ten years in one of the thirty thousand rural communes, where there is no resident medical man.*

"Finally, according to the practice in the middle ages, and that of foreign countries, the Bill continues, in the superior schools, the assistance given to secondary education to the sons of those who have deserved well of the State. At the lycées, the children receive the benefit without having earned it for themselves, and before it is possible to know whether their dispositions will render it useful or injurious; but, in the faculties, scholarships may be awarded with confidence, because it will be easy to see that the recipient is worthy, by his conduct and capacity, for the higher speculations of the mind.†

"Centralisation has done much for the brilliancy of our superior education; but the vitality which is superabundant in certain directions is wanting in others; let us see, by introducing liberty into it, as our neighbours, whose scientific rivalry becomes threatening, have done, whether we cannot re-animate the living forces which the administration protect, but from which it sometimes takes away the elasticity."

The Bill itself, of which the preceding is the preamble, containing forty clauses, and the following are the points which they present of general interest:—

Art. 1. Superior public instruction is given:—1. In the faculties maintained by the State; and secondly, in the public schools of superior education maintained by communes or departments.

Art. 2. There are four orders of faculties, namely—Letters; mathematical, physical, and natural sciences; law, and the economic and administrative sciences; medicine and pharmacy.

Art. 3. The faculties confer, after public examination, the degrees of "bachelor," "licentiate," and "doctor." Juries appointed by the minister, and composed of professors of all the faculties, grant, as at present, what are called "special" degrees of "bachelor" and "licentiate."

Art. 4. These degrees are granted alike to all students, whether inscribed in the faculties or not.

Art. 5. The degree of "bachelor" is required of all who desire to be employed in classical education, or in the special teaching of the lycées and colleges; the degree of "licentiate" is necessary for the humanity classes and the superior courses of special education in the lycées; and that of "doctor" for appointment in the faculties and public schools of superior education. The grade of "licentiate in law" is required for admission to the magistracy; and that of medicine or pharmacy for medical employment under the State.

Art. 8. The faculties are composed of titular professors, and *agrégés* or substitutes.

Art. 9. Professors must be natives of France, full thirty years of age, and of the degree of "doctors," and are nominated by the Emperor from a list of three candidates elected, by ballot, by the professors.

Art. 10. No professor can be removed from his chair except by the decision of a commission of five members of the Imperial Council, and on the advice of the Committe of General Inspectors of the faculty.

Art. 12. The *agrégés*, or fellows, are elected, after competitive examination; and tho judges, two-thirds of whom must belong to the faculty in which the vacancy occurs, are elected by their colleagues; the remaining third to be elected by the Academies of Inscription and of Sciences, the Court of Cassation, and tho Council of State, according to the faculty.

Art. 13. The candidates for tho title of *agrégé* must be natives of France, not less than twenty-five years of age, and doctors.

Art. 15. Every professor, or *agrégé*, is at liberty to open a course of lectures within the faculty, and to receive the fees.

Art. 16. The Minister of Public Instruction may authorise other doctors also to establish such courses.

Art. 18. Inscription of students on the list of the faculties is maintained, but the State abandons all fees, which are divided into two parts, by a vote of the Imperial Council; one of these parts goes to the professors, in proportion to the number of pupils inscribed for their course, and the other to the funds of the university, for the creation of scholarships, &c.

Art. 19. The dean of each faculty is elected from amongst the professors, by the votes of themselves and the fellows, and for the term of three years only.

Art. 20. A general council, elected for three years, consists of the deans and one professor from each faculty; it has the administration of the funds and all matters relating to the superior academic establishments in general.

The second chapter of the bill is specially devoted to the faculties of economic and administrative sciences:—

Art. 22. Faculties of economic and administrative science are founded within the faculties of law of Paris and Toulouse.

Art. 23. The instruction comprises the Code Napoleon, criminal law, and civil procedure, studied with regard to the economic interests of society and individuals; public law, the law of nations, commercial, industrial, and rural law, administrative law and judicial organisation, political economy, and the history of economic facts and doctrines.

Art. 24. Candidates for admission must have obtained the diploma of bachelor of letters or sciences; and students in law are also free to this faculty.

The third chapter deals particularly with the faculties of medicine and pharmacy.

Art. 25. The medical education is theoretical and practical.

It comprises, for the preparation for the grade of licentiate or doctor, normal and pathological anatomy, physiology, internal pathology and therapeutics, external pathology and operations, obstetrics, clinical medicine and surgery, pharmacology, medical applications of chemistry, physics, and natural history.

Art. 26. For the degree of doctor of medical sciences is added — Special pathologies, the public hygiene, forensic medicine, and medical history.

The students study dissection, manipulations, and analyses, under the professors or *agrégés*.

Art. 27. The pharmaceutical education comprehends physics, chemistry, botany, zoology, pharmacy, toxicology, the natural history of drugs; with manipulations, practical lessons, and herborisations, under the direction of the professors.

Art. 28. The degrees are of two grades:—

1. Licentiate in medicine and in pharmacy, or doctor and pharmacien.

2. Doctor in medical and pharmaceutical sciences.

Art. 29. Candidates for the degree of licentiate must have previously obtained the degree of bachelor of letters or of science, and have to undergo—

1. A first examination in the physical, chemical, and natural sciences applied to medicine.

2. Three other examinations on the subjects named in Art. 25, to be hereafter determined by the Imperial Council, and, finally, a clinical examination.

3. Hospital or pharmaceutical studies for the period of three years, dating from the first examination, and consisting of assiduous and registered attendance in an hospital, or in a laboratory under a licentiate.

Art. 30. Candidates for the degree of doctor in medical sciences must have previously obtained the degrees both of bachelor in letters and sciences, or of the degree of special bachelor, named above; the degree of bachelor

* The number of doctors and *officiers de sante* fell from 18,099, or 1 for 1,956 souls, in 1847, to 17,080, or 1 for 2,228 inhabitants, in 1866.

† A law of 1802 created 6,400 bursarships maintained by the State; four-fifths in the lycées, and one-fifth in the superior schools.

in letters is not required of those who seek the degree of doctor in pharmaceutical science. The candidates undergo three examinations on the subjects named in Articles 25 and 26, and write a thesis.

Art. 31. If the pupils, after seven years' study, have not obtained the degree of licentiate or doctor, their names are struck off the lists of the faculty; an exception is, however, made in the case of *internes*, dressers in the hospitals, pupils in lunatic asylums, and anatomical preparators and assistants.

Art. 32. Candidates for the degree of licentiate or doctor, who engage before the rector to exercise their art in any of the districts of medical assistance, where there is no practitioner, are relieved from all fees of inscription, examination, and diploma, and they may, moreover, obtain through the Minister of Public Instruction an annual allowance during the time of their studies.

Art. 33. Before entering on the practice of their profession, all who have obtained their degree must register their diplomas, either at the Academy or at the civil tribunal of their district.

Art. 34. The medical and pharmaceutical are declared not incompatible with each other.

Chapter 4 deals with the public schools of superior education.

Art. 35. The public schools which now exist, or may hereafter be founded by communes or departments for special superior education, law, economic science, medicine, and pharmacy, prepare pupils for the grade of licentiate, whether educated in private or public schools.

Art. 36. The professors and assistant professors in the public schools of medicine and pharmacy are named in the same manner, and on the same conditions as those of the faculties, with the single difference that the jury for the competitive examination of assistant professors is formed, two-thirds of professors of the said schools, and one-third of licentiates and doctors attached to the schools.

As regards schools of law or economic science, which any towns may desire to establish, the Minister will make the nominations, so long as there are no more than three such schools, after which the existing system of presentation will come into operation.

The regulations respecting professors in the faculties, given above, apply also to the public schools of superior instruction.

Art. 38. These schools deliver the diploma of licentiate, but the recipient must pass the final examination in one of the faculties. In the case of a medical degree the examination is clinical.

Art. 39. All laws inconsistent with the present are abrogated.

Art. 40. A commission of the Imperial Council will be charged with the revision of the statutes and regulations of the University.

The prorogation of the Senate and Corps Legislatif has deferred the consideration of this Bill until the next session; but it is evident that the subject has been thoroughly examined, and it may be fairly assumed that the bill in question shadows forth the reforms which are about to be made in France, in the all-important subject of superior education and professional degrees.

WASTE LABOUR TO WASTE LAND.

The fourth report of the Committee of the Industrial Employment Association lays before the public at considerable length, the position of the labour question, the food question, the pauper question, the emigration question, and, lastly, the universality of the demand, the wide world over, for what this association proposes to make from the "waste material," the surplus and unemployed stock of unproductive working men—agricultural labourers.

The past winter showed the distress and suffering of immense masses of the people, increasing visibly and daily. Deaths from starvation were reported daily in the journals, and the most piteous details were given of the misery which pervaded thousands of families, formerly fed and in the possession of humble sufficiency for the first wants of nature. The report then shows the failure of the proposed remedy of extensive emigration; indeed, not only is the utter inadequacy of the remedy shown, but experience has proved the indifference both of the public and the suffering classes, to extend, by subscriptions on the one hand, or by voluntary exile on the other, the well-intentioned scheme. Clerks, shopmen, and even skilled mechanics have no demand in most parts of the New World, or in most of our own colonies. Twenty thousand persons are out of work in Chicago, the great provision emporium, alone, and the same discouraging state of things is to be found in the Canadian Dominion and in Australia. The following are a few leading statistical facts compiled from blue-books, Parliamentary and official documents, and the most reliable sources:—

There are 34,918 families with four persons in each family; 27,519 families with five persons in each family; 19,503 families with six persons in each family; 12,136 families with seven persons in each family; and 6,212 families with eight persons in each family, having only one living-room for each family.

The number of stray or neglected children in London is upwards of one hundred thousand.

The number of paupers in England and Wales is above one million; 331,235 of these paupers are children under sixteen years of age.

Three hundred thousand of these children are so neglected that they have no means of getting a living beyond the chances of a street life, and, as a consequence, these wretched children recruit the armies of crime and villany.

It is estimated that there are about one million able-bodied men out of work.

There are 31,861,040 acres of uncultivated land in the United Kingdom.

At least ten millions of these acres are capable of cultivation, and could be made to produce food worth £10 per acre per annum, on an increase of food worth one hundred millions sterling per annum.

The cultivation of this waste land would afford temporary employment for men out of work, and permanent employment for all the pauper and criminal classes.

It would not then be necessary to expend forty-four millions sterling per annum on food imported from foreign countries for home consumption.

Neither would it be necessary to expend eighteen millions sterling annually on account of want and criminality.

Mr. Gladstone stated, at a meeting at the Mansion-house on Tuesday, July the 12th, that the annual increase in the wealth of the country amounts to one hundred millions a year, of which twenty millions are made in the city of London alone.

TECHNICAL INSTRUCTION IN AGRICULTURE IN FRANCE.

From the report presented to the French Legislature by M. Michaud, and reprinted by command of her Majesty, we obtain some useful information respecting the state of technical education in France. The principle is universally admitted and acted upon, that intellectual and material progress are intimately connected with each other; and, more perhaps than any other nation in the world, the French bring the higher artistic qualities of the mind to bear upon all their industrial pursuits. We select those portions of the report which especially appertain to the branch of agriculture. The government appears everywhere to be multiplying its efforts for the extension of education, and it is now proposed to continue and impart a fresh stimulus to the work. In this respect none has laboured more zealously than the second

empire for the improvement of the social condition of the masses.

Technical education, M. Michaud observes, must be of an essentially professional character, and it should always combine practice with theory—it has for its object the practice of the useful arts, and the application of scientific and artistic knowledge to the various branches of agriculture, manufacture, and commerce; to teach the young workman how to make the best use of his raw materials—how to profit by all the improvements discovered by science. It begins where primary education ends. Twelve is the usual age at which children enter the workshop or the farm, and commence the apprenticeship to the trade which will enable them to earn a living. By that age, the children will know how to read and write, and will be sufficiently versed in arithmetic to perform the calculations indispensable for the ordinary purposes of life. The Minister of Agriculture and of Public Instruction, by their joint action, cannot fail to produce satisfactory results. By their means the schools, properly so called, may be combined with practice in the workshop or in the field; measures have already been taken to teach the elements of agriculture and horticulture in the rural and primary schools. There are public courses of agriculture in a certain number of towns, as at Amiens, Beauvais, Besançon, Bordeaux, Nantes, Quimpre, Rouen, Rodez, and Toulouse. In some cases the expense is borne by the towns, in others the professors are paid by the State. The government supports the well-known schools of agriculture at Grignon (Seine-et-Oise), Grand Jouan (Loire-Inferieure), and at La Saulsaie (Diu). The breeding studs have a complete administration. The Imperial sheep farms and dairies are establishments actively engaged in technical education. More than fifty farm-schools are in operation in different parts of France. Agriculture has even what may be called faculties of medicine—the three great veterinary schools of Alfort, Lyons, and Toulouse.

The imperial schools of agriculture are placed under the authority of the Minister of Commerce and Agriculture. They receive boarders, externs, and free pupils. The candidates for admission must be eighteen years of age; Frenchmen by birth, or naturalised; and if they do not hold the diploma of bachelor of science, they must undergo an examination. The studies, practical and theoretical, extend over two years, and comprise a course of chemistry, engineering, sylviculture, viticulture, horticulture, and agricultural book-keeping. The practical includes the use of all tools, implements, and machinery; the planning and execution of all farming operations; practice in linear drawings, and surveying; manipulations in the laboratory, analysis of soils and manures. The terms for boarders are 750 francs a-year; for externs and for free pupils, 250 francs. These last undergo no examination, and are admitted only by a special permission of the Minister. Foreigners are also permitted by permission of the Minister. All the pupils who pass satisfactory examinations at the close of their studies receive a diploma; and, to the first two on the list, gold or silver medals are awarded.

The Minister of Agriculture has the right to aid in the encouragement of any schools, conceived by local patriotism, that are in danger of being arrested in their usefulness for the want of the resources, which are supplied to him for that purpose in his budget. Individual enterprise, free from all State control, has already obtained very remarkable results. For instance, there is the Normal Agricultural Institute, founded by the Christian Brothers, at Beauvais, with the support of the principal inhabitants of Oise, and now in a flourishing state. The agricultural instruction given in this establishment diffuses throughout the whole district a knowledge of new methods and of the latest improvements. In France, we learn that technical instruction applied to agriculture has at all times occupied the attention of good citizens and local authorities. Many institutions have been founded with a view to promote the progress of this industry, the oldest of all, the profession *par excellence*; and no one will dispute the importance of thus diffusing sound knowledge upon agriculture and horticulture. This instruction already exists, and there is only need to encourage and develop it.—*Mark Lane Express.*

IMPORT AND EXPORT OF AGRICULTURAL COMMODITIES.

The Board of Trade returns for the first half of this year have recently been issued. These statistics show that there was a great decrease in the supplies of cattle and sheep in the six months, as compared with the corresponding period in 1869. The total quantity of oxen received was 58,972 in the half-year 1870, as against 99,486 last, or a diminution of about 40 per cent.. Of sheep we had, up to the end of June this year, 327,678, as against 412,316 in the corresponding period of 1869. Lambs were in less demand, 9,822 to compare with 11,567 in the like term of the previous year. Swine and hogs were received in larger numbers, 41,089, in comparison with 23,637. The imports of all kinds of grain were much in excess of the half-year's receipts in 1869. Of wheat alone we had 13,843,124 cwts., as against 12,194,021 cwts. The following table shows that our chief supplies were derived from the United States, Russia, and Prussia:—

Wheat:—	June, 1869. Cwts.		June, 1870. Cwts.
Russia	3,316,375	..	4,563,334
Denmark	201,479	..	221,187
Prussia	2,104,509	..	1,215,653
Schleswig, Holstein, Lauenburg	27,609	..	10,511
Mecklenburg	323,492	..	313,567
Hanse Towns	301,679	..	152,196
France	155,200	..	17,377
Illyria, Croatia, Dalmatia	496,494	..	42,327
Turkey, Wallachia, Moldavia	768,763	..	220,032
Egypt	353,107	..	95,550
United States	3,657,308	..	6,081,277
Chili	193,385	..	187,020
British N. America	105,227	..	580,655
Other countries	189,394	..	142,438
Total	12,194,021		13,843,124
Barley	4,686,894	..	3,824,222
Oats	2,368,099	..	4,467,633
Peas	372,233	..	879,425
Beans	961,066	..	768,002
Indian Corn, Maize	6,618,574	..	6,498,538
Wheat Meal and Flour	1,817,580	..	2,476,192

The imports of butter were less in quantity than during the first half of the year 1869, but there was an augmentation in the receipts of cheese. The number of eggs sent from abroad was fewer by about 2,000,000 than in the corresponding term of 1869; the precise numbers were, for last half-year, 252,504,120, and for this half-year, ending June, 249,017,280. There was comparatively little alteration in the imports of fresh or slightly salted meat, and a decrease in bacon, and hams, and salted beef. In pork there was a slight increase, and also in meat not specially described before. The exact quantities of bacon and hams, beef, and of pork, were, for the half-year for which the returns are made up—bacon and hams, 361,259 cwts.; beef, 98,648; pork, 102,187 cwts. There was a great decrease in the supplies of potatoes from foreign countries, our own yield last year having turned out well. The quantities received were, in the first half-year of 1870, 435,998 cwts., in comparison with 826,327 in the first six months of the preceding year.

The imports of guano, during the six months ended

June 30th, were nearly treble the quantity received up to the same date of the year 1869, 118,598 tons, as against 43,499 during the first half of the year 1869. Bones were also imported in slightly increased quantities, 35,953 tons to compare with 33,950.

With regard to feeding stuffs, there was a decrease in the import of oil-seeds to the extent of about 11,000 tons, the quantities being respectively, this year, so far as the returns are made up and published, 63,735 and 74,948 tons. In cotton seed there has been an increase of nearly 8,000 tons, 79,179 tons being received against 71,187 tons. The imports of rape more than doubled in the six months, the quantity reaching us this year being 124,122 qrs. In flax-seed and linseed there was a considerable diminution in the receipts, to the extent of upwards of 80,000 qrs.

In clover seed also the decline was very marked, the supplies only reaching 117,578 cwts., to compare with 156,327 cwts. in the first half of 1869. There was a large increase in the supply of tallow, the total quantity received being 574,928 cwts.

The total quantity of flax, &c., received in the half-year was 905,097 cwts., more than half of which came from Russia; the two other countries standing next to Russia as exporters being Holland and Belgium. The excess in imports over those of the first half of the previous year is about 19,000 cwts. There is a decrease in the receipts of hemp to the extent of nearly 10,000 cwts.

We received 26,000,000 lbs. more of wool up to the end of June this year than we did in the like period of 1869, the excess coming nearly all from Australia. The following table shows the exact figures, and the sources whence our supplies are derived:—

	lbs.	lbs.
From Europe	7,984,679 ..	6,547,523
British Possessions in South Africa	14,931,178 ..	15,367,167
British India	6,495,905 ..	4,021,284
Australia	105,772,827 ..	136,475,703
Other countries	8,990,144 ..	7,901,572
Total	144,174,733	170,303,249

There was a small supply of imported bacon and hams exported from this country again; 359,708 cwts. of wheat, 29,851 of wheat-meal and flour, 2,230 tons of guano, and 50,943,703 lbs. of wool, or almost one-third of the whole of the quantity we received.

The value of the exports of British and Irish agricultural produce was as follows:—Bacon and hams, £51,731; beef and pork, £10,852; beer and ale, £1,110,603; butter, £137,664; cheese, £50,895; all of which sums are slightly in advance of those received for the same products in the corresponding period of 1869. The export of horses has fallen off nearly one-half in number, and proportionately so in value, the numbers sent away having been, up to the end of June, 829, and the value £45,620. It is certain that the returns of July and August, however, will show a large increase in horses. There was a decrease in the value of wool exported of nearly £60,000, the sums realised in last half-year being £249,875; in the corresponding period of 1869, £307,968.

THE PRESERVATION OF GRAIN.

The following is a translation from the *Echo Agricole*. It is taken from a volume on the "Preservation of Cereals," prepared by Dr. Louvel, at the instigation of the Society of French Agriculturists:—

The preservation of wheat in pits, still practised in the present day, goes back to a very high antiquity; and Dr. Louvel has written at great length on the process. He has brought forward a work of Doyere, who, it is well known, has suggested a rational system of pitting grain; and after having done full justice to all his predecessors, he compels his readers to acknowledge the insufficiency of these processes, and the necessity of doing better than they. Thanks to the application of the vacuum, he has solved this problem in the most satisfactory manner, and he may say with Archimedes, "I have found it!"

A sheet-iron cistern, occupying little space, and which will contain 100 hectolitres (upwards of 275 bushels), an air-pump that may be worked either by hand or steam, and a manometer (pressure guage), to indicate the degree of vacuum, comprise the whole apparatus of preservation of Dr. Louvel, and of which he has made proofs. Our chief editor, M. Victor Borie, has already, some years since, given an account of some very curious and conclusive experiments which had been made at Vincennes, and at which he was present as a member of the Committee of Examination, in company with Messrs. Boussingault, of the Institute; Senard, physician-in-chief of the marine; Tisserand, chief of the division of the crown establishments; Doisneau, former syndic of the Paris bakery; and Lecouteux, member of the Imperial and Central Agricultural Society, and now chief editor of the *Journal of Practical Agriculture*.

After a detention of seven months, the wheat, the flour, and the biscuit enclosed in the apparatus of M. Louvel were withdrawn in a state of perfect preservation. Bread has been made of that flour, and, having eaten of it, we can affirm that it was excellent; the cost price per year and per hectolitre, including interest on the apparatus and hand labour, was less than one franc (or £4 per 100 hect.); and it is certain that it will be still lower when the system is fully developed, and the manufacturer can purchase his materials at a better market.

The question is therefore settled. The following is the opinion of a competent judge amongst us, M. Touaillon, who thus expresses himself in the book that he has published after the Exhibition of 1867:—

"Dr. Louvel has invented a means of preservation (of grain) which completes that of M. Doyere, and has none of the inconveniences that I have pointed out. His apparatus consists of a sheet-iron cylinder, supported by a tripod, either wrought or cast-iron, or wood, painted or tarred. When the cylinder has received its charge (of wheat, flour, &c), the vacuum is made, not complete, which would be useless, but by a rarefaction of the air to a sufficient degree, indicated by the manometer fixed to the air-pump. Thus, the cylinders of M. Louvel are also as impermeable as the pits of M. Doyere, require no masonry, can be placed anywhere, the wheat, &c., is safe from fermentation, insects, and cryptogamic vegetations. One very important effect, and which results from the numerous and continuous experiments made, as well by the honourable inventor as by a committee appointed by the minister of the Emperor's house, is that the vacuum not only kills the parasitic insects and prevents fermentation, but it dries the grain at the same time.

"The hermetic apparatus of M. Louvel is calculated to render great services to agriculture, to commerce, domestic and foreign, to the departments of civil and military depôts of provisions, to all consumers, in short, since they allow of laying in a stock at any time, and of establishing at little expense store room in the open air to any extent, and without the erection of any building.

"M. Louvel has proved the price of preservation by his system will cost only from 70 to 90 cents., or 6¾d. to 8¾d. per hectolitre per year, according to the capacity of the cylinder, a very trifling cost compared with that of an ordinary granary room, which costs, independent of the shovelling, turning over, sacks, &c., more than two francs per hectolitre per year.

"I shall not again enter upon the question of large reserves and general depôts with warrants, which would only be possible upon Dr. Louvel's system; but I am convinced that the farmers ought to adopt it, if they wish to preserve their crops from the numerous causes of damage and destruction, and thus have a security which would allow them to borrow on their reserves."

We have nothing to add to this estimation, which is complete; and is, we repeat, that of a disinterested and particularly competent man.

THE ANGORA GOAT.

The *North British Agriculturist* says:—

We have a large extent of country suitable for the rearing of this valuable animal, and fit for nought else. The Angora goat is rearing in large flocks in the United States and California. We extract from the report of the Department of Agriculture of the United States the following description, which may prove interesting to those who may wish to devote their attention to the introduction of the animal.

The Angora goat, so called from a province of Natolia, or Anatolia, the ancient Cappadocia, in Asia Minor, and the principal place where the wool is bought, sold, and manufactured, has finally, like cashmere, given its name to the goat inhabiting a large region of country, extending from the Black Sea, on the north, to Diarbekir, on the plains of Mesopotamia, on the south, and from Persia and the Caspian Sea, on the east, to near the Mediterranean on the west, of which Angora forms the centre. This goat, though described as the *Capra angoraensis*, is only an improved variety of the *Capra hircus*, or common domestic goat, and is closely allied in many respects to the cashmere, but readily distinguished from the common goat by the greater size of its ears.

The Angora goat, and more especially the varieties it has produced, are probably the most valuable of all the goat family, and have been ably described by naturalists, Buffon, Pennant, Hazlequist, and travellers, as good-sized animals, generally of a beautiful milk-white colour, with short legs, and wide spreading, spirally-twisted horns.

The wool is described as "a very beautiful curled or wavy hair, of silvery whiteness, with a fine, downy, wool at its base," and this hair is disposed in long, pendant, spiral ringlets on the whole body. The horns of the female, instead of spreading as in the male, turn backwards, and are much shorter in proportion; those of the male are long, spirally twisted, but the size and direction are very different from the common goat, being generally extended from 15 to 30 inches in height on each side of the head, while those of the female end near the ears. The hair or wool often sweeps to the ground, and is from 5 to 12 inches long, especially in the older bucks, but not so fine.

The fleece of the ewe shears from three to five pounds, and that of the buck from five to nine. The tail is shorter than that of the Cashmere, and usually carried erect. "These goats have the hair very long, thick, and so fine that stuffs have been made of it almost as handsome and glossy as our silks, and have been known under the various names of cashmeres, camlets, &c., &c." This brief description will apply to almost all we saw in Western Asia, Europe, and in this country (say of several thousands), save some difference in the ears, for while many have pendant ears, others we examined have ears exceedingly small and short.

The fleece in some is longer, more curly, pendant, and wavy than in others. The boundary for these goats is set in Asia Minor, from which the natives say, if taken, they will deteriorate or lose much of their beauty, which, however, has been disproved by successful experiments, both in France and in the United States. They are there generally accustomed to high, dry land, the greater part of Natolia consisting of dry chalky hills, on which there are bushes rather than trees, or else of valleys, lying from 1,500 to 2,000 feet above the level of the sea, which, however, are quite bare of trees, and but scantily covered with grass. Even in this expanse there are spots that produce finer flocks than others, where the goats are mostly kept on hills, the natives attributing a general superiority to mountain flocks, which have a rare atmosphere, more feed, and a larger choice of herbs; and ranging widely, are kept in good health, on which the quality of their fleece mainly depends. Some roving tribes are said to keep their flocks out day and night, summer and winter (except when an unusual quantity of snow falls), so that they do not soil their fleeces by folding them. They are mostly kept on fresh food in winter, by shepherds leading them down and up the mountain sides, as the snow and grass appears and disappears, while the flocks of the valleys must be fed on hay or branches.

The fleece of the white Angora is called "tiff-tick," and is clipped annually, that of the yearlings and females being more valuable than that of the males, and is here manufactured into the most delicate articles.

A curious statement was made to us at Angora—that only the white goats, which have horns, wear their fleece in long, curly locks, which are so much admired, while the hornless ones have a comparatively close coat. The finer the fleece, the more readily and naturally it curls, while the fleece is made or kept finer by carefully washing or combing out all impurities, thus giving it a polish.

There is also a second or other variety of Angora or shawl-wool goat, besides those generally described. This goat has an unchanging outer cover of long, coarse hair, between the roots of which comes in winter an under coat of downy wool, that is naturally thrown off in spring, or is carefully combed out for use. A remarkably fine species of this breed exists throughout the area to which the white-haired goat is limited, and similar breeds prevail all over the high lands of Turkish and Persian Armenia, Koordistan, and at Kerman; and although some flocks yield finer fleeces than others, it is called the same wool or underdown as the wool of Cashmere and Thibet, and samples of the wool of the Thibetian and the double-woolled goat of the banks of the Euxine show them to be but varieties of the same species.

This goat is of a larger size than those of the more southern Turkish provinces, and its wool finer, and is probably the variety introduced by Dr. Davis, from Asia Minor, as the Cashmere, and now erroneously so-called throughout the country, as all the importations to this country, as far as we can learn, were shipped from ports on the Mediterranean, or Constantinople, several thousand miles from Cashmere or Thibet, through inhospitable and almost untravelled countries for Europeans, which goes far to prove the so-called "Cashmere goat" to be the Angora. This double-coated race of goats in these Turkish and Persian districts is also coloured black, brown, golden, light dun, grey, and piebald. The colours of the two goats do not necessarily correspond, black hair commonly overlaying brown wool. Others differ more or less in depth of shade. Goats of this breed are sometimes mixed with the white-haired goat, especially when a remarkable flock leader is required.

The articles of clothing worn and knit from this wool seem to combine in a greater degree the qualities which are so much desired in shawls—viz., lightness, softness, and warmth.

CORRESPONDENCE.

DR. CLARK'S SPELLING REFORM.

Sir,—The title of Professor Bain's article on p. 783 of the *Journal* for the 12th August, suggests that Dr. Clark's orthographical scheme is really put forward as a practical amendment of English spelling. It is certainly very ingenious, but cannot possibly come into use in England. It is confessedly inadequate in the consonants. The two sounds of *th* are not distinguished. The two sounds of *r* are not even suspected. Tho letter *j* is newly endowed with a double meaning, as in *jest*, *vijon* (vision). The compositor's cases are loaded with twenty-

five vowel characters, which, however, do not suffice for the representation of our received or dialectic vowels or diphthongs, much less for the French words which we have naturalised. But the principal objection is, that Dr. Clark's vowel scheme is not adapted for any pronunciation of English known in England, but only for that very curious system of reading our language which the Scotch learn in their schools under the name of English, because it is different from their vernacular. It would be easy to establish this by an examination of every one of the vowel characters, as Mr. James A. H. Murray, a native of Hawick, and author of a remarkable treatise on Lowland Scotch, now in the course of printing for the Philological Society, has kindly furnished complete materials for the purpose. But as such an examination might be too lengthy for the general reader, it will suffice to point out the peculiar Scotch character of the three pairs of signs, *í î, é ê, ú û*, for which Professor Bain claims originality on the part of Dr. Clarke, saying, "no mark had ever been proposed for this discrimination." And no wonder, because no Englishman ever made it, and every one in the south, not acquainted with the remarkable character of Scotch-English, as distinguished from Scotch-Scotch, must have been extremely perplexed by having been told to discriminate the vowel sounds in *pried, pride*, and *scene, seen*, which no Scotchman confuses. Less difficulty may have been felt with *pool, pull*, but this would only have arisen from the Englishman unhesitatingly giving the last word a different sound from the Scotchman. The Scotch sound of *pull* is the same as that of the French *poule*, which is also different from *pool* in length, but not in quality of sound. In Yorkshire they pronounce *book* with the same long vowel as *boon*, and in Scotland they make this same vowel short without altering its quality, so that most Southerners hear no difference between the Scotch and Yorkshire pronunciations, but distinguish both from their own sound of *book*. In my Glossic, introducing the signs of quantity, as explained in the *Journal* for 22nd April, p. 496, the Yorkshire sound is "b ō o k," the Scotch, "b ŏ o k," and the London, "b ŭ o k." Dr. Clark did not know the last sound, and in one of his first attempts at phonetic writing, called "Vocal English," did not distinguish the two sounds, "b ō o k," "b ŏ o k." His present scheme has no sign for "b ŭ o k."

In the same way, the sounds meant by Dr. Clark's *scene* and *seen*, which he writes *sén, sên*, are in Glossic "s ē e n," "s ĕ e n." The English "s ĭ n" differs from "s ĕ e n" (which is the French pronunciation of *sine*), precisely as "b ŭ o k" does from "b ŏ o k." Neither *ŭo* nor *ĭ* are much known in any language but English, but *ĕe* is the common sound of short *i* all over the Continent, and in Icelandic alone *ĕe ĭ* are distinguished by separate characters. The Scotch-English is regularly "s ĕ e n," "k ĕ e p," "s w ĕ e t," "s h ĕ e n," "g r ĕ e n;" the Englishman only knows "s ē e n," "k ē e p," "s w ē e t," "s h ē e n," "g r ē e n."

With *i, î*, the case is different. Dr. Clark treats them as vowels. They are of course diphthongs, and it is a great blot in his system that he writes one diphthong with a single sign, and leaves two others, *oi, ou*, with double signs. So that, for example, we should not know whether his *sîkloid* meant the Glossic "s ì k l o a i d," or "s ì k l o i d," both pronunciations existing. The Scotch-English habit is to pronounce the diphthong in the words, *I, pried, thy, my, high*, with the first element having a very long sound, like *a* in *father*, sometimes, or perhaps generally, with a much broader sound, like the French *â*, or deep German *a*, and the second element with long sound of *ee*, in Glossic "a a y," "p r ā a y d," "d h ā a y," "m ā a y," "h ā a y," or "ā h y," "p r ā h y d," &c. Such a diphthong is altogether unknown or vulgar in England. On the other hand, in the Scotch-English pronunciation of *pride, thine, life, kind, mind*, the first element of the diphthong is either the same as before, but exceedingly short, or else that indistinct vowel sound heard in the last syllable of *mention*, as distinguished from the *u* in *shun*, and written *u'* in Glossic; the second element is the same as before, but also much shorter. Hence, in Glossic, the Scotch-English sounds of the last words are "p r ă a y d," "d h ă a y n," "l ă a y f," "k ă a y n d," "m ă a y n d," or "p r ŭ' y d," "d h ŭ' y n," &c. The vernacular Lowland pronunciation of the two sets of words is, however, very different, but need not be at present discussed. The English pronounce this diphthong in a great variety of ways. The most common among highly educated southerners are "ŭ' y," "ă' y," the length of the last element being indifferent; but "ŭ u g," "ă a y," and even "ā a y" are also heard, and some cockneys say "ă y." Nevertheless, whatever be the sound that any Englishman uses in one of the above two sets of words, he also uses in the other. The difference in the habits of Scotch and English in this particular was a source of great perplexity to me more than 20 years ago, as I was then totally unable to conceive what my Scotch phonetic correspondents meant by the distinction, and they could not understand the badness of my ear in not perceiving it.

It seems to me that Dr. Clark's Scotch-English alphabet is as ill adapted for ordinary English-English as Lepsius's German-English alphabet would be. A phonetic alphabet, or system of spelling, must be based upon a wide knowledge of pronunciation, and not upon the habits of particular localities.—I am, &c.,

Alexander J. Ellis.

NOTICES OF PUBLICATIONS.

A Handbook to the Mineralogy of Cornwall and Devon, by J. H. Collins, F.G.S., octavo, price 5s., will shortly be published. Part 1 will contain full instructions for the examination and discrimination of minerals by the aid of the blow-pipe, and by other chemical tests, together with tabular arrangements of the various species and varieties found in the two counties; also a list of mines and mineralogical localities corrected to the present time, &c. Part 2 will consist of an alphabetical arrangement, with full descriptions, chemical and physical characters, formulæ, &c., of the minerals found in the district, together with definitions of the various technical terms employed in the science. The whole will be illustrated by several hundred figures, including most of the crystals known to occur in the district, forming a complete text-book for the use of the mine-agent and the student, as well as the many amateur mineralogists of Cornwall and Devonshire. Subscribers' names will be received by the author, at the Royal Cornwall Polytechnic, Falmouth; and by the publishers, Messrs. Heard and Sons, Boscawen-street, Truro.

NEW BOOKS.

The Modern Greek Language in its Relation to Ancient Greek. By E. M. Geldart, B.A., Baliol College, Oxford. (Macmillan and Co.)

A Practical Treatise on Mine Engineering. By G. C. Greenwell, M. Inst. C.E. Price £2 12s. 6d. (E. and F. N. Spon.)

Researches on the Action of the Blast Furnace. By Charles Schinz. Translated from the German by W. H. Maw and M. Müller. Price 8s. (E. and F. N. Spon.)

GENERAL NOTES.

Social Science Congress.—This will be held in Newcastle-on-Tyne, in the last week of September, under the presidency of the Duke of Northumberland. The following subjects will be discussed under the Health Section:—1. What is the best method of disposing of

sewage and excreta? 2. What modifications are desirable in the existing sanitary laws and administration? 3. What legislative measures ought to be taken to prevent the adulteration of food, drink, and drugs?

Photographs of the Sun.—Professor Winlock (says *Nature*) is now engaged in photographing the sun on a plan which, so far as we know, has not before been put into practice. He uses a single lens object glass, 4½ inches diameter, 40 feet focal length, of crown glass, made by Clark, and corrected for spherical aberration by means of an artificial star of homogeneous (sodium) light, in the focus of a 5-inch collimator. The image of the sun is 4½ inches in diameter. The tube of the tetescope points to the north, and the image of the sun is thrown in by means of a reflector of plate-glass. This glass is *not* roughened or blackened on one side, because, when that was done, the heat of the sun distorted the plane surface. The slit is at the object-glass end of the telescope, and that position has the advantage that, when it is thrown across, no dust is shaken down on to the plate, as is apt to happen in the usual way of working. It is Mr. Winlock's intention to photograph the sun every fair day now. It seems also probable that this mode of photographing might be of advantage for the partial phases of an eclipse.

The New Act on Factories and Workshops.—The statute to amend and extend the Acts relating to factories and workshops was passed on the 9th instant, in reference to print-works and bleaching and dyeing works, as also to amend the Acts on factories and workshops. There are two parts in the statute and three schedules. The first part relates to print-works and bleaching and dyeing works, and is to be construed as one with the Factory Act Extension Act, 1867; and after January 1st, 1872, the principal Act is to apply to print-works and bleaching and dyeing works. Certain regulations are to be enforced on the 1st of January, 1871, in Turkey-red dyeing works. The second part of the statute relates to fruit and fish preserves. The schedule to the Factory Acts Extension Act, 1867, and the schedule in the Workshop Regulation Act, 1867, are to be construed as if they were contained in each of those schedules. In the schedules the permanent modifications are set forth. In the manufacture of preserves from fruit, and in the processes of preserving or curing fish, women may be employed, between the 1st of June and the 14th of December, for a period not exceeding 14 hours on any one day.

New Training Ship for Pauper Boys.—Mr. Goschen, the President of the Poor-law Board, has caused to be addressed to the guardians of the parishes and unions of the metropolis, a letter, stating that he viewed with favour a proposition to provide, for the benefit of the pauper boys of the metropolis, a training-ship, where they might be fitted to enter sea-service. One of the chief difficulties of pauper education has been to provide suitable means of employment for the children on leaving the workhouse or district schools, and it seemed to him that the sea-service was an outlet especially suited for such boys, inasmuch as it would sever them from former associations, and increase the probability of their success in life. Under these circumstances, the Poor-law Board applied to and obtained from the Lords Commissioners of the Admiralty the ship *Goliath*, which would accommodate 500 boys, and had transferred the care of it to the managers of the Forest-gate District School, who were guardians of two water-side parishes; and they had, at a cost of £6,000, made the ship suitable for the purpose for which it was intended, and it would be ready for the reception of boys at the end of the present month. Commander Bourchier, R.N., had been appointed the superintendent. He felt assured that he might rely upon the co-operation of the boards of guardians to secure the success of the scheme, and send the boys eligible to the ship. The cost of their maintenance would come out of the Metropolitan Common Poor Fund.

Gold in California.—According to the Californian papers, the annnal production of gold in that State has, in eight years' time, fallen from £6,400,000 to £4,600,000. and has now become an ordinary occupation, yielding no more than an average remuneration, and not so much as many other trades. The business, it is stated, has passed under the control of large capitalists, and the miners receive wages of 19s. a day. The capitalists assert that they are unable to keep the mines in operation at these wages, while the miners are resisting reduction; as a consequence, "many of the mines are closed, and those still in operation do not offer any prospect of reasonable returns."

Snuff-taking and Consumption.—At the recent meeting of the British Medical Association at Newcastle, a paper was presented by Dr. John Murray, on "Snuff-taking, and its Utility in Preventing Bronchitis and Consumption," in reference to the influence of snuff-taking in so altering the delicate mucous membrane of the nose, where so many colds begin, as to render it less liable to be irritated by the ordinary external causes of catarrh. The facts, as given by Dr. Murray, are curious, and will interest the general reader. He remarks, in the first place, that an habitual smoker seldom or never dies of eonsumption; and further declares that he has seen the progess of eonsumption arrested by practising the habit of snuff-taking, which is equally efficient in the case of bronchitis. Dr. Murray says—"By titillating the lining membrane of the nostrils, snuff acts as a powerful derivative and counter-irritant, and its use will tend to preserve tho more important and susceptible pulmonary mucous membrane from evil. The sneezing which succeeds the un accustomed application of the errhine, or agitates even an old and seasoned nose, when a new titillant is tried, and the cough which is induced when, by chance, some of the lighter particles get into the throat, may be of some avail in effecting the elimination of alhumenoid matter (the precursor of tubercle) from the lungs, ere it has had time to fill the air-cells and minute bronchi, and coagulate, in like manner as sea-sickness is believed to do. The majority of medical men, when recovering from a common cold, will take a pinch, in order 'to speed the going guest.' If good to expedite the departure of a cold, I have no hesitation in affirming that it will be better still as an expedient in altogether preventing the catarrh; *e.g.*, if, when on a journey, you experienee a sensation of chills, in due time you may expect an attack of bronchitis, an infiltration of pneumonic or tubercular plasma, or illness in some other form, each tending to reduce the powers of life, and consequently liable to set up consumption in those predisposed. If a snuffer, you relieve the discomfort by having recourse to your box, from which, after gently tapping, you proceed to take a pinch of the agreeable, and, in this case, useful stimulant. The exercise, slight though it be, engrossed the attention, the pleasurable sensation, the diaphoresis, and the smart glow which is at onee diffused throughout your system by the pungent divertissement, the generally welcome conversation which the acceptance or refusal of a proffered sneeze is likely to elicit, materially serve to ward off, and make you forget the dangerous chill. Should it return, nothing is more easy than to repeat the excitation. It is said that in France, where tobacco is grown under state supervision, and manufactured by government, in nearly equal proportions, into tobacco, cigars, and snuff, the health of the *ouvriers* has been made the subject of official report, of which the following summary may not inaptly be given here:—The workmen in tobacco factories of the State do not suffer from any disease which the tobacco could be imagined to occasion. On the contrary, the *employés* seem to have had an immunity from typhus fever, as at Lyons; from dysentery, as at Morlaix; from miliary fever, as at Tonneins; and from cholera everywhere. The majority of physicians to the State factories believe employment among tobacco to be instrumental in preventing consumption in the lungs, and may even restore consumptives to health.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 2, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

THE EDUCATION ACT.

At Leeds, a special meeting of the Corporation has been held, at which the Town Clerk called attention to the circular letter from the Education Department, referred to in the last *Journal*. It was resolved that the letter be referred to the Public Library Committee, who were instructed to forward the necessary information. The Mayor then moved :—"That the Council present a memorial to the Education Department of the Privy Council, requesting that a school board should forthwith be formed within and for the borough of Leeds, in pursuance of the Elementary Education Act, 1870." He rejoiced that, after efforts extending over a number of years, the country really seemed now to have a prospect of a good national system of education. Of course, there would be found some difficulties in the way of working the Act of Parliament, but these would be overcome by mutual giving and taking, and the result would be that a large number of children who were at present without instruction would receive a good education. Councillor James Mosley thought that it would be advisable to wait and see how the system worked in other towns before adopting it in Leeds, remarking that many errors of detail might thus be avoided; but it was pointed out both by the Town Clerk and Alderman Carter, M.P., that if the local authority did not take action in the matter it would be taken by the central power, and that then the town council would be altogether put on one side, as far as regarded the administration of the powers of the Act. After a brief discussion, the resolution was carried by a very large majority.

A correspondence has taken place between one of the managers of the Sunningdale National School and the Education Department as to the interpretation of one of the clauses of the Act. The former says :—"Sunningdale is in an ecclesiastical district, in the parish of Old Windsor, but comprising bits of several other parishes. It has a population of between 600 and 700 souls. There are upwards of 200 children in the school, for whom there is ample accommodation. The school instruction comes fully up to the government standard, as the reports of the government inspectors testify. We are, therefore, safe against the operation of the new Act. The point on which I wish for information is—supposing the parish of Old Windsor generally does not come up to the requirements of the government inspectors (but which I hope it will do), would that part of the parish in which our school is situate be subject to the education rate, or should we be exempted in consideration of our continuing to support our school as at present—that is, by voluntary subscriptions, aided by the government grant and the children's pence?" In reply, Sir Francis Sandford says :—"Ecclesiastical districts will not be dealt with separately. If a rate has eventually to be made for the parish of Old Windsor, no part of the parish will be exempt from it."

SPELLING REFORM.

By E. Jones, Liverpool.

It appears to me that any scheme of spelling reform, to have a chance of general adoption in this country under present circumstances, should satisfy the following conditions :—

1. The new spelling should be such that it could be read, without an effort, by any one who can read the present spelling.

2. Those who may be taught the new spelling ought to be able to read the present without an effort.

3. The arts of reading and spelling (*i.e.*, writing words with the proper letters) ought to be acquired in considerably less time, under the new system, than at present.

In order to meet these three conditions—

1. There should be as little deviation as possible in the new from the present spelling.

2. It would not be desirable to indicate extreme refinements of pronunciation in the new spelling, as the pronunciation varies considerably in different districts, even among educated people.

3. All the letters and combinations of letters should represent, in the new spelling, their most common power or sound in the present spelling.

4. Practical convenience ought not to be sacrificed to theoretical consistency.

In accordance with these principles, the short vowels will be *a*, as in "Dan;" *e*, as in "den;" *i*, as in "din;" *o*, as in "don;" *u*, as in "dun."

In order to minimise the amount of change, and also to distinguish, by the spelling, words that have a different meaning, though pronounced alike, it is desirable to retain the two most common modes of indicating the long vowel sounds.

a	*o-e* as in rose.
ae as in Gael.	*u*
a-e ,, gale.	*ue* ,, rued.
e	*u-e* ,, rude.
ee ,, meet.	
e-e ,, mete.	*oo* as in food.
i	*au* ,, daub.
ie ,, tied.	*aw* ,, law.
i-e ,, tide.	*oi* ,, oil.
o	*oy* ,, boy.
oe ,, roes.	*ou* ,, out.
	ow ,, cow.

As diacritic marks are inconvenient, both for writing and printing, they should be used, if at all, sparingly. It may be desirable to use an accent mark for the sound of *u* in "pull," thus, *púll;* and for the sound of *a* in "calm," thus, *câm*. Both sounds are confined to a very few words, and are not of frequent occurrence.

$c = s$ before *e*, *i*, and *y*, and $c = k$ in every other position may be retained, as *c* occurs ten times at least as often as *k*.

On this plan, the maximum of advantage is secured with the minimum of change.

For comparison, the same passages as appeared in Dr. Clark's spelling, in the *Journal* for August 12, are given below in

Analogic Spelling.

The Lords Praer.

Our Father, which art in heven, haloed be thy name, Thy kingdom cum; Thy wil be dun in erth, as it is in heven. Giv us this day our daily bred. And forgiv us our dets, as we forgiv our deters. And leed us not into temptation, but deliver us from evil. For thine is the kingdom, the pour, and the glory, for ever. Amen.

Salm CIII.

1. Bless the Lord, O my soel, and aul that is within me, bless his holy name.

2. Bless the Lord, O my soel, and forget not aul his benefits.
3. Whoo forgiveth aul thine iniquites; whoo heeleth aul thy diseeses.
4. Whoo redeemeth thy life from destruction; who erouneth thee with luving-kindness and tender merces.
5. Whoo satisfieth thy mouth with good things, so that thy yooth is renewed like the eegels.

The Destruction of Sennacherib's Host.

The Assirian came down like a woolf on the fōld,
And his cohorts wer gleeming in purpel and gōld,
And the sheen of ther speers wos like stars on the see,
When the blue wave rols nietly on deep Galilee.

Like the leevs of the forest when sumer is green,
That hōst, with their baners, at sunset wer seen,
Like the leevs of the forest when autum hath bloen,
That hōst on the moroe lay withered and stroen.

For the āngel of deth spred his wings on the blast,
And breethd on the face of the foe as he past;
And the ies of the sleepers waxt dedly and chil,
And ther harts but wunce heevd, and for ever grew still.

And ther lay the steed with his nostrils aul wide,
But throo it ther rōld not the breth of his pride,
And the foem of his gasping lay white on the turf,
And cōld as the spray of the rok-beeting surf.

And ther lay the rîder, distorted and pale,
With the dew on his brow, and the rust on his mael.
The tents wer aul sīlent, the baners alone,
The lances unlifted, the trumpet unbloen.

And the widoes of Ashur are loud in ther wael,
And the îdols ar broke in the tempel of Bael,
And the miet of the Gentile, unsmote by the sord,
Hath melted like snoe in the glance of the Lord.

There will be objections and difficulties connected with any and every scheme. In order to avoid the objection to accent marks on the one hand, and to inserting more letters in a word on the other, Dr. Clark's notation has been used to indicate the long sound of the vowel where this was necessary, as in *hōld*, *īdol*, &c. Where there are two vowels already, as in *autumn*, *seen*, there seems as good a reason for retaining these vowel digraphs as for retaining the consonant digraphs in *chip*, *shop*, *thin*, &c.

There would be many minor points which could be best discussed and arranged in committee.

As opinions differ as to the best mode of dealing with two sounds of th, in *thin*, *than*, this point may stand over to wait further light.

THE MANUFACTURE OF TEA.

By J. McPherson.

The manufacture of tea is very little understood in this country. The following is a sketch of the earlier methods of manipulation, together with some of the improvements which have been put into practice, or have been suggested, since Europeans have devoted themselves to its production.

If we may depend upon the vague and obscure expressions to be found in some of the earliest Chinese writings, tea seems to have been known to those people, as a medicine or drug, long before the birth of our Saviour. The great Chinese moralist and philosopher, Confucius, who was born B.C. 550, makes an obscure allusion, in one of his compilations, called the "She-King," which is believed to refer to the infusion of tea leaves. He asks, "Who says the Tu is bitter?—it is as sweet as Csy." From A.D. 600 to 900, however, the allusions to tea, as a beverage, are more frequent and reliable; and one author, writing during this period, describes a mode of manufacture nearly agreeing with the method practised in the present century. He makes mention of the great variety of teas, there being thousands of kinds; he also suggests that the leaves should be gathered in clear, fine weather, that they should be tossed in the hands, dried over a fire, and closely packed. There is reason to believe that this was not the earliest known method of manufacture, but that it was the result of accidental discovery; indeed, the writer here alluded to seems to have been of opinion that tea was originally made in bricks or cakes, and that portions of these bricks were broken into powder, and made into a medicinal infusion, which was used at banquets, to promote digestion, or to stimulate the appetite, much as an infusion of rue or camomile might be used. The leaves used for making this brick-tea were steamed, to extract the bitter juices, and were then dried, either in the sun or over fires of charcoal. One author says, the leaves were broken into powder, after being dried, and subsequently formed into bricks; but it is well known that whole leaves, and even branches of the tea-plant, were used for making up these bricks, and that the very same practices are still persevered in. This early method of preparing brick-tea agrees in a remarkable manner with the method practised by some of the tribes of Assam, as related by Bruce and others. These tribes seem to have been well acquainted with the uses of tea, for a conversation between Lieutenant Charlton and his native servant led to the discovery of the Assam species in 1830. The means used to extract the bitter juices of the green leaves was not quite the steaming of the Chinese, it was rather boiling, which would be very nearly the same in effect. The leaves were gathered and thrown into a vessel of water, where they were allowed to remain until the water boiled; the liquor was then drained off, and, strange to say, the leaves were then buried in a pit dug in the earth and lined with dry leaves, where they remained for two or three months, when, upon the arrival of the merchants from the neighbouring states of Burmah and Central Asia, they were dug up and firmly pressed into joints of bamboo, or into earthenware vessels, and were thus carried away for consumption. This was of course a very clumsy and imperfect method, but it is highly interesting, as showing the taste of these people, and the kind of article that must be manufactured for the consumers of brick-tea; it need not be of a delicate Pekoe flavour by any means—they would have to acquire a new taste to appreciate such a tea—but it must be of a strong, green tea flavour, with a good proportion of the acrid juices retained, or only partially extracted; indeed, so far as may be judged from the description—viz., the boiling, the cooling, the burying, and the pressing into lumps or bricks—everything in such a process indicates that a very considerable portion of all the essential qualities of the leaf are retained. Under these circumstances, it is difficult to determine who were the first people to discover the use of the tea-leaves. The Chinese have a written history, which, however imperfect and unreliable in respect to precise dates, &c., yet enables us to trace back the uses of the tea plant to very remote times. The rude border tribes of India, on the other hand, are very frequently without a written language, and their oral traditions have been lost in very many instances, or, at any rate, so much distorted by transmission over ages of turmoil, embarassment, and strife, that they can scarcely be depended upon. It does not follow from this, however, that the uses of any article of food, or any beverage, should be lost to them in like manner; indeed, it is the most likely thing in the world that the uses of the natural products of a country should be preserved from age to age; and we find such tribes as the Singphos and Norahs not only acquainted with the uses and manufacture of tea, but actually carrying on a trade in the article with the Burmese and Chinese people. There can be no reasonable objection to the supposition that both the tea-plant and its uses were, at some remote period, introduced to China from Northern India. Not only is the process of manufacture, as practised by these rude border tribes in North-East India, the most primitive of which we

have any record, but it is also well known that the next stage of improvement is to be found among the frontier tribes of China; and not only this, it is equally well known that the seeds of the tea-plant are as little likely as any we know to distribute themselves naturally. Comparatively few animals feed upon them; they are too heavy to be carried by the wind, or by a stream of water; while, from the great amount of oil they contain, they turn rancid, and spoil with remarkable rapidity, if they are not planted directly they are ripe. Nor is this all that seems to point to Assam as the head-quarters of the species; the varieties of the tea-plant found in the north-western districts of China are said to approximate more closely to the Assam type than the small-leaved, dark-green varieties of the Bohea hills and other districts to the south of China; and this seems to prove that the species had been modified and varied by a warmer climate and varieties of cultivation, giving rise in turn to the necessity of modifications in the manufacture. It is well known that the effect of a warm and dry climate is to stunt the growth of the tea-plant, causing it to produce a great abundance of seed, and to develop, in a high degree, the more astringent qualities of the plant; hence the unmistakable necessity of such a modification of the cultivation and manufacture as to produce a kind suitable to the taste of the general consumer.

We have reviewed the leading points in the early history of the manufacture of tea, and pointed out how little progress had been made, during the last 1,000 years, in the method of preparing it. For this long standstill there must be some reason. The *principles* of manufacture must of necessity be preserved, but we cannot help thinking that something might have been done to render the vital process of manufacture more certain, and less dependent upon the variable operations of open fires on the one hand, and wet and adverse weather on the other. Probably the manufacture of no other vegetable food of equal importance has been at such a standstill for so great a length of time. Let us consider what improvements have been made in the roasting of coffee, or in the preparation of cocoa, and to what a great degree of certainty and perfection the process of manufacture has been brought. Both these articles are finally prepared in this country; tea, however, cannot possibly be manufactured here, and it is probably owing to this circumstance that so little advance has been made. So far as we know, there is not at this moment anything better than surmise (more or less correct), as to the actual effect of manufacture upon the green leaves of tea—that is, no chemist has as yet had an opportunity of noting the qualities of the raw, green leaves, and analysing them during the numerous methods variously employed in manufacture. It will be readily understood how necessary such inquiry is, when it is seen how various are the methods employed for the production of black and green teas.

For black teas, some prepare or dry them almost entirely in the sun, and finish them in an iron pan, or more commonly over open fires; others heat the green leaves on iron pans which are nearly red hot, some on comparatively cool ones, and others do not employ pans at all. Some ferment black teas, without any means whatever at their disposal for determining the degree of fermentation, others find fermentation hurtful, and altogether unnecessary. Some ferment teas before rolling, others afterwards. Tea is often only once rolled, to express the excess of bitter juices; at other times it is rolled and twisted three or four times. It is sometimes exposed to the sun for from two to twenty hours, and at other times never exposed to the sun at all. It is often finally dried over a charcoal fire for periods which, taken together, make up twenty-four hours, and quite as often from three to four hours are made to do. No wonder, then, that scarcely any two samples of tea are exactly alike. Green teas are made under similarly varied conditions. The bad green teas are sun-dried, and finally prepared on the sea-coast, where they are artificially coloured; the best green teas are prepared inland, and their natural green colour is preserved by rapid drying on iron pans; such teas require no painting or artificial colouring.

Now, the great object is to get hold of a system for artificially drying teas which will at once be economical and cleanly, and also capable of being safely put into the hands of ignorant workmen, without the least chance of their being able to injure either the apparatus or the tea. It must present the greatest possible heated surface, and have a limit to its heat, but yet so great a degree of heat as will be necessary; it must finally be placed in a well-arranged and well-ventilated building, but should also be capable of adaptation to any existing building. It seems to us that the choice must lie between hot-water, hot-air, and steam apparatus, and anyone who can devise an apparatus capable of application under any circumstances and anywhere, will do a great and lasting good to the tea-planting communities.

AGRICULTURAL STATISTICS OF VICTORIA.

The agricultural statistics of the colony, for the year ending 31st March, 1870, have been published. As compared with the previous year and every former year, the returns in almost every particular show a very gratifying amount of improvement. The quantity of produce raised during the year which has just gone by, was considerably in excess of the amount grown in the year which preceded it, and the quantity of land under tillage was 114,669 acres more, while 22,485 acres more had been enclosed. It seems strange, however, to find that the extent of land in occupation during the latter period was 34,707 acres less than during the year ending March, 1869. The number of holdings have increased from 29,218 to 30,376, and the extent of purchased rented land from 1,233,559 acres to 1,374,199 acres, being an increase of 140,640 acres; while the freehold land in occupation has decreased from 5,744,454 acres to 5,658,767 acres; and the Crown land rented to other than pastoral purposes, from 8,884,193 acres to 8,849,486 acres, or a total decrease of 175,347 acres. The net result is, as before stated, a decrease of 34,707 acres in the total area in occupation. The details of these numbers are as follow:—Shires and road board districts, number of holdings exceeding one acre, 28,294; freehold purchased land, 5,598,295 acres; rented, 1,348,287 acres; Crown land rented for other than pastoral purposes, 1,797,793 acres; total area in occupation, 8,744,375 acres. Corporate towns and boroughs—Number of holdings exceeding one acre, 1,900; freehold purchased land, 42,194 acres; rented, 22,261 acres; Crown land rented for other than pastoral purposes, 8,113 acres; total area in occupation, 72,568 acres. Other portions of the colony—Number of holdings exceeding one acre, 182; freehold purchased land, 18,278 acres; rented, 3,651 acres; Crown land rented for other than pastoral purposes, 10,614 acres; total area in occupation, 32,543 acres. The extent of land enclosed during the year ending March, 1870, was 7,962,298 acres in shires and road districts, 65,910 acres in corporate towns and boroughs, 26,415 acres in other portions of the colony; making a total of 8,054,623 acres, or an increase of 22,485 acres on the previous year. Of land under tillage there were 797,903 acres in shires and road boards, 27,695 acres in corporate towns and boroughs, and 1,936 acres in other portions of the colony, making a total of 827,534 acres, or an increase of 114,669 acres. The following is an account of the number of acres of land under each description of crop during last year throughout the colony:—Grain crops—wheat, 288,514, increase of 28,710; oats, 144,791, increase of 29,855; barley, 28,115, increase of 8,893; maize, 1,081, increase of 217; rye and bere, 4,275, increase of 1,889; peas, beans, millet, and sorghum, 3,989, increase 270; total, 470,764;

total increase, 69,834. Green crops (exclusive of those in market and kitchen gardens)—potatoes, 41,216, increase 5,012; turnips, 164, increase 7; mangold wurtzel, 1,521, total 200; beet, carrots, parsnips, and cabbage, 2,162, increase 765; onions, 329, increase 89; total, 45,392; total increase, 6,073; hay, 140,435, increase 28,153; green forage, 102,512, increase 15,109. Other crops (including tobacco and vines) 19,149, increase 2,816. The land under tobacco had increased from 138 to 144, and that under vines from 4,046 to 4,938 acres. The land in fallow had decreased from 56,598 acres to 49,282 acres.

Turning to another branch of the returns, it is found that a material increase has taken place in the yield of every description of produce, with the exception of tobacco, in which a slight falling off is noticeable. The total yield of grain of all kinds for the last year was 10,304,299 bushels, as against 6,869,336 for the previous year, bieng an increase of 3,434,963 bushels. The details of the yields for the later year are as follows:—Wheat, 5,697,056 bushels, increase 1,467,828; oats, 3,761,408 bushels, increase 1,502,885; barley, 690,248 bushels, increase 397,583; maize, 22,141 bushels, increase 5,093; rye and bere, 65,822 bushels, increase 36,283; peas, beans, millet, and sorghum, 67,624 bushels, increase 25,291. In the division "green crops," we find that the yield of potatoes has increased from 79,944 tons to 127,645 tons, an increase of 47,701 tons; that of turnips, from 964 tons to 1,234, an increase of 270 tons; that of mangold wurtzel, from 10,295 tons to 16,217, an increase of 5,922 tons; that of beet, carrots, parsnips, and cabbage, from 5,663 tons to 13,855 tons, an increase of 8,192 tons; and that of onions, from 12,084 cwt. to 35,818 cwt., an increase of 23,734 cwt. The production of hay has incrreased from 122,800 tons to 224,816 tons, an increase of 102,016 tons. The number of vines under cultivation has increased from 7,682,698 to 9,249,587, an increase of 1,566,889; and the quantity of grapes made into wine or brandy, from 65,553 cwt. to 85,205 cwt., an increase of 19,652 cwt. The quantity not made into wine and brandy exhibits a slight decrease, viz., from 25,574 cwt., to 24,980 cwt. The wine produced from grapes has increased from 448,547 to 577,287 gals., while the brandy similarly produced has decreased from 2,025 gals. to 878. It is to be borne in mind, however, with reference to the return of vines, that, whilst the acreage and number of vines, in common with the remainder of the statistics, are for the year ending 31st March, 1870, the quantity of grapes gathered, and of wine and brandy made, are for the previous season. The grape crop comes in too late to admit of its being returned when the agricultural statistics are collected.

The average produce per acre of wheat, oats, potatoes, and hay, for the two periods was as follows:—Wheat, in 1870, 19·8 bushels; in 1869, 16·3 bushels; oats in 1870, 26 bushels; in 1869, 19·7 bushels; potatoes in 1870, 3·1 tons; in 1869, 2·2 tons; hay in 1870, 1·6 tons; in 1869, 1·1 tons.

CORRESPONDENCE.

INDIAN ARCHITECTURE.

Sir,—It is not often that a layman preaches such sound doctrines on architectural art as Lord Napier has lately been doing in India. I request you, for the benefit of the members, to insert some passages from his address. They will be found to accord very much with the opinions expressed generally at the reading of Mr. Fergusson's able paper to the Society, on 16th December, 1866; and a hope may be expressed that the enlightened administration of the present Governor-General, Lord Mayo, will assist Lord Napier and others in India who desire that the future arts of Anglo-India may be rescued from their present debased, mongrel condition, and take a development founded upon sound principles.—I am, &c., Felix Summerly.

Lord Napier urges that in selecting materials, &c., the architect should consider two things chiefly—1. The sources of supply; and 2. The object of the structure. Lord Napier proceeds:—If the rules concerning material which are here enunciated are correct, I need scarcely say that they are in every respect so violated in India on every hand, as to rouse the regret and condemnation of all reasonable critics, and to make the *virtuoso* weep. Madras is the epitome of every error that architecture can commit with reference to material. Look at the railway station, the High Court, the Custom-house, the sea front of the fort buildings, all discovering the same shameful condition of chronic disfigurement and decay; all blistered, discoloured, and crumbling, the victims of an unequal strife between the elements and stucco. Yet, at no great distance, there are inexhaustible supplies of the finest stone, and the very soil beneath our feet teems with clay, which only requires the skilful exercise of a familiar art to yield qualities of brick and terra-cotta competent to resist the attacks of the blast and the spray for ever. The Presidency College and the Sailors' Home are the first attempts to build in an honest manner with undisguised materials, but the act of preparing them is not attained in a day, and I fear that we can scarcely regard these buildings otherwise than as the forerunners of a better era.

I turn my eyes with satisfaction from our own misdeeds to the more attractive errors of our neighbours. Two considerable buildings have been recently erected, under English impulse and superintendence, in two native states. I speak of the public offices at Bangaloro and the public offices at Trivandrum. Both countries possess peculiar materials in the highest perfection, and both were in possession of ample financial means. Mysore is the region of granite, Travancore is the region of wood.

At Bangalore, it is natural to suppose that in a great public building the plain external walls would be constructed, for cheapness and variety of colour, of substantial, well-prepared, well-tinted brick, while the columns, corners, entablatures, and cornices would be composed of grey granite, which is procurable with the greatest facility, and at comparatively little cost. A more natural, more beautiful, and durable combination could scarcely be conceived. But not at all. Instead of this, you have an immense, well-distributed, and useful pile, constructed of materials too perishable to remain uncovered, so that the whole edifice is cloaked in cement of a very coarse texture, and dull, uniform hue.

In Malabar there are still, on a small scale, examples of a very picturesque order of local architecture, which has been fashioned gradually, in past times, in obedience to the properties of the most accessible material and the requisitions of the sun and the monsoon. The solid portions of the structure are of laterite or brick, but the detached and salient parts, the columns, the deep eaves, the high-pitched gables, the shady and protected verandahs, the overhanging balconies, are constructed of the splendid wood of the country admirably wrought. The gateways of the temple at Trichoor, the pagoda at Tellichery, the older portions of tho palace at Trivandrum, tho remarkable ancient residences of the princes of Travancore, at Pudmanavapoorum, offer attractive specimens of an indigenous art, which is fast yielding to decay and the usurpations of European conventionalism. But in the construction of the public offices at Trivandrum, thero was a fortunate opportunity to build with local materials in the native style, and to unite both with the expansions and modifications necessary for the convenience of civilised administration. With brick or laterite for the inner portions of the fabric, with teak and jack-wood for the porticos and colonnades, the public

offices at Trivandrum might have been made to harmonise with the past and present, to grace the landscape, to resist the weather, and to suit the habits and instinctive tastes of the native officials and the population. The opportunity has been signally cast away. There was no want of liberality, no want of good intentions, but the despotism of foreign example was irresistible, and a costly edifice of the familiar plaster, classic type, which looks as if it had been designed in some European art academy in the second decade of the present century, affords an asylum to the cutcherry and durbar of the Maharajah of the Nairs and Moplahs. I may remark that meanwhile the beach at Aleppy was strewed with magnificent timber, which the government of Travancore neither sell nor use.

It is only just to add that the railway companies have in India, as in England, done much to accredit the use of solid, honest, and appropriate materials in construction; that the Art School of Madras is solicitous and active in the same direction; and that the government is building an improved brick and terra-cotta kiln, under the direction of the Department of Public Works, which will emancipate our public architecture for ever from the tyranny of chunam.

Let us now proceed to consider the question of style. Speaking broadly, there are four styles of architecture disputing the soil of India at the present time; the Hindu or Brahminical, the Mussulman, the European classic, and the European mediæval. These several styles claim our attention, with reference to cost, to convenience, to beauty, and in regard alike to public and to private buildings.

There is no order of architecture belonging to an ancient and civilised people absolutely deficient in the elements of grandeur, and those who neither accept the principles nor admire the decorations of the Brahminical style, may yet approach its capital monuments with interest and respect. Long before the traveller reaches the sacred precincts, whilst he is yet winding slowly over the weary plains, his eyes are fixed on the lofty pyramidal towers which preside over the Indian landscape with harmonious solemnity. As he draws near, the porticos for the accommodation of pilgrims and for the purposes of traffic form a secular and popular adjunct to the temple, full of picturesque life. On one hand, the stairs descend to beneficent waters; on the other, the pepul throws its religious and salutary shade. The entrance to the abode of the gods is fashioned with stupendous solidity. Within the walls, the multitude of cloisters, galleries, and pools, the profusion of ponderous material and delicate sculpture, and the dimness of the inner shrine, all combine to affect the imaginations with those impressions which belong to vastness, mystery, and the lapse of incalculable time, to the patient, devoted application of human labour, and the ceaseless tribute of human worship. The Brahminical architecture is imposing; it is even poetical, with its accessories; yet, regarded both from a scientific and an æsthetic point of view, it is manifestly defective. In the Brahminical style, the ruling feature is the horizontal line; the wall or the column supports a beam, and the beam supports a flat roof. When the building is lofty, the fabric ascends by successive horizontal stages, one succeeding another in diminishing proportions to the apex. The inherent poverty of this method of construction is often ingeniously concealed by decoration on the contours, and the fabric rises with a certain measure of continuity and elegance; yet the fundamental features can still be discerned. The characteristics of the style, as practised in the temples of Southern India, are a multitude of supports crowded together, small intervening spaces, square apertures, horizontal superposition, a vast expenditure of solid material, and radical defects of form, disguised by minute ornamentation, I know that in the northern varieties of Hindu building there are elevations externally of a curvilinear, and sometimes of a domi-form outline; I know that the ancient Jain and Buddhist builders were familiar with the construction of a dome on mechanical principles, consistent with moderate proportions, and that some of their apertures have the configuration, if not the true constructive qualities, of the arch; but I seek not to explore the recesses of antiquity, or to analyse all the diversities of style which, at different epochs, the different provinces of this vast peninsula may have disclosed. It is abundantly clear, from our every-day observation, that the arch and the dome are repugnant to the genius of the Hindu architecture, and have been for many ages practically unused by the Brahminical builders. But the introduction of the arch was the emancipation of architecture from the despotism of material. The arch and the dome are the most beautiful, the most scientific, and the most economical forms of construction; they are the proper methods by which large spaces can be covered; they are indispensable to the usages and recreations of modern public life. Considering the mechanical deficiencies of the Hindu style, and the predominance of sculptural ornamentation which it exhibits, it appears to me to be unavailable, under the present government, for the purposes of the State, and ill-adapted for the common and public use of the collective people. But is the Hindu style of building, for that reason, to be banished and degraded from all secular use, as is the case at present under the influence of unreflecting and ignorant innovation? Most certainly not. The methods of Hindu architecture may be practised in moderate dimensions with the greatest advantage, and they are perfectly adapted to the wants of the people. Domestic architecture should be the expression of social institutions and the necessities of climate. The principles of the old-fashioned Indian dwelling were seclusion and shade. For the women, a tranquil, retired, and busy retreat; for the men, privacy and repose after the labours of the day, and protection from the scrutiny of grasping authority; for all, shelter from the sun. In its principal features, it is the dwelling of the ancient Italians which we have exhumed; it is the dwelling that we admire at Damascus. To the street, a plain exterior, pierced by a few apertures, but often furnished with a hospitable porch, supported by stone or wooden columns, of quaint design. A narrow door, deeply sculptured, leads into a court, supported by a pillared verandah, on which the private apartments open; behind this, the offices and the habitations of the domestics. The interior court is the charm of the whole, it is the feature which the Indian house-builder should never forsake, and it is just the feature which he is giving up. It forms the most becoming frame for the life by which it is animated. It is in perfect harmony with the figures, the costume, the ornaments, the primitive industry, and the simple furniture of the inhabitants. The columns, the beams, the cornices, the panels of the ceilings, the doors, the pavements, all display the mouldings and patterns in which native art is so rich, and over which the patient native workman delights to linger. The ugly, conventional image sculpture of the pagoda scarcely invades the Indian home, but some pleasant tree, natural to the soil, will add its rustle and its fragrance. There are such interiors still in Madura and Tinnevelly of very modest pretensions, but which nevertheless reveal a true artistic character. Now, if this domestic architecture of other days discovers, even in its humility, a perfect appropriateness and a powerful attraction, what might not the same architecture become at the present time, in the hands of a person of ample means, cultivated taste, and intelligent patriotism? If all the proportions were expanded, if all the materials were selected, if all the designs were chosen for the most exquisite and correct patterns—and of such the whole country is a storehouse—I do not hesitate to assert that nothing in the world could surpass it. Yet what do we see? The moment a native of this country becomes educated and rich, he abandons the art of his forefathers and imitates the art of strangers, whom, in this respect, he might be competent to teach. Nothing is more lamen-

table than the corruption and confusion of taste which is everywhere apparent, combined with unmistakeable evidence of increasing opulence and an honourable desire for domestic comforts and decoration. The Hindu and European styles and ornaments are all jumbled and piled together. In some thriving provinces a favourite improvement appears to be, to build a Doric upper story, with plaster pillars of immense diameter, over the unpretending porch of the last age, with its slender Indian granite shafts. The same malady which infects the middle classes attacks the highest. I had the pleasure of visiting, not long since, in his country residence, a native nobleman, who, in addition to all the gifts of birth and fortune, possesses in his person and manners an unusual share of dignity and grace. I need not say that there is a numerous retinue and an overflowing bounty to Brahmins and native strangers. But the Jaghirdar recognises the duty of hospitality in every form, and he has built himself a little palace in a pleasant garden, where he delights to honour his European guests. It may seem ungrateful in me to criticise a dwelling in which I was treated with so much respect and kindness, but I could not repress a sentiment of regret when I found that every trace of native style had disappeared from the most recent example of native building, and that a handsome European villa, of spotless chunam, had risen among the grey pagodas and choultries and the whispering palm trees.

It is possible that I may be speaking in the presence of some native gentleman who has made a fortune by the exportation of cotton, and who is about to build a new house. The case is not common in Madras, but it is not incredible. If there be such a one here, I beseech him to pause before he sanctions the modern "Muster" which I mentally see before me. I say to him, 'Discharge your Madras architect, and take a maistry from some remote part of the Mofussil, where the traditions of the fathers are still preserved. Determine to have a national house, but such a house as an Indian gentleman should inhabit under an honest government, in an age of peace, justice, and learning, a house in which the light of heaven, and reason, and freedom can penetrate. Adhere in general to the ancient plan, and especially to the court and colonnade; collect all the best models and patterns of native mouldings and sculpture; use brick of the finest quality from the School of Arts for the exposed surfaces; employ timber for the pillars within, Cuddapah stone for the pillars without, glazed tiles for the floors; make a liberal use of ornamental stucco and painting where the rain cannot penetrate; fill the unglazed apertures with the beautiful tracery of which Indian art offers an unrivalled variety. For glazed windows, authentic models may be wanting; but they can be treated in the spirit of the style; and the government architect can show you how. Get all your carpets from Vellore, and your stuffs from Madura and Tanjore. Where the Hindoo patterns fail you, borrow from the Mussulmans. Make a sparing use of European furniture, and endeavour to harmonise it with the native forms. But in doing this, make everything lofty, light, bright, spacious, and accessible. The task would not be easy, but it can be done; and every effort would be better than that which preceded it. Endeavour to realise this, that the Indian arts which you are at this moment casting away here, are at this moment, in London and Paris, an object of inquiry and study to the most learned and cultivated minds. Do not imagine that you are required to do anything unprecedented. All I ask you is to do has been done in Europe itself. In Europe, the ancient national arts were, for a couple of centuries, as much forgotten and despised by us as the ancient national arts of India are now forgotten and despised by you. You have hitherto imitated our errors, I call upon you to imitate us in correcting them. I may add that an admirable opportunity now presents itself for an intelligent revival of the domestic architecture of the Hindus, in the construction of a small palace at Bangalore for the residence of the young sovereign of Mysore. The building will be placed, I believe, in juxtaposition with the dilapidated but beautiful Durbar-hall, constructed in a mixed Indo-Saracenic style by Hyder Ali. There is no want of time, there is no want of money, and the authorities mainly concerned are an accomplished civilian and an accomplished soldier, Mr. Bowring and Colonel Malleson, both trained in the north of India, where secular and palatial architecture attained, under native government, the most exquisite perfection. I expect the result with curiosity.

* * * * * *

I now come to consider the forms of architecture introduced by the English in this country, which reflect the condition of art in England itself.

In an artistic point of view, the contemporary use of conflicting styles of building, or the abrupt addition and juxtaposition of modern styles of one type with older styles of another, is undesirable. The most conspicuous proofs of this may be seen in English cities at the present time, when one style is generally used for domestic and another for public and sacred structures; and where occasionally private houses of an unusual character are thrust into long rows of habitations of the familiar sort. We have private houses which, for convenience, I may designate as classical and Gothic churches, and here and there we see a mediæval house interposed among its classical neighbours. The horizontal and ascending lines are thus mixed up in our streets and squares, in a fashion which offends and perplexes the eye; decorations and details are not diversified, but discordant; buildings acquire the appearance of specimens or imitations selected capriciously from the examples of the past; art ceases to be the expression of any necessity or taste common to the age; and its harmonious development, in conformity with new social requisitions, is materially retarded. This state of affairs is the more deplorable, because it is unquestionable that our ancient national style of building, as it existed before the substitution of the classical for the Gothic forms, was equally available for secular and religious purposes, that it was susceptible of developments suited to modern life, and that it comprehended varieties of outline and ornament which would have defended it against the reproach of a tedious uniformity. The northern nations of Europe do not require more than one style of architecture, comprising, of course, the local and subordinate diversities which the use of stone, brick, or wood, opulence or poverty, exposure or protection, and similar secondary influences would naturally produce. Those nations have all naturally the same religion, the same institutions, the same climate, the same habits of life. It is more easy, however, to lament the existing confusion than to correct it. No one can predict to what issue we are drifting; no one can tell whether the prevailing chaos of taste will settle down into some new order, or whether the architectural anarchy is to last for ever.

The harmony of architecture, which might have been preserved in England, and, indeed, throughout all the nations of Germanic origin, could not have been expected in India, where, for centuries, two peoples, sharply opposed in religion, and distinct in many other respects, have occupied the soil, and where a third race and a third religion have recently been planted, in artistic antagonism with the others. Under these circumstances, contrasts were unavoidable, and my countrymen have done nothing to mitigate them. The English have simply transported to India the fashions and revolutions in architectural taste which have occurred at home, but following them leisurely and being always behindhand. We, too, live and work in one sort of building and worship in another. The ruling opinion at present appears to be, that the classical style is good for habitation, and the Gothic indispensable for prayer. I venture to dispute the first position, and I most earnestly deprecate the second.

It would be unjust and ungrateful to depreciate, in all respects, the buildings which we inhabit, and which for

the most part we owe to the liberality of a former generation. Many of the houses of Madras are constructed with due regard to the nature of the climate, and in proportions which far excel anything with which we are familiar in England. Some even indicate a higher cultivation and feeling in art, among the official architects, in an earlier period than is usually found among those of the present time. It must be admitted, however, that there is a mournful uniformity of design externally, a total absence of colour, and a disgraceful poverty of material; while the authoritative practice of this kind of building is not only at variance with all that India formerly produced, but, by the force of example, tends to pervert the tastes of the natives of this country. If the classic houses are bad, the Gothic churches are worse. The Gothic style of architecture, which was developed in a temperate climate, cannot be rendered appropriate to a tropical one, without modifications of structure, which only an accomplished and inventive artist could design. Of all the styles which possess a perfect mechanical development it is the most expensive. It demands the finest materials and the most delicate treatment; painting and sculpture, in their highest forms, are alike indispensable to its perfection; and though it may not absolutely exclude the use of brick, it is decidedly uncongenial to that material, the extensive use of which is so indispensable here. The ordinary style of a Gothic church in India may be seen in Blacktown or in Veperey—meagre, cheap, plaster counterfeits of the glorious originals, to which we affectionately turn in memory and in hope. I know that there are happier attempts. At Megnanapoorum, in the sand wastes of southern Tinnevelly, the energy of an enterprising missionary has raised a fabric in the Early English style, which would grace the plains of Suffolk or Lincoln, and in which I have heard 2,000 Tamil voices mingled in Christian psalmody. At Edeyengoody, the most learned pastor of the Shanars, but who counts his learning for nothing compared with the service of the Lord, trains the Indian mason in the arts of the northern craftsmen, and watches over the growth of a Decorated structure which will be the creation of his life and the monument of his ministry. Even the Roman Catholics at Dindigul and elsewhere are following the same track. I admire the piety of the founders, but I question the wisdom of the selection. I question the propriety of adopting the Gothic as the architectural type of Indian Christianity. It cannot be necessary, for Christianity flourished for a thousand years before the Gothic was invented, and for three hundred while the Gothic was in abeyance. It can scarcely be desirable, for the Gothic is remote from the forms of Oriental art, and from the traditions of the Oriental church. It may be objected that the notion of bringing Christian architecture into harmony with the native architecture of India is impossible, and that if it were possible it would be of no importance. I grant that it is not of any serious or vital importance. It is a mere matter of fancy, of taste, not one of policy or morals. But I do not admit that it is impossible, and I affirm that if it is not done, the blame, if such there be, must rest with the artists and not with art.

I have already submitted that the Mussulman style of architecture offers, for secular public buildings, all the conditions of beauty and utility that can be desired. As a matter of personal taste, I see no objection to the adoption of the same style for the private habitations of Europeans. There is nothing in that style incompatible with our habits and beliefs. It allows no images, it uses no symbolical ornaments, it possesses nothing that essentially fixes to any particular nationality or particular faith. The florid caligraphic inscriptions in the Persian and the Arabian characters, which occupy in this order of art the place of pictorial representations, can be dispensed with, or supplanted by the superficial linear combinations, which are equally sanctioned. The rest is mere form and colour. Mussulman art is essentially spiritual and universal. Englishmen might, however, in general, demur to live in habitations constructed in a style which is historically and conventionally, if not by any positive principle, associated with races of a different religion and different manners from their own; and it is certain that Christians cannot assemble for worship in a mosque. Where, then, is the method of reconciliation between native and Christian art? To what point of approximation can the European advance? The history of art supplies an expedient. It contains a style of building which is at once Oriental and Christian?

While the architecture of ancient Rome assumed, in the hands of the Mussulman builders, that beautiful transformation which we designate Saracenic, the Christians of the East worked out the same original forms in another but a cognate manner, which prevailed for a time over Northern Italy and Asia Minor, which assumed in Georgia a type peculiarly ornate and picturesque, and which became the basis of the national architecture of the Russians. It has been revived in various parts of Europe in our own day, under the general title of Byzantine. The Byzantine style, like the Saracenic, embodies, as its distinctive features, the arch and the dome, while the slender separate campanile in the first answers to the minaret in the second. The arch has rarely if ever assumed, as far as I remember, in the hands of the Oriental Christians, when used constructively, the pointed or the horse-shoe shape; but when used decoratively, it offers, in its superficial combinations and intersections, many resemblances to the Saracenic forms, resemblances which are still more apparent in the minor details of mural ornamentation. The two styles have ever retained a certain family likeness, and the common possession of the dome constitutes a capital point of union. While the Byzantine style of building is perfectly adapted for every domestic purpose, I need scarcely say that, in the hierarchy of Christian styles, it occupies the most venerable place. It was the first Christian style, nor has Christianity formed a finer since. To the Anglican it presents the image of those primitive centuries in which our Church loves to trace the patterns of our faith and ritual. To the Roman Catholic, the architecture of St. Mark's can never be repugnant. To the Protestant bodies generally, it furnishes forms more simple than the Gothic, more suited to great congregations and to oral teaching. The question is a speculative one, and many might deprecate, in our present position, another innovation. But to me the Byzantine style seems to offer the best architectural type for Christianity in India—a type sufficiently distinct, yet most in harmony with one capital section of the ancient monuments of the country.

THE WANTS AND MEANS OF INDIA.

Sir,—On the 27th July, Mr. Dadabhai Naoroji read a paper, under the auspices of the East India Association, in the Great Room of the Society of Arts. I was unable to say what I should like to have said on that occasion, and venture to hope that you will allow me to make some remarks in the *Journal*. The paper was entitled "The Wants and Means of India," and proposed the following question:—Is India at present in a condition to produce enough to supply all its wants?

These were stated to be:—

1. Sufficient food, clothing, and shelter for the whole population, to keep it in a healthy condition.
2. Sufficient to provide for all its social wants, arising from various social duties and positions.
3. A sufficient saving by each individual, and of the wealth of the nation generally every year, to meet any unforseen contingency of natural calamity.
4. Means for improvements, or new public works.
5. Means to pay for the high price of foreign rule, which causes a great and continuous drain, in consequence of the amount withdrawn from India to the extent of £10,000,000 annually.

I shall not dwell upon the first four points, concurring as I do with the writer, that they are common to all nations. I would only remark that that nation whose people neglect, by means of self-help and self-exertion, to provide themselves with a sufficiency of everything alluded to in those four points, may expect nothing but troubles and calamities as the inevitable result. Before entering into details, allow me to say generally that the word "foreigner" or "foreign rule," occurs too often in the paper, and in a way which sensitive parties might term invidious. It is calculated to give a tone to the whole paper which does not harmonise with the kindly feeling of the writer, and with the spirit of common brotherhood which ought to exist between Indians and Britons, whose interests are mutual.

"The ten millions—the means to pay for the high price of foreign rule—which causes a great and continuous drain, in consequence of this amount drawn from India, to the extent of ten millions sterling annually (quoting from the first paragraph). The whole question of the existence of a foreign rule depends upon this peculiar circumstance. No foreign rule can maintain itself unless it manages to enable the country to produce, not only sufficient for the ordinary wants of a civilised nation, but also for the price of the foreign rule itself. If the foreign rule fails to produce this result, its existence is naturally felt as a crushing burden to the nation, and either starvation, recrimination, and poverty, or rebellion against the foreign rule is the inevitable consequence." Thus, we find, in the first paragraph, the term "foreign rule" repeated not less than six times.

If this is not the language of one who feels that he belongs to a conquered nation, and not only that, but that the conquerors and the conquered have never been reconciled on a satisfactory basis of "reconstruction," I am greatly mistaken. It is like the old cry of "absenteeism," spending in a foreign land that wealth which is made in India, and ought to be spent in India. Now, this line of argument on the part of the natives of India is very natural, and were it not that it is based upon a fallacy it would be very just. The fallacy will develop itself as we proceed. With regard to blaming the finance minister or the Viceroy for not producing "something out of nothing," I quite concur; and I would remark that it is useless to throw the blame on any official when it is the whole system that is wrong. With due respect, I am of opinion that the writer is labouring under a delusion when he finds fault with Europeans for holding India stock, for if the natives will not embark in loans to the Indian government, for the purpose of public works and reproductive improvements, how is it likely that Indians can produce "something out of nothing," unless Europeans or some one else find them the money? And if they find the money, surely they are justly entitled to receive interest? All other States are only too glad to come to London when they require twenty or thirty millions for such purposes, especially the United States, whose agents for railway bonds or five-twenties are to be counted by hundreds in all our seats of industry.

But the United States have a wise, far-seeing "Waste Land Law," which attracts the flower of our artisans and labourers, and this again is what creates a demand for capital; and I need not say that the wedding of labour to land by such means enables the Americans to create "something out of nothing," simply by making twenty blades of grass grow where none grew before (put cotton for grass, if you like.) And, as Mr. Naoroji says (page 5), this is the way the Americans are "regaining their lost ground, producing three million bales this year, and likely to give three and a-half millions next year, and hope to produce five millions before five years are over." This quotation speaks volumes, and ought to "point a moral in the minds of our legislators, if wisdom dwells therein."

In 1862, I wrote to the papers, pointing out that America's folly was India's opportunity, for a more criminal folly than that war could not well be imagined. Since then, India has had more than five years. Yet she has not increased but rather diminished her production during the latter part of this period. Considering this fact, viz., that at the close of a devastating war, which, according to official estimate, destroyed no less than £1,800,000,000 worth of property, and half a million pairs of hands which (according to American computation) is equal to £500,000,000 more, I say, consider these facts, and in connection with the position of the two countries at the starting-point in 1861 to the present day, and let us try to find out what it is that prevents India from becoming "one of the most prosperous portions of the earth's surface."

Mr. Grant Duff, with his three and a-half millions a-year "spent and lost" in making railways, will never be the man to make India regain her lost ground in the race with America.

If India had been at this moment sending to Europe this five million bales of cotton, she would be getting back from Europe 50 millions sterling at least. What would become, then, of the cry about sending out of the country 10 millions for "foreign rule?" There would then be no complaint that India was exporting more than she was importing, when in one article alone (cotton), she multiplies her wealth by five annually, to say nothing of jute, tea, silk, coffee, sugar, rice, linseed, hides, flax, wool, &c., &c., for it should always be borne in mind that by irrigation you not only increase the amount per acre of cotton, but of all other produce. Thus, the operation of irrigating the country in India, is like the operation involved in the ancient Egyptian proverb, "Cast thy bread upon the waters, &c."

Mr. Naoroji has quoted Mr. Mill, and he has given quotations from a paper read by himself, which appears in the Association's journal; he has given us figures innumerable to prove that India is the poorest country in the world, which is quite true. Indeed, so poor is she that infanticide is become a settled institution, with a view to avoid death by famine. But Mr. Naoroji, I submit, is not quite consistent in dealing with the remedy for this state of things. In page 2 of his paper he complains of foreign loans as being, in the shape of interest, "heavy weights in its rage for prosperity;" and, at pages 10 and 11, we find he agrees with Sir B. Frere's system, which is a system of State loans for public works. I regret he did not quote from Sir Arthur Cotton's papers, in order to show that, whether by government or private enterprise, if India is to regain her lost ground in the race with America, it must be, first, by a sound system of wedding labour to land, as in America, where last year (1869) above 60,000 homesteads were carved out of the prairie or jungle; second, by a grand system of irrigation works; third, by water transit, as suggested by Sir A. Cotton; and fourth, when she can afford the luxury, a grand and comprehensive railway system. As to "natural agents, waste lands," now for the way how to do it. This will be found in a paper read by your humble servant, entitled, "An Indian Policy for the New Reformed Parliament," in the Society's Room, February 1st, 1868, and printed in the Association's journal, in the discussion of which an old Indian (Mr. Sloan) spoke as follows:—He said "he thought Mr. Briggs should have gone further, and proposed that some action should be taken on the course pursued by Sir C. Wood with reference to the steps taken by Lord Stanley. When the waste land rules first came out to India, everyone hailed them as the greatest boon that could be conferred upon the country, and almost every individual, whether in the government service or engaged in trade, looked forward to investing his savings in land. Englishmen in India, from the difficulty of acquiring anything like a landed estate, never thought of looking upon that country as a permanent residence; and the money that would have been expended in India, if they had had opportunities afforded them of beneficially investing their savings in India in land, was brought to

England. Lord Canning framed a set of rules, which were afterwards set aside by Sir Charles Wood, and great indignation existed in India at the time when Sir Charles Wood's dispatch came out. Many individuals who were prepared to purchase land, and who had gone to all the expense of preliminary surveys, &c., found that the lands were to be put up to auction, and individuals who had undergone no expense in making the selection, were allowed to bid over the heads of those who had. This policy discouraged people from purchasing land. In Madras, for miles and miles together, he (Mr. Sloan) had travelled through a country of rich virgin loam, which would yield the highest return if the soil were cultivated; but no inducement was held out to capitalists to enter upon its cultivation." Again, he said, "Had Europeans been encouraged to become settlers in India, the mutiny would never have assumed the magnitude it did." Such is the opinion of men who have spent a lifetime in India.

The chairman for the time being (Colonel French) said "he had taken a great interest in the question of allowing the ryot to redeem his rent-charges. When that desirable state of things was brought about, he thought, with Mr. Briggs, that means would be found to carry on a vast improvement in India. But with regard to the waste lands, he (Colonel French) thought they should be put up to auction, and sold to the highest bidder. He hoped that the subject would be resumed on a future occasion, as it was a most important one as regarded the stability of our rule."

Now I take this to be a fitting opportunity to bring forward this vital question of waste lands. It is very natural for a practical, good business man, or any individual of good, sound common-sense, or even a local corporation, to say (as Colonel French actually did say), "If a man fixed his eye on a plot of ground, and made a tender to government, the government might very fairly say, 'We will not sell this to you in a hole-and-corner fashion; we will not deprive the revenues of the amount which might be paid by another in excess of the sum which you are prepared to give." I repeat, that it is quite right and fair, and consistent with good business principles, for individuals in dealing with property to act thus. But, as the sequel has painfully proved (to the minds of all sound observers), it is anything but right, anything but just and economic, and it is very undignified for a government or ruler of a vast and populous country like India, where the land is lying waste for thousands of square miles, whilst the people are periodically dying by hundreds of thousands for want of the common necessaries of life.

It is a penny-wise and pound-foolish policy for the rulers of such a country to turn paltry hucksters, not only of the land, but of the produce thereof. For instance, where is the economy in hugging the six or seven millions of opium revenue at the fearful cost of depriving the people of bread, and losing the 50 millions that would be received from cotton alone. The rulers of such a country are the trustees of the lands only, and have no right to assume the functions of absolute owners. Their functions consist in providing a sound code of laws for the alienation of the unoccupied waste lands to the proper subjects of the country, and in seeing it administered justly and honestly, that the earth may be cultivated and bring forth her increase, so that all classes of producers, while pursuing their personal profit, may confer a benefit on the country at large. When this code is passed, and the battle between the railways *versus* steam-ship canals is fought out, Sir B. Frere may then work out his scheme successfully. Private enterprise will then see safety in embarking, and will be real, and not "sham." We may then, and not till then, expect (Mr. Mill), "firstly, better government, moderate taxes, a more permanent and more advantageous tenure of land, securing to the cultivator the undivided benefits of the industry, skill, and economy he may exert; secondly, improvement of the public intelligence, the decay of usages or superstition which interfere with the effective employment of industry, and the growth of mental activity, making the people alive to new objects of desire; thirdly, the introduction of foreign arts, which raise the returns derivable from additional capital, &c., which renders the increase of production no longer exclusively dependent upon the thrift or providence of the inhabitants themselves, while it places before them a stimulating example, and by instilling new ideas and breaking the chains of habit, if not by improving the actual condition, tends to create in them new wants, increased ambition, and greater thought for the future."

The operation of enforcing taxation will then be no longer like that of "tearing a shirt from a naked man's back," and "difficulties and discontent will vanish in time." The people, as a mass, will set their affections on the government, which will then be no longer considered a "foreign ruler;" mutual confidence will be established, so that the plough will take the place of the sword.

As regards Mr. Taylor's proposal, I would support it with all my might if I thought anything would come out of it. I am still of opinion, as I expressed it two and a-half years ago, in the paper alluded to above, that this is a question of such vast importance, that the people, the press, and Parliament cannot fathom it, and the consequence is they one and all shirk it. This Society, if it expects to succeed, must issue a decree throughout the length and breadth of England, Ireland, and Scotland, showing the nature of the question, with strict injunction to all voters not to vote at the next election for any one who does not take an interest in settling this question, without regard to "Liberal or Conservative," or any other party cry, save the interest of the commonwealth. I am, &c.,

THOS. BRIGGS.

The Homestead-house, Richmond.

THE REVISED CODE AND ELEMENTARY SCHOOLS.

SIR,—The letter of a "Teacher," from the *Birmingham Gazette*, in your last number, deserves, and will I hope receive, the most earnest attention. As having, for many years last past, carried out a scheme of examining village schools by papers, and in some years as many as forty-five schools, in four or more different counties, on the same day and under the same conditions, I can bear the testimony of experience to the practicability and efficiency of the scheme which he recommends, expressing my entire assent to the general outlines of the plan. There are some of the details in which I should differ from your correspondent. That he may see that I have fully entered into his propositions, and that I may clearly set forth my own ideas on the subject, I take his proposals in the numerical order in which he has placed them, and consider them:—

"1. The examination of all elementary schools in the country (both day and evening schools) in writing, spelling, and arithmetic, should be conducted on one day in each year, between certain hours, by means of papers sent down from the Privy Council Office."

This proposition will be startling to many—"all the elementary schools in the country examined in one day in each year, between certain hours." I do not believe it to be at all impossible, if it were entrusted to a sufficient staff in each county, under the supreme control of the Council Office; but I doubt whether it is either necessary or expedient. If different sets of questions (for I suppose it to include not merely the "three R's," but general school knowledge) were issued, as he proposes in No. 5, and a requirement exacted of the managers, as a condition of any grant, that they returned all the papers of questions, and certified that no copy had been allowed to be taken, there would be no fear of

copying, and they might use all the same papers under certain conditions of fresh numeration, which I will mention under No. 5, and then hold the examination in any week or fortnight they might select, having the choice of day to suit the convenience of the managers.

Nos. 2 and 3, as proposed by "Teacher," namely, that:—

"2. The managers of schools, with perhaps one or two other persons associated with them, should be responsible for the proper conduct of the examination.

"3. Girls and boys in the same standards should be examined in the same room. Two or more small schools might be grouped together for convenience."

require little or no comment, except only that care should be taken that neither the teacher, *i.e.*, the master or mistress, should be a manager, or even present, except, perhaps, to preserve order.

On No. 4, which runs thus:—

"4. The post-master of the nearest post-office should deliver to and receive from the managers, at specified times, the packets of papers."

I would only say that it would not be necessary to impose any extra duty on the post-master. The packet would be sent by post as the copies now are of the Department of Science and Art, and by the post, and the first post (the evening post) on which the exercises are worked they must be returned, attested by the managers, to the Council Office.

No. 5, which is an important proposal, runs thus:—

"5. To prevent the possibility of copying in the examination, every exercise in the same school should be different from every other. But every scholar throughout the country having the same number on his school register would have the same exercises."

It would be very simple so to number the papers as almost to prevent the possibility of copying. I will suppose twelve sets of questions, or even a less number would be sufficient; Nos. 1, 11, 21, &c., up to 90, being the same; Nos. 2, 12, 22, 32, to 92, &c., being the same. The children in each school would be numbered and placed according to their numbers, and then the letter from the office should say what No. should be given No. 1, say 35, and that the rest should follow on accordingly. The arrangement of this in standards or classes would of course be equally easy, and we should thus attain an examination up to any age the candidate wished, and get a recognised standard, which I fear we shall never attain by any of the voluntary examinations. I take it for granted that a certificate would follow the examination, and such a certificate as everybody would respect, doing away to a great extent, if not entirely, the necessity for the Civil Service Examinations, and putting everybody in the position which he ought rightfully to occupy.

I will not quote Nos. 6 and 7, because I think in the foregoing remarks I have assented to them, and, according to my own views, provided for them. I do not think it of so great importance to establish the value of the teaching of different schools, as it is to secure to the individual the value of his examination by certificate. The rest will of course be readily known, and the schools will feel the value of their teaching in the money payment they receive in accordance with it. There are two other points on which I should like to add a few words—First, on the visit of the inspectors, which is very important, but I should like to see it confined to the general tone and condition of the school on his visiting it, and make an inquiry whenever and as often as it may please him; with the examination, except simply as to these points, I would not trouble him. Let him take the number in school the day he visits it; let him see the managers, and if thought right, examine, so as to satisfy himself, any of the lower classes, but leave all above ten years of age to be examined on paper. If we know what the school is above that age, it is not difficult to say what it is below. My second point is, a word in favour of retired schooolmasters, for whom the setting the questions and looking over the answers would afford employment. A Board of this kind would very easily get through its work, and would provide an honourable post of retirement for those who have worked hard in their country's service. It might afford, at the same time, a reward, if fairly and judiciously managed, for those who have been most successful in the examinations.

I press these thoughts and considerations on the Society of Arts, and through the pages of its *Journal*, because it has been so long and so honourably distinguished in the promotion of the cause of education. I worked long and cordially with its excellent and devoted agent, Mr. Harry Chester, and wish that he could have lived to see the fruit of the seed sown by him. Let us be thankful for the success achieved, and now turn all our thoughts and hopes to the utility of it, that the country may derive all the good it so richly deserves from the prolonged and wearisome discussions of last session.—I am, &c., S. Best.

NEW BOOKS.

Perpetuum Mobile: or, a History of the Search for Self-motive Power from the 13th to the 19th century, with an Introductory Essay. By Henry Dircks, C.E. Second series. Cuts and plates. Crown 8vo., cloth, 9s. (E. and F. N. Spon.)

In the Press.

Tales of Old Japan. Translated by Capt. A. B. Mitford, attaehé to to the British Embassy at Jeddo. With illustrations by Japanese artists. (Macmillan and Co.)

Professor Seeley's Lecture and Essays. (Macmillan and Co.)

Fine Art; a sketch of its history, theory, practice, and application to industry, being a Course of Lectures delivered at the University of Cambridge. By Sir M. Digby Wyatt, M.A., Slade Professor of Fine Art. (Macmillan and Co.)

The Sun. By Balfour Stewart, LL.D., F.R.S., and J. Norman Lockyer, F.R.S. (Macmillan and Co.)

The Beginnings of Life, including an account of the present state of the "Spontaneous Generation" Controversy. By H. C. Bastian, M.D., F.R.S., Professor of Pathological Anatomy in University College, London. (Macmillan and Co.)

The Depths of the Sea, an account of Investigations conducted on board H.M. Ships *Lightning* and *Porcupine* in the years 1868–69, under the scientific direction of W. B. Carpenter, M D., F.R.S., J. Gwynn Jeffreys, F.R.S., and Wyville Thomson, LL.D., F.R.S. Edited by Dr. Wyville Thomson. (Macmillan and Co.)

A Treatise on Magnetism, designed for the Use of Students at the University. By G. B. Airy; Astronomer Royal. Crown 8vo. (Macmillan and Co.)

An Introduction to the Osteology of the Mammalia, being the substance of the Course of Lectures delivered at the Royal College of Surgeons of England in 1870. By W. H. Flower, F.R.S., F.R.C.S., Hunterian Professor of Comparative Anatomy and Physiology. (Macmillan and Co)

A Handbook to Beethoven's Nine Symphonies for Amateurs. By George Grove, Secretary to the Crystal Palace Company. (Macmillan and Co.)

New Volumes of the School Class Book Series:—Elementary Lessons in Logic, deductive and inductive. By Professor Jevons. 18mo. Elementary Lessons in Physics. By Professor Balfour Stewart, LL.D., F.R.S. (Macmillan and Co.)

OBITUARY.

John Brocklehurst died on Saturday, August 13th, in London. He was born in October, 1788, and received his education in the Old Grammar School, King Edward-street. In the year 1812, after some probation, he was placed by his father in partnership with his brother, Thomas Brocklehurst, Esq., of the Fence. Having from the commencement of their business career the command of an ample fortune, the firm made rapid progress, and became the largest silk-manufacturers in England, working eight mills, and employing, at one time, upwards of 5,000 hands. Mr. John Brocklehurst made the silk-trade his special study;

and, although a free-trader, so far as the necessities of life are concerned, he fancied that silk might be regarded in the light of a luxury, and that as on its first introduction into this country it had received the fostering care of the government, it must, if it were to continue its success, be largely protected. Hence we find that when, in 1824, there was a contemplated interference with the protection it had hitherto received, he strongly remonstrated with the government and the Board of Trade. In 1826, Mr. Huskisson's first reduction of the duty on imported thrown silk came into operation, and Mr. Brocklehurst, fearing that it was the forerunner of a disastrous policy, sought frequent interviews with ministers of the day, and protested to the Board of Trade against the unfairness of thus commencing their free-trade policy on an article of luxury, which he contended ought to be taxed for revenue, and that the imports of food and the necessaries of life ought, first of all, be removed. Mr. Huskisson admitted, it is said, that Mr. Brocklehurst's views were legitimate, but stated that it would be vain to attempt any alteration in the corn laws as they existed. In 1832, he succeeded in inducing the government to grant a select committee to examine into the state of the silk trade. Mr. Brocklehurst was always an advocate for the spread of education, especially among the working classes, and several of the societies of Macclesfield were founded by him. Mr. Brocklehurst was elected member of Parliament for Macclesfield at the passing of the Reform Bill, in 1832, and was elected a councillor in the corporation on the passing of the Municipal Reform Bill, on the 31st December, 1835, also one of the aldermen on the same day. He had, therefore, been 35 years an alderman of the borough, while he represented the town in Parliament 36 years, namely, from the 14th December, 1832, to April, 1868. Mr. Brocklehurst became a member of the Society in 1838.

Joseph Feilden, died on Monday, at Witton-hall, near Blackburn, at the age of 79. He was lord of the manor of Blackburn, which town he represented in Parliament from 1865 to 1869, when he was unseated, on petition of supposed intimidation. The prosperity of Blackburn is mainly due to the spirit and enterprise of the deceased gentleman. Mr. Feilden was a county magistrate for more than half a century, and a member of the Society of Arts since 1857.

EXHIBITIONS.

Fine Art Exhibition at Bradford.—An art exhibition was opened on the 17th August, by Lord F. Cavendish, M.P., in the Congregational School, at Great Horton, Bradford. There were about six hundred pictures exhibited, and a large variety of curiosities from Australia, Japan, China, America and Africa.

Cordova Exhibition.—The preparations for the Argentine National Exhibition at the city of Cordova are in active progress. The building is approaching completion, and the tramway to connect it with the railway station has been commenced. The tramways in the city have experienced great success, and caused an amount of building speculation in the suburbs beyond the available supply of labour. Several important railway proposals, involving prospective loans of magnitude, are under discussion in Congress.

GENERAL NOTES.

New Zealand's Progress.—The quarterly return of revenue, to 31st March last, showed that the total imports amounted to £1,378,127, and the exports to £1,989,219. The gold exported was valued at £616,608; the wool at £1,134,824; the grain shipped to other colonies at £20,381; the flax at £39,134. The ships entered inwards were 201; outward, 199. The population of white faces, or *pakehas*, amounted to 237,249, further outweighing, by about four to one, the natives, so that war may be said to die out by effluxion of time.

Explosive Compounds.—M. A. Noble, a Parisian engineer, has taken a patent for improvements in the composition and fabrication of explosive compounds for mines. It is to be hoped that some day means may be found to utilise without too much danger the terrible power of nitro-glycerine. The success which has been achieved with steam, which caused at the outset such deplorable accidents, aids the hope to a certain extent. M. Noble seems to have made an important step in the right direction, as regards the use of nitro-glycerine for mines. The following shows the composition of two types of his powder:—(1) Sixty-eight parts of pulverised nitrate of barytes; twelve of charcoal, of light texture; twenty of nitro-glycerine. (2) Seventy parts of barytes, as above; ten of powdered resin; twenty of nitro-glycerine. The charcoal should be carbonised at a low temperature, and consequently still containing hydrogen. An addition of five to eight per cent of sulphur to either of the above mixtures gives a powder which fires more briskly, but, at the same time, it increases the danger in the manufacture, carriage, and application of the powder, which should not be lost sight of. The method of using these powders is to place them in cartridges like firework-cases, covering the powder with a little fulminant, such as mercury, for example, before closing and priming. The cartridge has merely to be placed in the hole, and covered in the usual manner, and it may be fired either by a fuse or the electric spark; in either case, the fulminating powder acting on the nitro-glycerine inflames the whole of the contents instantaneously. To render carriage of the cartridges less dangerous, a little ordinary gunpowder may be substituted for the mercurial fulminant.

The British Assoociation.—The fortieth annual meeting of the members of the British Association for the Advancement of Science will be held at Liverpool, on Wednesday, the 14th inst. Professor Huxley will assume the Presidency, and deliver the inaugural address. The following sectional arrangements are now announced:—A.—Mathematical and Physical Science (in the Crown Court, St. George's Hall): President, J. Clerk Maxwell, F.R.S.L., and E.; Secretaries, Professor W. G. Adams, W. K. Clifford, Professor G. C. Foster, F.R.S., Rev. W. Allen Whitworth. B.—Chemical Science (in the Royal Institution, Moore-street): President, Professor Henry E. Roscoe, Ph.D., F.R.S., F.C.S.; Secretaries, Professor A. Crum Brown, F.R.S.E., F.C.S.; A. C. Fletcher, F.C.S.; Dr. W. J. Russell, F.C.S. C.—Geology (in the Concert Hall, Lord Nelson-street): President, Sir Philip de Malpas Grey Egerton, Bart., M.P., F.R.S., F.G.S.; Secretaries, W. Pengelly, F.R.S., F.G.S.; Rev. H. H. Winwood, F.G.S.; W. Boyd Dawkins, F.R.S., F.G.S.; G. H. Morton, F.G.S. D.—Biology (in the reading-room and lecture-room of the Free Public Library): President—Professor G. Rolleston, M.D., F.R.S., F.L.S.; Vice-Presidents—John Evans, F.R.S., F.G.S., F.S.A.; Prof. Michael Foster, M.D., F.L.S.; Secretaries—Dr. T. S. Cobbold, F.R.S., F.L.S.; Thos. J. Moore; H. T. Stainton, F.R.S., F.L.S., F.G.S.; Rev. H. B. Tristram, LL.D., F.R.S. E—Geography (in the small concert-room, St. George's Hall): President—Sir Roderick I. Murchison, Bart., K.C.B., D.C.L., LL.D., F.R.S., F.G.S.; Secretaries—H. W. Bates, Assist. Sec. R.G.S.; Clements R. Markham, F.R.G.S.,; Albert J. Mott; J. H. Thomas, F.R.G.S. F.—Economic Science and Statistics (in the Council Chamber, Town Hall: President—Prof. Jevons; Secretaries—E. Macrory; J. Miles Moss. G—Mechanical Science (in the Civil Court, St. George's Hall): President—Charles Vignoles, C.E., F.R.S., M.R.I.A., F.R.A.S.; Secretaries—Pe Le Neve Foster; J. T. King.

Paving Streets by Steam.—A steam-paving machine has recently been introduced in Paris, and made use of by the municipality for the repair of the streets of that city. This machine consists of a small steam-engine on wheels, drawn by one horse, to the rear of which is attached the "pavior," which is forced upon the ground by a blow from the piston, and slides on a bar some six feet long, and can thus be directed by the driver to any stone which requires forcing home. The machine was lately at work in the Rue de Grenelle, and is considered a success.

The Select Committee on the Tramways Bill.—The following are the settled resolutions of this Committee:—1. That provisional orders be substituted for certificates. 2. That the consent of ratepayers be not required in boroughs governed by a municipal council. 3. That the consent of such municipal council be given at a special meeting, at which two-thirds of the members shall be present. 4. That local inquiries by the referee of the Board of Trade be at the discretion of the Board. 5. That the Board of Trade, after considering objections, shall have power to proceed with the provisional order, notwithstanding that certain of the local or road authorities refuse their consent, and shall report to Parliament their reasons for the same. 6. That clause 5 of the Bill conferring powers of sale upon the promoters be omitted. 7. That the provisional orders shall specify the nature of the traffic for which the tramways are sanctioned. 8. That the maximum tolls be inserted in the provisional orders. 9. That the Metropolitan Board be the local authority of the metropolis, except for the City; but the consent of the vestries be necessary as road authorities, subject to resolution 5. 10. That a *locus standi* be reserved for the owners and occupiers of property fronting a road or street through which it is proposed to construct a tramway, to appear before referees at any local inquiry directed by the Board of Trade, and also before Parliament. 11. That power be given to local authorities to make bye-laws for the regulation of traffic, and for licensing drivers and conductors of vehicles. 12. That power be given to local authorities to remove tramways found injurious or disused. 13. That the Bill be extended to Scotland.

New Salt for Intense Electric Currents.—M. Etève, of Paris, has taken a patent for the composition of a salt for the production of very intense currents of electricity, which he calls double acetate of iron and potash. The inventor claims to remedy the inconvenience arising from nitrous exhalations disengaged from solutions of nitric acid, in the following manner:—The nitric acid is replaced by a salt composed of one part of sulphate of protoxide of iron and one part of nitrate of potash, dissolved in a sufficient quantity of the ordinary acetate of commerce, the solution being aided by a slight heat; the whole is then left to cool and crystallise, and the crystals, after being drained, are stone-dried. When the salt is thus prepared, the pile is mounted in the following manner:—In the non-porus vessel is placed a saturated solution of common salt, and a zinc cylinder is introduced, within which is placed the porous vessel containing the charcoal, upon which is poured water containing 30 per cent. of sulphuric acid. In this state the pile will not act, or in an almost insensible manner; but, in order to develop the current, it is only necessary to introduce a few crystals of the above-named double salt, when the current becomes remarkably intense, if not superior to that of the common pile; the current may be maintained constantly and regularly without by merely adding a few crystals from time to time, and without any nitrous vapours being disengaged. M. Etève believes that his salt is a double acetate of iron and potash, but a writer in the *Moniteur Scientifique* objects to this, and says that if small quantities of this salt are formed, as is probable, with the aid of the acetic acid, the greater part consists of two sulphates and two nitrates of potash and iron. He believes that the activity of the salt in question arises from the fact that the small quantity of the acetate of protoxide of iron, finding itself in the presence of a nitrate of the same metal, becomes peroxidised; heat as well as electricity will bring this about. This is the salt that has proved of so much value in the dyeing of black silk, and which is improperly called nitro-acetate of iron. All who have attempted to reduce nitro-benzine by ferrous acetate know how rapidly this converts nitric acid into ammonia. Gun-cotton may also by it be brought back into the natural state of cotton. It is, therefore, quite natural that no nitrous vapours should be evolved from a pile fed by such salt. Perhaps nitrate of soda might be substituted for nitrate of potash with economy.

Tower Subway.—The difficulties of the subway under the Thames, from Tower-hill to Vine-street, have now been successfully overcome, and the trains are running with perfect regularity, making every day, except Sundays, twenty trips per hour. The line has been open from the 2nd inst. Mr. Barlow, the engineer, states, in the report of the company just made, that at first some difficulty was experienced on account of the new resistances to be contended against by carriages propelled under such novel circumstances; but these have been successfully dealt with. The carriage and the lifts at each end are now worked with perfect ease and regularity.

Newspapers to Paupers.—At the usual meeting of the St. Marylebone Board of Guardians, held at the workhouse, Northumberland-street, Mr. Braess, presiding, Mr. Hodgson Pratt moved that the clerk to the board be directed to place himself in communication with the secretary of the Metropolitan Railway, for the purpose of obtaining the sanction of the company to the placing of a box at the Baker-street Station, for the reception of any newspapers which passengers may be disposed to deposit therein for the use of the inmates of the workhouse. He remarked that if they obtained the permission he asked, they would obtain enough papers to supply all the aged and infirm. Mr. Harlow having seconded the motion, it was carried unanimously.

International Scientific Relations.—Dr. A. Boué, in *Les Mondes*, calls attention to the fact that a great many scientific publications of the northern and easterly parts of Europe remain, unfortunately, almost unknown, save in the countries where the languages (Swedish, Danish, Finnish, Lithuanian, Russian, Czech, Slavonic, Magyar, Polish, Neo-Greek, and Roumanian, to which may be added Dutch) in which they are published are vernacular. The author proposes that it would be an advantage if, for each of these publications, either a full translation or an abstract of the papers were simultaneously published in French, English, or German.

Irish Flax.—In a recent speech, the Lord Lieutenant said:—It is of great importance to encourage the growth of this product, and I think that the encouragement by the government, during past years, has been attended with the best results. I believe that what is more wanting, and which must precede the general introduction of a new crop, is the more general knowledge of land throughout the country. All new crops require very great agricultural care and skill in their production. Flax requires great knowledge to select the seed, to prepare the land, and to select the rotations that should come, and other agricultural knowledge requiring great agricultural skill. I believe that the west and south of Ireland are admirably adapted for the growing of flax; but I do not expect that it will be generally cultivated until there is a general improvement in the cultivation of the country. If that takes place, I feel sure you will be doing an immense amount of benefit throughout this country. The northern merchants would prefer home flax to flax grown in Belgium and Holland, and I believe that Irish land is able to produce, and that Irish land is able to compete successfully with the flax-growers of Belgium and Holland.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 9, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF INSTITUTIONS.

Albert Memorial Night School.—The annual exhibition of horticultural and industrial produce, in connection with the Albert Memorial Night School and Industrial Institution, Weston, was held in the schoolrooms on Thursday, August 4th. The distribution of prizes took place in the evening, at the Town-hall, in the presence of a large number of spectators. The Rev. W. W. Rowley, president, occupied the chair.—Major-General Gore Munbee, in addressing the meeting, pointed out that the object and aim of the institution was to diffuse knowledge amongst boys of a certain class, who were not able to attend other schools, and who attended the night school at times when they were likely to be led astray with many temptations. The lads were taught to read, write, and cipher, and many kind friends were good enough to instruct them in other branches of education. They prepared their minds by book learning for their respective stations in life, and the superintendent, by practical illustrations, taught them many things which they would not be able to acquire by reading. Attached to the institution was a workshop, and a number of garden allotments—the fruits from both of which had been on view that day. In the industrial department they had seen many specimens of the handicraft of the lads, whilst in the garden department were productions which showed that the boys had been taught how to increase the food of this great country. The end and aim of all temporal objects in this life was for them to deserve that blessing which he trusted would be inherited by all hereafter. He then proceeded to speak of the certificates that had been obtained by lads from the Society of Arts in London through the Weston branch—of which the Albert Memorial Night School had taken advantage. Although held at the school, it was by no means confined to its scholars, it being open for anyone in the town to compete for certificates and prizes.—The Chairman observed that, in addition to the certificates distributed by General Munbee, three lads of the school had gained certificates in the second grade for freehand drawing, in connection with the Art Department of the Kensington Museum.—Dr. Swete said the foundation stone of a new museum and superintendent's residence had been laid during the past month, and ere long the whole scheme would be complete and in working order.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The Council of the Institution of Mechanical Engineers have recommended the following gentlemen to act as a committee, to secure an adequate representation of mechanical inventions in the Exhibition of next year:—Sir William Fairbairn, Sir Joseph Whitworth, Mr. John Anderson, Mr. Charles F. Beyer, Mr. Frederick J. Bramwell, Mr. Thomas Hawksley, Mr. John Hick, M.P., Mr. Walter May, Mr. William Menelaus, Mr. John Penn, Mr. John Platt, M.P., Mr. John Ramsbottom, and Mr. C. W. Siemens.

CONDITION OF THE INDUSTRIAL CLASSES IN FOREIGN COUNTRIES.

The following tables are compiled from reports from her Majesty's diplomatic and consular agents abroad, respecting the condition of the industrial classes in foreign countries, ordered by the following circular:—

Foreign-office, April 30th, 1869.

My Lord (Sir),—I have observed with pleasure the care and ability with which her Majesty's secretaries of legation have drawn up their reports, and which have secured for those documents notice and approval on their being made public in this country. These reports, however, relate, as you are aware, generally to matters of an economical and financial character, but there are other subjects on which the secretaries will be in a position to furnish information, on points connected with questions which have great public interest at the present moment.

The points to which I allude are those which connect themselves with the position of the artisan and industrial classes in foreign countries; such, for instance, as the proportion which the number of those so employed bears to the other classes, the description of houses or lodgings generally occupied by them, the nature of their engagements with employers, the rates of wages received by them (explained in British currency), and any information as to the state of the labour markets, explaining whether they present openings for the introduction of labour from without, or the reverse.

Information on these points will be most useful in this country, as exhibiting the condition of labour in other countries, when compared with those which exist in the United Kingdom, and as serving to indicate possible openings of which the skill and enterprise of the labouring classes may take advantage.

I have accordingly to request that you will direct the attention of the secretary to your legation to these subjects, and to state to him that it is my wish to receive from him a report on the subject. In order, however, that the information to be comprised in such a report may be as complete and accurate as possible, I shall be satisfied if these reports are forwarded so as to reach this office not later than the close of the current year, in time to be presented to Parliament in a collected form at the opening of the session of 1870; and I have only to add that it will generally be desirable, in compiling them, to embody any information collected from printed documents on the subject, rather than to forward the documents themselves, which, if published with the reports, must materially increase bulk and involve the expense of translations.

I am, &c.,

(Signed) Clarendon.

CONDITION OF THE INDUSTRIAL

Name of country.	No. of persons belonging to the industrial classes, and their ratio to the whole population.	Educational advantages.	Condition, &c., of the industrial classes.	Nature of their employment, and hours of work.
AUSTRIA.	Total workmen ... ... 6,340,000 Trades workmen in Vienna .. .. 100,000 Employed in mines ... 104,356 ,, salt mines 12,771	Excellent trade schools. Drawing and Sunday Schools supplied on some mines by the proprietors. Good schools for adult workmen much wanted. The General School Bill of the 14th May, 1869, was one of the greatest benefits conferred upon the working classes, rendering national education compulsory, and elevating its standard. Compulsory attendance from the age of 6 to 12, and for a longer period if necessary. Religious instruction provided in the creed in which each child is born. Working Man's Educational Union in Vienna, with 8,000 members.	Intellectual and educational attainments rated low, but not justly so. Their condition improving and power increasing. Guilds established to which every Austrian workman is compelled to belong. Also courts of arbitration, mining clubs, and other institutions in which the improvement of the working classes is kept in view. The sanitary condition of the mining population, on the whole, is good. The needs of the industrial classes is so far attended to as to produce first-rate workmen. 76 whole holidays in the year.	Various important mines. Turnery, a special and conspicuous branch of trade; also weaving. Numerous factories, but manufacturing industry of comparatively modern growth. Hours of work for adults, ten to twelve; ditto for children, six to ten, per day.
GRAND DUCHY OF BADEN.	Total population (1864) 1,428,090 Total working classes... 101,557	Carefully maintained. Good factory schools.	Condition of agricultural labourer not satisfactory. Factories flourishing. Good industrial laws and improvement unions.	Mirror, hemp, cigar, and other manufactures. Jewellery and clock trades, with various other industries.
BELGIUM.	Total population (1865) 4,800,000 Total (masters and men) engaged in agriculture 1,000,000 Total engaged in commerce ... ... 156,803 Ditto in manufactures ... 866,947 Two-fifths of the population are engaged in manual labour.	Greater than in England in some respects. The industrial classes are able to read and calculate, and generally to write.	Character indifferent and independent. Superior workman fairly paid. Inferior ditto unable to live on his wages; badly fed and clothed; ill-housed. The Council of Prud'hommes, a recognised tribunal, consisting of equal numbers of employers and employed, very useful. 79 Friendly Aid Societies recognised by government, and 76 unofficially brought under its notice.	Various manufactures, and the usual trades.
BRAZIL.	It can hardly be said that there is any industrial or artisan class here; half the people are employed in the public service, a quarter of them in professional occupations, and of the rest few enter into trade or commercial pursuits. Slave labour is so cheap that a good mechanic could not get good remunerative work.			
DENMARK.	Total population ... ... 1,800,000 Industrial classes ... ... 630,000 Or 35 per cent.	Popular education obligatory. Industrial and educational unions. The Danes write admirably on all subjects except art.	Condition not really good. Character phlegmatic and languid; a slowness to comprehend and act. Of 10 old and decayed workmen 9 have to go to the parish. Houses badly ventilated. In Copenhagen 213 cubic feet of air is the average for each individual. Building societies, co-operative stores, provident societies, and savings banks prosperous. Of these last there are 86, with 205,997 depositors, or 1 in 8½ of the population. £6,000,000 savings in Danish banks.	Cloth, glass, and other factories, with various trades.

CLASSES IN FOREIGN COUNTRIES.

Rent.	Cost of Living.	Rate of Wages.	State of Labour Market, &c.
Houses commonly built by the proprietors of mines and factories, and gradually purchased by the workmen. 59,343 provided with lodging by their employers.	Workmen furnished by their employers, in many of the mines, with food at market prices, and on some cheap eating-houses are established. Patches of ground also given for cultivating garden produce. 46,739 (13·7 per cent. of the whole working class) provided wholly or in part with board by the establishment to which they belong. Estimated sum for an unmarried working man per ann.: £ s. Board 36 10 Lodging 10 0 Clothing 6 14 £53 4	Agricultural labour valued at £4 per annum, with board and lodging, in 1867; it has since considerably risen. Turners (lowest wages) 8s. to 10s. per week. Meerschaum carvers, 16s. to 36s. ditto. Weavers, 10s. ditto. Plumbers, 16s. ditto. Silversmiths, 12s. to 20s. ditto. Joiners, 5s. to 10s. per day. Tailors, 4s. to 6s. ,, Smiths, 4s. to 6s. ,, Builders, 1s. 8d. to 2s. 8d. ,, Extra time, 3d. to 5d. per hour.	The demand for agricultural labour greater than the supply.
An ordinary working man's sleeping place, 4 kreutzers per night. Houses built and sold to workmen for £90, paid by instalments of from 92 to 150 florins, extending over 13 years.	Ordinary cost of meals for a single workman:—Out of the factory, 24½ kreutzers; in the factory, 19½ kreutzers.	Average daily earnings, 1 florin 11 kreutzers.	No want of employment. Room for many manufactures, if there were sufficient capital and enterprise. Much water power in Baden. Many foreigners employed in the construction of railways.
Houses deplorable.	Food generally poor. At a self-supporting restaurant, established by an Englishman, President of the Council of Prud'hommes, the following is the schedule of the prices:— Centimes. Soup (1 litre) ... ... 10 Meat or fish ... ... 20 Vegetables ... ... 10 Beer (pint) ... ... 7 Bread ... ... 5 Coffee 5	Inferior class, 1s. to 2s. 6d. per day. Skilled labourers, 3s. 6d. to 8s. ,, Journeymen carpenters, smiths, and tailors, 1s. 4d. to 1s. 8d. ,, Colliers, 3s. 6d. to 4s. ,, Engine drivers, 5s. to 8s. ,, Carpenter on his own account, 4s. to 6s. ,, Coppersmith (with family), £80 per annum.	First-rate native work hardly to be obtained. Every new undertaking started by foreign money and enterprise. The Belgian workman noted for producing a cheap article. No temptation for English competition, nor any certainty for foreign hands.
Lodgings very ordinary, with bad accommodation.	Living expensive and indifferent.	Engineers, 3s. to 5s. per day. Blacksmiths, 2s. to 3s. ,, Carpenters, 3s. to 4s. ,, Tailors and shoemakers, 4s. to 5s. ditto. Government labourers, 2s. 6d. to 3s. 6d. ditto. Labourers, £4 to £5 per month.	No opening whatever for foreigners.
First-floor, £7 10s. per year. Ground-floor, £6 10s. ,, Accommodation on a flat, £8 ,, Furnished room, 10s. per month. Unfurnished lodgings (two rooms and a kitchen) 13s. ditto.	Rye bread universally eaten. An operative expends 1s. 6d. per day.	Bricklayers, Carpenters 15s. 6d. to 17s. 6d. Per week. Smiths, Bookbinders 20s. ,, Weavers, 15s. 6d. to 22s. ,, Painters, 17s. 6d. ,, Tailors, 15s. 6d. ,, Shoemakers, 13s. ,, Daily workmen 8s. 6d. to 10s. 6d. ,, Provincial rates a little lower; a carpenter would receive 9s. per week with board and lodging. Railway navvies in Jutland receive from 2s. 9d. to 3s 6d per day.	In the present state of the Danish labour market, capital must presumably continue to dictate its own terms.

Name of country.	No. of persons belonging to the industrial classes, and their rates to the whole population.	Educational advantages.	Condition, &c., of the industrial classes.	Nature of their employment, and hours of work.
FRANCE.	Total population... ... 38,067,064 Agriculture supports more than half the population. Commerce and industry supports more than one third. Producing population:— Employers. Workmen. Textile fabrics...26,283 825,829 Mines & quarries 4,553 121,824 Metallurgy ... 2,850 49,675 Metal manufactures 6,332 145,846 Leather „ ... 1,227 34,000 Ceramic „ ... 2,596 71,801 Chemical „ ... 2,205 21,841 Building ... ...10,884 480,388 Lighting ... ... 2,990 13,509 Furniture ... ... 1,469 48,684 Food ... ...25,758 159,393 Transport ... ... 1,759 60,759 Science, letters, and art 5,161 59,549 Luxuries and amusements 2,541 63,084 Military ... ... 725 22,441 Various ... ... 1,093 9,839 In Paris:— 11,963 live by gardening, 214,349 „ commercial professions 948,541 „ industrial „ 76,339 „ various „ among which porters (concierges) number 45,323 persons. Of those receiving wages:— Total employés... ... ... 206,528 „ workmen... ... ... 755,007 32 in 100 supported by absolute work 62 in 100 supported by wages in various forms.	Primary and religious instruction of children in factories up to the age of 12 years, and afterwards, if necessary. (100,000 children employed subject to the Factory Law of 1841.) Schools des Arts et Métiers for technical training of youths. Also Conservatoire des Arts et Métiers for lectures on industrial subjects (free).	The Empire has done its best to secure the affection of the working classes, although mechanics' institutes and working men's clubs are wanting. The industrial classes generally well cared for. A very small proportion of Paris workmen are native Parisians. In 1867 there were 488 savings banks and 564 branch banks in all France—1 depositor to every 20 persons. The sum deposited, as calculated 31st Dec., 1867, was £22,834,767, giving an average of £12 7s. 5½d. per depositor. There are also 5,829 friendly societies.	Many important manufactories and the usual trades. Hours of work per day:— For children to 12 years ... 8. From 12 to 16 years ...10 to 12. For men ... ... 12. Sometimes 13 or 14. In Paris sometimes 11.
GREECE.	Industrial population scanty and scattered.		Character frugal and primitive. Great disadvantages from a scarcity of capital. Manufactures only established within the last 12 years.	Principally engaged in agricultural and seafaring occupations.
HANSE TOWNS.	Total population ... ... 306,507 Industrial classes rather less than one quarter of this number.	Good educational institutions.	Well clothed. Frugal and provident. Moral, intellectual, and material condition greatly improved.	Carriage building, engineering, ship building, meat curing, sugar refining, &c., with the ordinary trades.
NETHERLANDS.			Industrious, provident, but perhaps too independent, with great aversion to foreigners.	Ordinary trades (limited).
PERU.	Population of Lima ... 100,000 Skilled artisans 5,000	A school of arts for 200, but never more than 70 in attendance.	Good and steady workmen in a condition of comfort and independence.	The gas and water companies, estate owners, steam navigation company, owners of machine shops and foundries, employ chiefly foreign labour.

Rent.	Cost of living.	Rate of wages.	State of labour market, &c.
Apartments in a "cité," £8 to £14 per annum. Single room without a fireplace, £4 ditto. The same prices all over Paris, but accommodation is better, as distance from the centre increases. Average price of lodgings for a family belonging to the industrial class, about £2 10s. per annum.	The cost of food has risen 50 per cent. since 1855. A workman can board in Paris at the rate of (3 francs) 2s. 4¾d. per day. In 1869, bread cost 2d. per kilogramme (1lb. 1⅗oz.); beef, 10d.; butter, 1s. 2⅜d.; 12 eggs, 1s. 2⅜d.; potatoes, 1s. 2$\frac{3}{6}$d. per decalitre (2 imperial gallons 1½ pint); ordinary wine, 7⅜d. per litre (1¾ pint).	The rate of wages has risen 25 per cent since 1853. Artificial flower-makers, 4s. per day. Blacksmiths, 4s. 4d. to 6s. 4d. ,, Brickmakers, 2s. 9½d. to 4s. 9½d. ,, Shoemakers, 4s. to 5s. 2½d. ,, Carpenters, 4s. 9½d. ,, Charcoal workmen, 3s. 7½d. ,, Coppersmiths, 4¾d. to 8¾d. per hour. Gardeners, 2s. 9½d. to 4s. 9½d. per day. Masons, 2s. 9½d. to 4s. 4¾d. ,, Painters, 4s. 9¾d. ,, Printers, 3s. 2½d. to 6s. 4¾d. ,, Miners, 4s. to 4s. 9¾d. ,, Tailors, 3s. 2½d. to 5s. 7½d. ,, Watchmakers, 4s. to 6s. 4¾d. ,, Weavers, 2s. 4¾d. to 5s. 7¼d. ,, Wheelwrights, 3s. 7¼d. to 4s. 9½d. ,,	
Badly-built houses, with earthen floors, and only one or two rooms, 7s. 1d. to 14s. 2d. per month.	On fast days (195 in the year) only bread, wine, and olives are eaten. Meat (very inferior), 5d. per lb.; common bread, 1½d. per lb.; resined wine (largely drunk), 2d. per pint.	Per day. Watchmakers, 1s. to 2s. 1½d. ,, Tailors, 2s. 1½d. ,, Shoemakers, 2s. 1½d. to 2s. 10d. ,, Printers, 1s. 5d. to 2s. 1½d. ,, Carpenters, 2s. 1½d to 3s. 6½d. ,, Caulkers, 2s. 1½d. to 2s. 10d. ,, Blacksmiths, 1s. 5d. to 1s. 9¼d. ,, Masons, 1s. 9¼d. to 3s. 6½d. ,, Operatives in factories, 1s. 9½d. to 2s. 1½d ,,	The supply equal to the demand, caused by the low rates of wages for skilled labour. No room for foreign workmen.
Lodging, £5 per annum. Better class, £7 to £11 ,, Travelling workmen, for board and lodging, 9s. to 10s. 6d. per week. Houses too crowded; the average being 109 per Prussian morgen (2r. 21p. English) in the city, and in the country 65 per Prussian morgen; whilst in Berlin the average is only 29.	Prices risen during the last 20 years.	Skilled workmen, £45 per annum Ordinary workmen, £30 per annum. Stonemasons, summer, 18s.; winter, 15s. per week. Carpenters, summer, 18s.; winter, 15s per week. Painters, summer, 16s.; winter, 14s. per week. Printers, 18s. per week. Engineers, 18s. ,,	Pretty full. Higher wages and greater opportunities for amusements attract other Germans there.
In the Hague, 2s. to 2s. 6d. per week. Model lodging-houses (one floor), 2s. 1d. to 2s. 8d. ditto. Working classes are fond of a house to themselves.	Very frugal in their meals. Meat seldom tasted by the working classes. Cook shops provided for them, where they obtain a meal for 2d.	Skilled workmen, 16s. per week. Gas-work stokers, 17s. 6d. ,, Artisans in smaller towns and factory hands, 10s. ditto. They are also paid sometimes at the rate of from 2d. to 4d. per hour.	Labour cheap. A few skilled foremen only required, who, after 2 or 3 years, are dispensed with.
1 room, 18s. to 25s. per month. 2 rooms, 24s. to 36s. ,, Small houses, 45s. to 75s. ,,	A native's food, 1s. 2d. to 1s. 6d. per day. The English labourer boards at from 2s. 3d. to 3s. ditto.	A native labourer or "peon" 3s. to 6s. per day A native agricultural labourer 2s. 3d. ,, English— Carpenters, 9s. to 12s. ,, Plumbers, 10s. 6d. to 15s. ,, Ironfounders, 12s. to 18s. ,, Common labourers, 3s 9d. to 6s. ,,	Not overstocked. A large demand for agricultural and outdoor workmen. Steady mechanics can obtain remunerative employment, although the climate is a drawback.

These tables will be continued in next "Journal."

THE ROMFORD SEWAGE FARM.

Recently, a party of gentlemen paid a visit, at the invitation of Mr. W. Hope, to Breton's Farm, Hornchurch, which has been purchased by the Romford Local Board of Health, for the disposal of their sewage by irrigation. The *Essex Times* has the following account of the visit:—

The main object of the visit appeared to be for the purpose of inspecting the result of the application of sewage to the land and crops. One of the first crops to which attention was drawn was a piece of Italian rye grass, sown on the 19th March, since which four crops have been cut, averaging $7\frac{1}{2}$ tons per acre, and sold for £1 per ton on the ground. Close by was a piece of Dalmahoy potatoes, planted on the 2nd April, which were producing $1\frac{1}{2}$ cwt. per rod, and worth about £25 per acre. Some of these were very large. Some "Early Rose" Kidneys were also shown, which produced 10 or 12 at each root, many being from 4 in. to 7 in. in length. Some beans and peas, sown on the 2nd April, produced —the former £9, and the latter £15 per acre, without the straw. Another piece of rye grass, sown 9th April, will be ready to cut for the fourth time in a few days. Next came some dioscoreas, or yams, planted on the 6th June; adjacent to which were some very large Jersey cabbages, about 3 ft. in height: these, if successful, and under favourable circumstances, may reach a growth of 10 ft. A little further on was a specimen patch of clover, sown on the 23rd May, which was very thick, and about a foot high. Adjoining, were about four acres of transplanted mangold wurtzel, looking rank and strong. Another crop of the same kind exhibit some very fine roots, many of the "globes" being over two feet in circumference, and some of the "long" two feet in length. Close to those was a crop of parsnips, sown on the 28th April, which averaged from $1\frac{1}{2}$ in. to 2in. in diameter, and of a proportionate length; also a fine crop of cauliflower, planted on the 19th July. Some fine carrots, crimson beetroot, and runner beans are also growing. A strip of a newly-imported kind of grass, called *Bromus odoratus Australiacus*, was sown on the 4th June, and was cut on the 1st August; this, if the trial proves successful, it is expected will, to a great degree, supplant the Italian rye grass, being a perennial, and lasting much longer than the latter. Following this, comes a fine crop of maize, or Indian-corn, for ripening, sown on the 2nd June; it averages from 3 ft. to 4 ft. in height, some of the heads reaching nearly if not quite 5 ft. A strip of American oats looks very fine, though somewhat laid by the recent storms; these are said to produce 20 qrs. per acre. Close by was a crop of intermediate carrots, about four acres in extent, sown on the 4th April a month later than they ought to have been. Some of these have already been cleared off and sent to market, where they fetched at the rate of £41 per acre. Those that still remained had been sold as growing, at £21 per acre, it being worth the additional amount to prepare and get them to market. The above may be considered as the principal crops, but there are many others, most of which have been put in for the purpose of trial, and are not large in extent, but all appear to be more or less successful. Each crop is labelled, showing the time of planting and the results that have been achieved. With regard to the manner in which the sewage is put upon the land; it is first pumped to the top of the engine-house, and then conveyed in sheet-iron troughing to about the centre of the farm, where it branches off in all directions, there being outlets at short intervals, which can be opened for the discharge of the liquid or plugged up, or even set to a certain quantity, as required. The sewage eventually flows into channels of concrete or earth, and thence again into smaller off-shooting channels, which run along in the crown of the beds, the ground having been originally laid out in proper inclines; these smaller channels are then dammed up where required, and the sewage overflows the beds. Of course there is a large amount of effluent water which percolates through the soil, and this is carried back again, in a state of purity, to the tank, or down to the river at pleasure, by drain-pipes laid at a depth of six feet from the surface, and at a distance of 150 feet apart. The effluent water was clear and sparkling; most of the company drank some of it, pronouncing it excellent, and we were informed by Mr. Hope that it not only compared favourably with the well water of the district when tested with permanganate of potassium, but that it also resists even Heische's new test, which is generally considered by chemists one of the most delicate tests yet discovered. Though the system and works are not so complete as they will be after a time, yet, judging from the present appearance of the crops, there can be but little doubt of the success of the project, when it shall have been carried out in its entirety.

At a luncheon which followed,

Mr. E. Chadwick, C.B., said it was a great gratification to him to see that which was the pestilence of their towns, the waste of manure, by this farm made profitable. He hoped—it was a long time ago when he predicted it—that that waste of manure, which in towns meant pestilence and disease, would, in the agricultural districts, mean high and enhanced production. He was quite sure that they would see, especially under such leadership as they had seen that day, that that waste which desolates towns and lowers the condition of the population would, in the agricultural districts, give the highest amount of production of food that would elevate the condition of the population. He believed that this movement, of which they had seen so brilliant an example that day, would lead to an enormous increase of the productive power of the soil, not only in this country, but, through the example set, in the countries abroad. It required great labour, great skill, great power, and he thought that that power had certainly, as far as he had seen, been displayed by their host. It had given him singular pleasure to be present on this occasion, and he hoped, for the sake of this country, and for the sake of the example, that sewage irrigation might have due support and due success.

Mr. R. Rawlinson, C.B., said he had striven to come to an understanding, as far as he had studied the question, as to whether sewage ought to be treated as the waste product it had been treated, or whether it ought to be treated as they had seen it treated to-day; and he had come to the conclusion that the proper place for sewage was the land. He had been a member of several Royal Commissions, and sat upon one for eight years, which had been appointed to inquire into the best means for utilising town sewage. On that commission the Lords, Commons, chemistry, medicine, and engineering were efficiently represented, the latter branch by Mr. Austin and himself. During the eight years, they examined all the places in Great Britain where sewage had been or was attempting to be utilised. They reported and drew up conclusions, in which they said that town sewage could be utilised; circumstances might so intervene as to prevent its being utilised for the profit of the town, that was, direct money profit, but it should always be utilised, because of the very great profit to the community at large. Romford was so situated that they were able to get rid of their sewage without its being any burthen to the community; and some of them would, no doubt, remember that, at the inquiry, he told them that if proper means were taken to utilise the sewage on the land, instead of being a burden, as many of them feared, it would really relieve their rates, get rid of litigation, and put them in a position of comparative comfort. From what they had seen to-day, he did not see any need to fear the result, but he sincerely hoped that Englishmen would learn a lesson of plain common sense, and that they would do their best, shoulder to shoulder, not to bolster up a subterfuge, not to try any tricky dodge, but

to take that which poisoned their towns, contaminated their rivers, which produced nuisances, disease, and discomfort, and do with it what they were doing at Romford, which was an example that all England ought to see. He hoped they would soon see sewage generally applied to the land, and have that done which brought produce and food to the multitudes of our country.

ON THE ADVANCE OF SCIENCE AND ART IN WAR, AND ON THE ECONONY AND EFFICIENCY OF AN EDUCATED NATIONAL ARMY.

By Edwin Chadwick, Esq., C.B.

It is due to point out that the great conflict now going on between France and Germany involves a conflict between the opposing systems of military art and administration which were put in issue in the discussions lately raised in the Society of Arts. For it is a conflict between a national army and a standing army; between an army in which civilian element prevails in the rank and file, and an army of exclusively military training; between an army of (comparatively) short barrack and camp service—of men who are the greater part of their time engaged in civil productive occupation, from which most of them are taken direct, and an army of men long—of almost life-long—service, exclusively of barrack and camp occupation. The front ranks of the Prussian national army are chiefly composed of the civilian element. To those ranks we have seen called from London, artisans, shoemakers, tailors, waiters from hotels (sixteen waiters are stated to have left from the Langham-hotel), clerks, and warehousemen, as well as artisans, manufacturers, and merchants from Manchester and Bradford, who have been called home to join in the ranks with men direct from the plough and the forge, from Brandenburgh and elsewhere. By such comparatively short-service and civilian force, some of the best battles that have recently taken place between equal numbers have undoubtedly been done against the men of the long-service force, of life-long training and occupation in the French barracks.

The late conflict between the Austrian and the Prussian armies was also, in principle, a conflict between a *German* long-service standing army, of exclusively military elements, and a *German* comparatively short-service army, composed largely in the rank and file of civilian elements. So confident was the leading military opinion in our War-office and the Horse Guards (represented in the discussions in the Society) in the greater efficiency of the exclusively long-service standing army, that a few days before the opening of the campaign, it was confidently and unanimously declared, by all the commands, high and low (with scarcely an exception), throughout our army, that as against what they asserted was the superior organisation of the Austrian standing army, the national army of Prussia had not the slightest chance of success. And, after the downfall of the standing army of Austria, the old commandants in this country would have it that Sadowa (notwithstanding previous success by the national army in battle after battle) had been won by some exceptional circumstances and extraordinary good luck, which really did not affect the superior principle of the standing army. Not long before he died, Marshal Niel declared that the standing army of France, which immediately after Sadowa could not be opposed with entire confidence to the Prussian national army, was now its match, and that it was "a pity that so fine and superior an instrument as the French standing army should not be used." The *France en Orient* gives the subjoined account of a conversation which occurred in the committee named to examine the project of the declaration of war, previously to bringing it before the Chamber:—"Count de Kératry—Marshal, are we prepared? Marshal Lebœuf—Quite so. Count de Keratry—Do you give me your word of honour that such is the case? Think well of it; it would be a crime to let France engage in a struggle without having foreseen all, and provided against everything. Marshal Lebœuf—I give you my word of honour that we are completely ready. (Movements of satisfaction.) M. de Cassagnac—One word more. What do you mean by the two words, 'being ready?' Marshal Lebœuf (with emphasis)—I mean by them that if the war lasted a year we should not have to purchase even a gaiter-button. (Textual.)" The Emperor evidently relied implicitly on the assurances of his marshals and on the system. And we know in society that, immediately on the declaration of war by France against Prussia, our military authorities, the old commands and advocates of the long-service and standing army principle in this country—indeed, the commissioned officers throughout the country—participated in the entire confidence of the heads of the standing army of France, that it would everywhere overcome the short service and civilian element, and overthrow the army of Prussia, and arrive and dictate conditions of peace at Berlin.

The downfall of these long-service armies, it may be observed, is the downfall of the dangerous and false administrative and economical doctrines on which such standing armies are maintained, at the expense of progress in the Arts, Manufactures, and Commerce in countries subjected to them.

It is part of the case for the principle of national and short-service armies, that, at a less amount of expense, the principle gives a greater numerical force; and it is no answer that the French standing army has been overmatched in number. But before Metz, the shorter-service and civilian force kept its ground against superior numbers of the long-service and standing army force, and has at other points prevailed where there has been no numerical overmatch. Mr. Cole, on competent testimony. estimated that, on the principle of a national short-service army, a force of a million of men might be obtained at seven millions less of money than now largely exhausts the ordinary tax-bearing power of our population. Switzerland, which was referred to for a corroborative example of a national force, it is to be observed, with a population not more numerous than Scotland, had, within a week of the surprise of the French declaration of war, a well-appointed army of forty thousand men, chiefly collected from manufactories, from workshops, and from counting houses, on the frontiers for observation; and it is declared that had there been need of it, an effective army of two hundred thousand men, complete in its field organisation, and declared to be of as good a quality as the Prussian rank and file, and as competent to confront the standing army of France. Yet the expense of the Swiss national army is stated to be no greater than the expense of our volunteers; whilst the Prussian standing army, of about a quarter of a million of men on a peace footing, and three-quarters of a million of men in reserve, is maintained on a budget of seven millions and a-half sterling (as against our fifteen), and the total expense of all the German national armies is stated as at within ten millions sterling. The cost per man of the French army is 1,000 francs, or £41 13s.; of the Prussian army, by which it has been beaten, it is 230 thalers, or £35; of our standing army, it is stated at £100 per man. But the economy and efficiency of the principle of the national military force, as displayed in these instances, may be largely augmented, as I submit I have demonstrated, whilst the national elementary training and instruction may receive a necessary improvement, by the transference of the greatest proportion of military training from the productive adult stages to the non-productive or school stages, such as we had displayed to the entire satisfaction of Field-Marshal Sir John Burgoyne and other distinguished officers at the review at the Crystal Palace. The general adoption of that measure would reduce, probably by one-half, the loss of productive power, even by national armies on the Prussian footing. I have received the expression of a confident opinion from Prussia that if the principle were adopted there, and it is to be hoped that it will be soon pressed for adoption there, the period of

adult military service may be reduced from three years to one. In this country the principle would tend to make the entire male population of the country an inexpensive reserve force. It would, moreover, by the augmentation of physical and mental strength and aptitudes, augment the civil productive power of every community, as proved, by one-third.

It is to be observed of the great lesson now going on on the Continent, that to save France from the disaster occasioned by the defeat of the great standing army, a levy *en masse* is called for; that is to say, that recourse is being had to what is, in fact, the principle of a national army—to levies of such civilian force as may now be obtainable. But a dreadful mistake is committed in ignoring the large changes of condition since the Republican levies of '92, when the arms in use were comparatively rude and were available with little training, when the rank and file of the invading forces were comparatively ignorant, and mostly little better than apathetic serfs, instead of, as now, of educated and zealous men, ready trained to the use of new arms of precision of manifold power.

It may be urged properly that an expansion of our volunteer force, with commands equivalent in science and special instruction (and training in the ranks) to the Swiss and German commands, would bring up our army as a national force to the Swiss or the German national forces. Officers who are convinced of the necessity of such an improvement raise objections to it, as to what Englishmen would or would not like, and whether they would "like" even a reduced amount of service in camp or under colours. But it being admitted with us that more extensive popular military training is expedient and absolutely necessary for the formation of a defensive force, if there be immediate difficulty on account of the demands of productive science in the *adult* stage, is there not the greater reason for the immediate and general introduction of it in the *infantile* or *juvenile* stage, where there are no such potent wills of voters to be encountered, no such dislikes to be met; but, on the contrary, properly conducted, great liking and pleasure in its befitting bodily exercise? Would it not be wise to begin with this compulsion at once in the available infantile and juvenile stages, as a preparation for what appears to be required for a national force in the adult stages?

It is important to observe that the great conflict is between a comparatively ill-educated and extensively uneducated, and a comparatively well-educated rank and file. "We don't want your educated men; we want only men who will do what they are told," has been the answer given to me by old military authorities. The elucidation of this question is of great public importance. The education of the great body of the French commissioned officers is reported to be first-rate. The education of the entire body of the German commissioned officers is reported to be at least equal to that of the French officers, and, to some extent, superior to it, as being more sound and practical; and it is stated to be throughout the line almost equal to the education of the officers of our scientific corps, the engineers and artillery. But, such as it is, the Prussian authorities are not satisfied with it, and they propose, on the grounds of military efficiency, to discontinue the education and training sought for here of an exclusive standing army or military caste, and to assimilate the commands to the civilian element of the ranks. Lieutenant John W. Hozier, of the Scots Greys, the secretary to the Military Education Commission, in his general remarks after an examination of the Prussian system of education, states that the feeling of the Prussian army "against preparatory military schools appears to be increasing. A strong opinion is entertained as to the narrowing effects of exclusive class education, and a preference is very generally exhibited for officers who have had the ordinary education of civil schools." And in those civil Prussian schools to which reference is made, there is just that predominance of elementary art and science instruction which has been contended for in the Society of Arts, for the improved secondary and technical education in this country. "The connection which exists in Prussia between the military system and the general education of the country is remarkable," says Lieutenant Hozier. "The *porte-epée fahnrich* examinations are not only based on the course of instruction at civil schools, but have been also used as means of raising the character of the education given at these schools. On the one hand, the advantages offered to *arbiturienten* and to those who have been at a university"—widely different from our English universities—"indicate a wish to encourage men of liberal education to enter the army as officers; on the other hand, by making exemption from the ordinary period of compulsory service in the ranks dependent (among other conditions) on educational attainments, the military system has been employed as an engine for stimulating education among the middle classes." He adds that the recent introduction of "the civilian element" into the superior boards of military education is deserving of notice; not merely the professors of the schools, but eminent men connected with the University of Berlin, are employed upon them, and have a voice in determining the system of military education." Austria, taught by the downfall of its standing army, is following the course of Prussia in respect to the conciliation of its commands with the civilian element. In a pamphlet by the Minister of War, on the necessity of reorganising the educational system in the Imperial army, he states:—"As the army is not only to be composed of drilled soldiers but also of generally well educated men,"—meaning scientifically educated, "in order to improve their intellectual position and the spirit of the army, and to prevent the undue growth of drill and mere formalities, it is of great necessity that the military schools should be brought into harmonious concert with the civil schools. The deficiencies of the latter are less than those of the former, and it may be expected that they will be soon removed."*

Now, it is to be repeated, the French officers have under their command a rank and file of men generally indifferently educated, and a large proportion positively ill-educated, and some, the Turcos, in

* It would seem that our Army Education Commissioners have interpreted the desirable addition to civil education to mean our university education, and actually propose to go back for more of Greek and Latin, when the conditions of the time, as seen by other interpreters, demonstrate the necessity of going forward for more of practical science and art. According to Colonel Beauchamp Walker, C.B., our military attaché with the German army, who, in an able letter, expresses his agreement with the Prussians in their extension of the civilian element in military education, they are reducing or leaving behind much of the work of the cloister or the desk, and going forward for more of the work of practical instruction in the field, which he thus describes, as it is conducted by General Von Moltke:—"The instruction is given in military tours, for which a sum of £2,550 is annually granted. These journeys, more especially those conducted by Geoeral Von Moltke, are a most valuable source of instruction for officers of the staff. All the officers who can be spared from the duties of the office take part in these tours, as also a few staff officers called in from the commands, and a selection from the commanders of regiments. They are also made on a smaller scale by the staff of the corps, augmented by regimental officers attached for instruction, under the superintendence of the respective chiefs of the staff. For the tour superintended by General Von Moltke, the theatre of operations and certain conditions likely to influence them aro indicated, a supposed strength is given to two opposing armies, their depôts and means of reinforcement are clearly laid down, and the influence likely to be exerted by the movements of other armies or bodies of troops on their flanks are taken into calculation. According to these data, the senior officers present make their plans of manœuvre, employing their juniors in the preparation of all the subordinate arrangements, the movements of the troops, the selection of positions for attack or defence, the arrangements for supply, and for retaining a communication with the base. All these measures are carried out on the spot, and daily reports are made to the superintending officer, which, when necessary, aro accompanied by such rough sketches as are usual during the progress of a campaign. From these materials he is enabled to form an idea in what degree the spirit of the operations has been grasped by the directing officers, and in how far their juniors are instructed in the details of duties which they may hereafter be called on to perform." Imagine officers of volunteers so trained! Major-General McMurdo made a very successful commencement of instruction, on the principle thus exemplified, with an engineer branch of the volunteer corps.

a state of almost primitive barbarism. The Prussian officers have under their command a rank and file of men generally well educated. The French leaders appear, from their absolute and boundless confidence, to have made the mistake absolutely of supposing that they had the same sort of rank and file to deal with as that encountered by Napoleon the First; a rank and file a great part of which had only recently emerged from positive servitude, and who were, as testified by Göethe, comparatively torpid and apathetic to the results of the conflict. They have had now to encounter men of another generation, whose patriotism and intelligence has been stimulated by national education.

In a paper which I read at the United Service Institution, on the gain of military force by the introduction of military drill as a part of a national system of education, I have cited the testimony of soldiers of long service, proving the superiority of educated over uneducated soldiers in the English army. The characteristics of the uneducated rank and file are ignorant passion, wildness, panic; of the educated, comparative coolness, steadiness, self-restraint, and exact obedience. I showed that a national education would bring up the quality of the rank and file to at least that of non-commissioned officers. It would be as if the rank and file were all of corporals and sergeants. I cited also the experience of the School of Musketry, that success in shooting was—in classes—generally as the intelligence. The common exercise of the educated skill, however, is commonly in shooting within a range of five hundred or six hundred yards—the range of the needle-gun. But for wielding successfully guns of a higher quality and longer range, such as the Whitworth, it was found that a higher order of intelligence was generally needed.* Military officers have objected to putting the arms of precision into the hands of our uneducated rank and file, on the ground that they were incompetent to wield them; they objected to putting into their hands breech-loaders or repeating guns, on the ground that they would fire wildly and rashly, and soon exhaust their ammunition. This is just what has happened with the like uneducated rank and file of the French army. In their hands, inferior use has been made of the superior weapon, the chassepôt, which has a range one-third longer. In the hands of the better educated German rank and file, according to all testimony, superior use has been made of the inferior weapon. They have been cool and steady, and have fought more intelligently and effectively.

According to all testimony, the German rank and file have fully realised the anticipations of the improved moral behaviour of a better educated force, and it is reported that it is generally acknowledged by French correspondents and by French townspeople that the German soldiers have behaved, on the whole, better than the French soldiers have done to their own people.

I have been challenged, by some persons who have not paid much attention to the subject, with the supposed absence, as they considered, of any marked manifestation hitherto in this conflict of the growth of the power of defence over offence. I had anticipated this objection, by stating the reasons why it would probably be little manifested—chiefly for the reason that the complete use of the new arms and of new methods of warfare was not to be expected from old commands unaccustomed to them. The French leaders had planned an exclusively offensive campaign, which was at once met by a counter-plan, also on the offensive. But the conditions of defensive warfare, in the efficiency of the new arms of precision, and those not the most perfect, have been fearfully proved. Dr. Russell, the *Times* correspondent, says:—"One incident I have heard would seem to vindicate the opinion of those who hold that the days of cavalry charges against infantry in formation, armed with breechloaders, are numbered. The 8th Cuirassiers, superbly mounted, and most gloriously led, came down on the 80th Prussian Infantry, and were met by such a fire that the squadrons were nearly annihilated by the time they were within 100 yards of the bayonets. While retiring in confusion, they were charged by a regiment of Würtemburg horse, and, it may be said, they ceased to exist. The colonel, the *beau-ideal* of a soldier, a stately, handsome, middle-aged man, led the charge to the very line of needle-guns, and came down, as his horse rolled dead, with a heavy crash in his cuirass." In another description of a battle, he observes:—"When the excitement and the dust were over, the mass of horses and red coats that lay upon the ground convinced one that it is mere murder to send cavalry now-a-days against infantry, unless they have tremendous assistance both from infantry and artillery." The correspondent of the *Pall Mall Gazette* gives the following examples of French cavalry charges:—"The cavalry then tried to do a little Balaklava business, but without the success of the immortal six hundred. We took the guns in the Balaklava valley. Down came the cuirassiers once more, this time riding straight for the two field-pieces. But, before they had got within 200 yards of the guns, the Prussians formed line as if on parade, and, waiting till they were within fifty yards, gave them a volley, which seemed to us to destroy almost the whole of the squadron, and so actually to block up the way to the guns for the next ones following. After this large charge, which was as complete a failure—although most gallantly conceived and executed—as the two preceding ones, the infantry fell back rapidly towards Sedan, and in an instant the whole hill was covered by swarms of Prussian tirailleurs, who appeared to rise from the ground. After the last desperate charge of the French cavalry, General Sheridan remarked to me, 'I never saw anything so reckless, so utterly foolish, as that last charge—it was sheer murder.'" But if charges of cavalry swordsmen be "sheer murder" as against infantry, with even the present arms of precision, what is it to send infantry with the bayonet against them? Dr. Russell cites a passage from a letter from a French officer, who states that from a bayonet charge, out of a brigade of 800 men, not above 50 returned. War such as this the oldest soldiers declare they never saw before; that at Sadowa was mere child's play to it. An old colonel, on seeing the utter destruction of his regiment by the new arms, it is related, went into hysterics at the sight of the few who were left. The like destruction was incurred on the German side. Out of 3,000 men in one of the battles before Metz, not more than 200 were left. These facts are in entire accordance with those I previously cited as from recent French military authorities, in justification of their declarations that charges of cavalry and of infantry were no longer possible—that there was an end of combat *avec l'arme blanche*; that is to say, without an amount of destruction of life which those same authorities considered it to be impossible that civilised warfare could hereafter be conducted.

We see it stated for admiration, as a proof of heroism on the part of the French, that one standard had, during the battle, changed bearers twenty-seven times; but can rational people see in such exposure anything but wanton waste of force (to say nothing of its cruel wickedness) by the commands, and a reckless sacrifice to brutally ignorant

* I beg to repeat that, on the professional points of the question, I rely exclusively on professional experience and authority. The late Brigadier-General John Jacob. C.B., who in India had anticipated the principles of some of the late most successful improvements in the arms of precision, after describing them, says:—"Such are the arms with which I would propose to arm the British soldier. Their use implies skilful workmen in our ranks instead of pipe-clayed automatons. It implies, further, an entire change in our tactics, so as to give full scope not only to the bodily but to the high moral and intellectual powers of our men. English soldiers, so armed and developed, would overpower and destroy any number of mere masses of semi-barbarous or ordinary enemies. With open files and ranks, each man a skilful combatant, but still all acting in perfect concert (as would be easy with such brave, trusty, intelligent, and skilful men), they would sweep their enemies from the earth, themselves almost unseen, while a single discharge from a company 1,000 yards distance, would annihilate the best field battery now existing."

passion. We see it noted that a battle field was strewed with Prussian helmets that had been shot through, with their glittering spikes. What is such head-gear but loading men with weight without defence? presenting the *glint* of objects for the aim of the rifle? And so with the cuirasses. The cases presented by the war were numerous of "mere murder," on which it may be submitted, on recognised principles, the commanders who continue the use of old methods, with such certain results, ought to be called judicially to account for the crime of doing so.

The conclusion which I stated was, that the gain of defence as against attack, by the new arms of precision, appeared to be as *three* to one, and, in support of that conclusion, I cited the example of the Confederate General Lee, by means of shelter pits, keeping at bay the army of General Grant with four to one; and the conclusion is not invalidated by instances where the assailants are reckless of a sacrifice of *ten* to one. A day or two before the opening of the campaign, an officer, who had served with the Confederate army, personally represented to the Emperor, as I am informed, his observation of the efficiency of the systematic use of earthworks as used by that army. But a campaign of attack alone had been planned, and when the reverse came, only partial and inapt use could, within the time, be made of systematic means of defence. The Prussian official reports state that, had such defensive earthworks as were thrown up by the French been properly used, they would have cost even more life than they did to the assailants. Instances are stated where the French soldiers, though protected by earthworks, were found to have fired so wildly and rapidly that they had no ammunition left when the assailants came up to assault them. The oldest works of regular fortifications could hardly have availed against the extraordinary German heroic determination to "storm" through the country for the attainment of their end, regardless of every sacrifice of life. But if the proper use of those defences would have so aggravated the destruction of the German *assailants*, they may be asked to consider what they might, with their better educated rank and file, have themselves done with such works as *defenders?* It is stated that the Danish commissioners, who visited the French army, reported their belief that it was incompetent to the most effective use of the new arms of precision and new works. When I stated the gain of offence over defence, it would be implied from what I had said as meaning in competent, educated hands.

It is to be observed, however, that neither side appear to have been up to the progress of mechanical art and science in the adoption of the best of the new arms of precision. With the old commands the progress of art and science is of the slowest. The breech-loading arms are now more than twenty years old; Prussia was ten years advance in the adoption of the needle gun. Since then, the volunteers in this country were warned from the Horse Guards against looking to breech-loaders. The adoption of the Minié was followed very slowly by the Enfield; and the needle-gun, by the Chassepôt in France; and here, by the Snider, by which it is exceeded, and the Snider is again exceeded, in accuracy of shooting and in penetrating power, by a breech-loader of Sir Joseph Whitworth's, as well as by the Martini-Henry. If any one will examine and consider the performances of the Adams' revolver, which (including reloading) fires twenty times faster than the old smooth bore, and more accurately at the old firing distance,—if he will consider how secure of his own life he would feel with such a revolver, not yet introduced into the ranks, against an enemy coming upon him with bayonet, sword, or lance—he may form his own opinion of the state of military administration in which old weapons are retained, and how much defensive warfare has yet to gain from science.

The mitrailleuse appears not to have fallen into the most competent hands for its most effective use. The principle on which it was brought forward (as a rifle platform), and patented in 1858 by Sir Charles Shaw, was for use in numbers of the weapons close together, or in batteries, but the weapon has mostly been applied separately, and the Germans soon found out that they could avoid the direct fire of the single mitrailleuse, and that they could send forward rifle marksmen to the right and left, of it who shot down those who wielded it. If it were used, as intended, in batteries, this would have been prevented, and in some instances, where it was used close together, the fire is related to have been as effective as was anticipated from it. One such battery, worked by three men, would have given fire more than equivalent to that of a company of infantry of fifty men, and ten or twelve of them would have been more than equivalent to an infantry regiment. Infantry only change position at about the rate of three miles and a half an hour. With three horses to each rifle battery or mitrailleuse, it might change position at a rate of light cavalry, or seven miles an hour. It was proposed as an enormous economy of defensive force, as the recent very partial experience with the mitrailleuse proves that it would have been. But, soon after it was introduced, it was objected that a Whitworth three-pounder, with its Boxer shell or its shrapnell shell, giving off an equivalent or more effective fire, and with its case-shot for close quarters, and, with a hundred rounds of ammunition, weighing no more than a Hansom cab, would, with a threefold range, do all that the mitrailleuse does, and more. This may be taken to have been demonstrated by some recent experiments at Shoeburyness, with, in important respects, an inferior gun and shrapnell shell.

So far as the present war has gone, I submit, it offers a lesson that old and unscientific commanders, habituated only to old weapons, cannot be expected to adopt readily or completely the new arms which science and art has provided for defensive warfare, and that new and appropriate commands will be needed to achieve the full and large gain of defence over attack, demonstrated even by the scattered and as yet partial use of second-rate and comparatively inferior weapons of precision. It shows that in the future of war victory will be to science and art applied with educated zeal. It shows that national education, so far as it has gone with the present generation of Germans, has relieved them from the proverbial slowness of apprehension and clumsiness of execution of the last generation, and given them the superior alertness, the daring, and the *élan* which once belonged to their adversaries.

If the present war were to close, leaving a standing army in France, the men remaining as soldiers would all return to camp and barrack, a continued burden to the exhausted country and to themselves, constituting, with their augmented ranks, a pernicious war interest. When peace happily arrives to the national educated army, all those remaining of it, after large unnecessary havoc, which consummate strategy and victory does not exonerate, will, for the greater part, return to their homes, indisposed to future war, except under the most dire necessity, and will relieve the country of the burden of their continued maintenance, and recruit its strength by renewed productive labour in the pursuit of Arts, Manufactures, and Commerce. In my experience in Poor-law administration in England, the disbanding of the standing army force of the existing quality, unapt to regular industry, has supplied a heavy contingent to an army of paupers and mendicants.

GENERAL NOTES.

Honour to Science.—The King of Sweden has conferred the Knighthood of the Order of Wasa on Mr. Frederick Hendriks, F.S.S., of London, in appreciation of his writings on international coinage and statistics.

Railways in Belgium.—In Belgium there are 1,250 miles of railroads, making an average of two and a-half miles to every 10,000 of the population, or ten miles to every hundred square miles of territory. These railroads were constructed at an average cost of £18,300 a mile. They were partly constructed by the State and partly by companies, who were given the privilege on condition that they should absorb their capital by a system called *amortisation*, and by which a portion of their earnings should be used, not as dividends, but to repay their capital; and that, when this was done, the roads should be the unencumbered property of the State.

Export of Iron.—During the first six months of this year, the exports of bar, angle, and rod iron from the United Kingdom were 162,748 tons, against 148,297 tons in the corresponding period of 1869, and 138,191 tons in the first six months of 1868. To these totals, June in each year contributed 33,373 tons, 31,262 tons, and 25,925 tons respectively. The total of 162,748 tons, forming the exports for the first six months of this year were made up as follows:—The Hanse towns, 4,022 tons; Holland, 5,912 tons; France, 3,916 tons; Italy, 15,664 tons; Turkey, 6,843 tons; the United States, 21,455 tons; British America, 19,395 tons; British India, 18,308 tons; Australia, 6,961 tons; and miscellaneous, 60,302 tons. The value of the exports made in June was £271,002, against 238,927, in June, 1869, and £193,405, in June, 1868; and in the six months ending the 30th June, £1,298,246, against £1,378,349, in the corresponding period of 1869, and £1,042,339, in the first six months of 1868.

Oak Timber.—There are no less than 140 species of oak known, and, although there are many sorts cultivated and growing in England, botanists and arborists agree that there are principally two varieties, the Durmast oak, and another which is commonly called the old English oak, although both are supposed to be indigenous. In the Durmast oak, the acorns grow in clusters close to the twig, and the leaves are set on short leaf stalks; while in the old English oak the acorns generally grow singly, or at most two together, on stalks of from two to three inches in length, and the leaves are closer to the twig, without the intervention of any length of leaf stalk. These are the principal distinguishing marks between the two varieties, and it is doubtful whether any other distinction can be relied upon. There is no doubt as to the comparative inferiority of the Durmast oak, and almost all the English writers on timber have asserted it, and both Buffon and Du Hamel are of their opinion, and give a decided preference to the oak bearing large acorns on separate stalks over the oak bearing acorns in clusters, which characteristics are just the distinguishing differences that have been particularised as existing between the English and Durmast oak. In favourable soils, the English oak has seldom more than twelve to fifteen concentric layers of alburnum, but in the Durmast oak there are frequently from twenty to twenty-five, or even thirty. This proves at once, by analogy, the inferiority of the Durmast oak, for it is an established fact that the best hardwood timber is that in which the proportion of heartwood to sap is largest; besides which, the numerous layers of alburnum form the basis of a proportion which shows the greater age the Durmast timber must attain before it becomes perfect wood. In England, the Sussex oak has always been celebrated as being superior to all others, and in France, the oak of Provence enjoys a similar reputation, the soil, in both cases, being favourable to its growth. Still, an oak tree grown in a soil but ill-adapted for it, as for instance, a marshy soil, will retain its superiority of species over the inferior timbers, as the willow and the poplar, to which such a soil is less favourable, although in quality it will fall very far short of the standard of perfection for oak timber. In fact, oak grown on such soils will, in some measure, partake of the qualities of the timber to which such soils are better adapted, and be of more open texture, of softer fibre, and of less durability than average oak timber. Oaks of slow growth, those for instance from the mountains of Scotland and from Cumberland and Yorkshire, are very hard and durable. From marshy soils, the texture is more open and the colour often of a dull red, or the timber has "foxey" stains in it, as incipient decay is called.

Art Museum in Sheffield.—At the Cutlers' feast, on the 1st of September, the new Master Cutler, Mr. W. Bragge, announced that he would make it his business, during his year of office, to establish a museum in Sheffield, useful to the art-industry of the town; and a meeting was held the next day, when a committee was appointed to promote the work.

The Problem of the Age.—Under this heading, says the *Mechanics' Magazine*, we observe in the papers an advertisement announcing the offer of a prize of twenty guineas, by the editor of the *Gardener's Magazine*, for the best essay on irrigation as applied both to the farm and the garden, and with reference both to the storage of rainfall and the utilisation of sewage. We gladly give publicity to the offer, hoping thereby to augment and sustain the interest which we trust will be evoked by the judicious and spirited conduct of our able horticultural contemporary. It is time, indeed, that the engineer stood at the elbow of the farmer, and occasionally gave the gardener also the benefit of practical advice. Ever since the days of drainage dawned, we have been drifting into ruinous habits in respect of the employment of water in the cultivation of the land, and in seasons of drought like those of 1868 and 1870 we have had to behold burnt-up fields and unproductive gardens which might have been luxurious and profitable beyond compare, had but precautions been taken to store for use when wanted the surplus rainfall of the winter immediately preceding. The condition of pastures and garden lawns throughout the whole of the past season has been a reproach to agriculture and horticulture alike, proving that the practitioners of these arts have hitherto neglected to take the engineer into council with them. We can but echo the words of the editor of the *Gardener's Magazine*, when he says:—"The needs of the farm are repeated in the garden. The case of the river is reproduced in the brook. Almost every garden in the land would have been the better for more water than it had obtained during the past three months. It is a question if the water pot and the ordinary garden-engine do not represent an enormous waste of labour for very poor results. It is possible, too, that a system of irrigation might be devised for gardens, which would enhance their beauty and productiveness a thousand times. Might we not, for example, send nourishing streams through numerous channels amongst our peas, beans, cauliflowers, cabbages, and potatoes, which we now leave to battle with drought, or actually injure by dribbling drains of water amongst them by means of paltry watering-pots? In almost every garden there is a lack of water in a dry season, or, if no lack of water, lack of skill in employing it, else why should we see the grass plots burnt up by Midsummer-day, and thenceforward rendered hideous by drought until the end of September? Yet, in how many of the burnt-up gardens are there streams and springs that never fail, ditches that are noisome as they flow, but stores of wealth and health for such as will divert their blackened waters to the land? It is time the gardener was instructed in the simplest modes of raising water from wells, and of preparing the water for use by exposure to sunshine, and of applying it at last with a view to the economising of every precious drop, not only in the lifting and distributing, but also in the final result, so that every drop shall perform its due share in the production of root, leaf, flower, and fruit."

Exports of Unwrought Steel.—The quantity of unwrought steel exported from the United Kingdom, in June, was 3,145 tons, as compared with 2,873 tons in June, 1869, and 2,350 tons in June, 1868. In the six months ending June 30th, this year, the aggregate exports were 16,626 tons, against 16,284 tons in the corresponding period of 1869, and 12,998 tons in the corresponding period of 1868. The total for this year was made up as follows:—France, 1,707 tons; the United States, 7,492 tons; and other countries, 7,427 tons. The figures for the corresponding six months of 1869 were:—France, 1,488 tons; the United States, 8,887 tons; and other countries, 5,909 tons. The value of the unwrought steel exported, in June, was £100,677, against £92,200 in June, 1869, and £77,723 in June, 1868; and the six months ending June 30th, this year, £529,229, against £516,439 in the corresponding period of 1869, and £430,846 in 1868.

Declension of Iron Manufacture in Russia.—This arises chiefly from deficiency of fuel, and the great distance of the mines from the centres of commerce and civilisation. The iron industry in Russia owed its origin to Peter the Great, and, 150 years ago, vast mines were wrought and great works erected. The empire seems to produce every description of ore, and each in great variety. In the Altai and the Oural vast masses of magnetic ore are found. There are various other directions where magnetic ore is found in smaller deposits. Very fine ore for the purpose of steel manufacture is extracted in several districts. Ordinary ores are much more abundant, and are discovered over a wider area of country. In the centre of Russia red oxide is the prevailing yield. One great advantage is, that a deep iron mine is not known in Russia; whenever the metal is found it is near the surface. It would be impossible to estimate the resources of this country in iron; probably it exceeds that of any other country in the world.

The State of Trade.—Tho Board of Trade returns for the past month present some slight indications of the influence of the declaration of war which occurred at the end of the first fortnight. Compared with the corresponding month of last year there is a diminution of only about a quarter per cent. in the declared value of our exportations, but in several branches of manufacture there are evidences of a check having been experienced. The cotton trade, however, continues to show an increase, the exports of manufactured articles having been in excess of those of July, 1869, to the extent of 10 per cent. in value and 17 per cent. in quantity. Cotton yarn figures for a decrease of 4 per cent. in value, but an increase of 2 per cent. in quantity. The chief falling off has been in the woollen trade, woollen yarn showing a decrease of 34 per cent. in value, and woollen manufactures a decrease of 16 per cent. in value and 25 per cent. in quantity. A diminution is also shown of 15 per cent. in earthenware, 10 per cent. in haberdashery, and 6 per cent. in machinery. On the other hand, thero was an increase of 1 per cent. in the shipments of coal, 1 per cent. in hardwares, 2 per cent. in linen manufactures, 14 per cent. in silk manufactures, and ½ per cent. in iron manufactures. In the various articles classed as miscellaneous, there has also been an increase of 7½ per cent. The comparison of the month with that of last year would have shown a reduction of 2 per cent., instead of only ¼ per cent., but for the fact of telegraphic wire and apparatus figuring for £231,542, against only £12,307 in the samo month of last year. The consignments of "arms, ammunition, and military stores" have been only £118,622, against a nearly similar amount in 1869. With regard to the importations of the month, it appears that tho arrivals of wheat were 2,878,873 cwts., or 30 per cent. less than in July, 1869, but there was a considerable increase in thoso of barloy and oats. Of cotton, owing to augmented supplies of American, the arrivals were 985,229 cwt., an increaso of 30 per cent. on those of July, 1869.

Local Taxation of the United Kingdom.—William Tayler, Esq., F.S.S., F.S.A., has placed in the hands of the council of the Statistical Society the sum of fifty guineas, to be awarded by them as a prize for the best essay on the local taxation of the United Kingdom. It is desired that the essay shall exhibit, as far as possible, a complete summary, with full statistical details, of the local taxation of the United Kingdom since 1850, the objects for which it is levied, the amounts collected and expended for each object, the mode and cost of collection, the expenditure and incidence of local taxes, and any special circumstances connected with their nature or operation. The amounts raised by local taxation for various purposes should be subdivided as between different counties or districts, and the connection between the general character and occupations of the population and the amount expended for different local purposes be investigated, so as to exhibit in the most lucid and instructive manner the required summary of local taxation. The inquiry as to the present condition of our local taxation should be supplemented by suggestions for new and improved sources of local revenue, direct or indirect, such as markets, gas and water supply, sewage farms, licences, &c.; for diminution of expenditure, as by consolidation of different rates, concentration of administrative control, industrial schools, &c.; and also for promoting the equitable incidence of local taxes; and endeavours should be made to attain to fixed rules or maxims capable of giving a systematic character to the principles of local taxation, and to discriminate between the proper provinces of local and general taxation. The main objects of the essay may be aided and illustrated by reference to the recent history of local taxation in this country, and to the systems of taxation of other countries; but it should be borne in mind that the principal purpose of the essay is to exhibit a complete chart of the local taxation of the United Kingdom, with suggestions for its amelioration in principle and machinery.

The Hog Crop of 1870.—The first estimate of the probable number of hogs available for slaughter in the packing season of 1870-71, is furnished by the official tables of the State Auditor of Ohio, the assessors of the State returning the gross number six months old and over, on the 1st day of April, at 1,720,113, against 1,455,943 on the corresponding date of 1869, or an increase in round numbers of 275,000. There is, however, a slight decrease as compared with 1868, a deficiency of over 300,000 as compared with 1867, and a still greater falling-off as compared with the crop of previous years, which reached the maximum of 2,765,900 in 1863. It is evident that the same causes which led to the large product of 1863—high price of the packed product and consequent profit to breeders—have stimulated the production this year in Ohio, as it has probably in Illinois; but it is questionablo if the increase is equal in other Western States. Upon the subject of possible values the *Cincinnati Gazette*, from which wo have extracted the above figures, says:—"The returns to the Auditor include only those over six months old on the 1st of April. Large numbers, therefore, not included in our figures, may be made ready for market by January next. A good corn-crop and high prices for hogs usually insure a large surplus of the latter. Hogs are commanding high prices, and, while it is not likely that packers will be able to pay as much as was realised last winter, still, if corn yields as well as it promises, farmers will find hogs moro profitable than any other product. They cannot get so many hogs ready for market as to put the price below a paying point. Thoso who buy stock hogs at high prices to fatten will run the risk of losing money, of course, but farmers who raise hogs and fatten them cannot fail to come out ahead. Packers now think they can afford to pay 8 dols. per 100 lb. net, as the averago for hogs next winter. Upon this it will, we think, be safe for feeders to figure; and 16 dols. to 20 dols. per head for hogs as matters now stand, and are likely to stand, should insure a good profit."

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 16, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

THE BRITISH ASSOCIATION.

The fortieth annual meeting of the Association commenced at Liverpool, on Wednesday, September 14th, when Professor Stokes vacated the presidential chair, in favour of Professor Huxley, LL.D., F.R.S., who delivered the following address:—

My Lords, Ladies, and Gentlemen,—It has long been the custom for the newly-installed President of the British Association for the Advancement of Science to take advantage of the position in which the suffrages of his colleagues had, for the time, placed him, and, casting his eyes around the horizon of the scientific world, to report to them what could be seen from his watch-tower; in what directions the multitudinous divisions of the noble army of the improvers of natural knowledge were marching; what important strongholds of the great enemy of us all, ignorance, had been recently captured; and, also, with due impartiality, to mark where the advanced posts of science had been driven in, or a long-continued siege had made no progress.

I propose to endeavour to follow this ancient precedent, in a manner suited to the limitations of my knowledge and of my capacity. I shall not presume to attempt a panoramic survey of the world of science, nor even to give a sketch of what is doing in the one great province of biology, with some portions of which my ordinary occupations render me familiar. But I shall endeavour to put before you the history of the rise and progress of a single biological doctrine; and I shall try to give some notion of the fruits, both intellectual and practical, which we owe, directly or indirectly, to the working out, by seven generations of patient and laborious investigators, of the thought which arose, more than two centuries ago, in the mind of a sagacious and observant Italian naturalist.

It is a matter of every-day experience that it is difficult to prevent many articles of food from becoming covered with mould; that fruit, sound enough to all appearance, often contains grubs at the core; that meat, left to itself in the air, is apt to putrify and swarm with maggots. Even ordinary water, if allowed to stand in an open vessel, sooner or later becomes turbid and full of living matter.

The philosophers of antiquity, interrogated as to the cause of these phenomena, were provided with a ready and a plausible answer. It did not enter their minds even to doubt that these low forms of life were generated in the matters in which they made their appearance. Lucretius, who had drunk deeper of the scientific spirit than any poet of ancient or modern times except Goethe, intends to speak as a philosopher, rather than as a poet, when he writes that "with good reason the earth has gotten the name of mother, since all things are produced out of the earth. And many living creatures, even now, spring out of the earth, taking form by the rains and the heat of the sun." The axiom of ancient science, "that the corruption of one thing is the birth of another," had its popular embodiment in the notion that a seed dies before the young plant springs from it—a belief so widespread and so fixed, that St. Paul appeals to it in one of the most splendid outbursts of his fervid eloquence, "Thou fool, that which thou sowest is not quickened, except it die."

The proposition that life may, and does, proceed from that which has no life, then, was held alike by the philosophers, the poets, and the people, of the most enlightened nations eighteen hundred years ago; and it remained the accepted doctrine of learned and unlearned Europe through the middle ages, down even to the seventeenth century.

It is commonly counted among the many merits of our great countryman, Harvey, that he was the first to declare the opposition of fact to venerable authority in this as in other matters; but I can discover no justification for this wide-spread notion. After careful search through the "Exercitationes de Generatione," the most that appears clear to me is, that Harvey believed all animals and plants to spring from what he terms a "*primordium vegetale*," a phrase which may nowadays be rendered "a vegetative germ; and this, he says, is "*oviforme*," or "egg-like;" not, he is careful to add, that it necessarily has the shape of an egg, but because it has the constitution and nature of one. That this "*primordium oviforme*" must needs, in all cases, proceed from a living parent is nowhere expressly maintained by Harvey, though such an opinion may be thought to be implied in one or two passages; while, on the other hand, he does, more than once, use language which is consistent only with a full belief in spontaneous or equivocal generation. In fact, the main concern of Harvey's wonderful little treatise is not with generation in the physiological sense at all, but with development; and his great object is the establishment of the doctrine of epigenesis.

The first distinct enunciation of the hypothesis that all living matter has sprung from pre-existing living matter, came from a contemporary, though a junior, of Harvey, a native of that country, fertile in men great in all departments of human activity, which was to intellectual Europe in the sixteenth and seventeenth centuries what Germany is in the nineteenth. It was in Italy, and from Italian teachers, that Harvey received the most important part of his scientific education. And it was a student trained in the same schools, Francesco Redi—a man of the widest knowledge and most versatile abilities, distinguished alike as scholar, poet, physician, and naturalist—who, just two hundred and two years ago, published his "Esperienze intorno alla Generazione degl' Insetti," and gave to the world the idea the growth of which it is my purpose to trace. Redi's book went through five editions in twenty years; and the extreme simplicity of his experiments, and the clearness of his arguments, gained for his views and for their consequences almost universal acceptance.

Redi did not trouble himself much with speculative considerations, but attacked particular cases of what was supposed to be "spontaneous generation" experimentally. Here are dead animals, or pieces of meat, says he; I expose them to the air in hot weather, and in a few days they swarm with maggots. You tell me that these are generated in the dead flesh; but if I put similar bodies, while quite fresh, into a jar, and tie some fine gauze over the top of the jar, not a maggot makes its appearance, while the dead substances, nevertheless, putrefy just in the same way as before. It is obvious, therefore, that the maggots are not generated by the corruption of the

meat; and that the cause of their formation must be a something which is kept away by gauze. But gauze will not keep away aëriform bodies or fluids. This something must, therefore, exist in the form of solid particles too big to get through the gauze. Nor is one long left in doubt what these solid particles are, for the blowflies, attracted by the odour of the meat, swarm round the vessel, and, urged by a powerful but, in this case, misleading instinct, lay eggs, out of which maggots are immediately hatched, upon the gauze. The conclusion, therefore, is unavoidable; the maggots are not generated by the meat, but the eggs which give rise to them are brought through the air by the flies.

These experiments seem almost childishly simple, and one wonders how it was that no one ever thought of them before. Simple as they are, however, they are worthy of the most careful study, for every piece of experimental work since done, in regard to this subject, has been shaped upon the model furnished by the Italian philosopher. As the results of his experiments were the same, however varied the nature of the materials he used, it is not wonderful that there arose in Redi's mind a presumption that in all such cases of the seeming production of life from dead matter, the real explanation was the introduction of living germ from without into that dead matter. And thus the hypothesis that living matter always arises by the agency of pre-existing living matter took definite shape, and had henceforward a right to be considered and a claim to be refuted in each particular case, before the production of living matter in any other way could be admitted by careful reasoners. It will be necessary for me to refer to this hypothesis so frequently that, to save circumlocution, I shall call it the hypothesis of *Biogenesis*; and I shall term the contrary doctrine—that living may be produced by not living matter—the hypothesis of *Abiogenesis.*

In the seventeenth century, as I have said, the latter was the dominant view, sanctioned alike by antiquity and by authority; and it is interesting to observe that Redi did not escape the customary tax upon a discoverer, of having to defend himself against the charge of impugning the authority of the Scriptures; for his adversaries declared that the generation of bees from the carcass of a dead lion is affirmed, in the book of Judges, to have been the origin of that famous riddle with which Samson perplexed the Philistines:

> "Out of the eater came forth meat,
> And out of the strong came forth sweetness."

Against all odds, however, Redi, strong with the strength of demonstrable fact, did splendid battle for biogenesis; but it is remarkable he held the doctrine in a sense which, if he had lived in these times, would have infallibly caused him to be classed among the defenders of "spontaneous generation." "Omne vivum ex vivo," "no life without antecedent life," aphoristically sums up Redi's doctrine; but he went no further. It is most remarkable evidence of the philosophic caution and impartiality of his mind, that although he had speculatively anticipated the manner in which grubs really are deposited in fruits and in the galls of plants, he deliberately admits that the evidence is insufficient to bear him out; and he therefore prefers the supposition that they are generated by a modification of the living substance of the plants themselves. Indeed, he regards these vegetable growths as organs, by means of which the plant gives rise to an animal, and looks upon this production of specific animals as the final cause of the galls and of at any rate some fruits. And he proposes to explain the occurrence of parasites within the animal body in the same way.

It is of great importance to apprehend Redi's position rightly, for the lines of thought he laid down for us are those upon which naturalists have been working ever since. Clearly, he held biogenesis as against abiogenesis; and I shall immediately proceed, in the first place, to inquire how far subsequent investigation has borne him out in so doing.

But Redi also thought that there were two modes of biogenesis. By the one method, which is that of common and ordinary occurrence, the living parent gives rise to offspring which passes through the same cycle of changes as itself—like gives rise to like; and this has been termed *Homogenesis*. By the other mode, the living parent was supposed to give rise to offspring which passed through a totally different series of states from those exhibited by the parent, and did not return into the cycle of the parent, this is what ought to be called *Heterogenesis*, the offspring being altogether and permanently unlike the parent. The term heterogenesis, however, has unfortunately been used in a different sense, and M. Milne-Edwards has therefore substituted for it *Xenogenesis*, which means the generation of something foreign. After discussing Redi's hypothesis of universal biogenesis, then, I shall go on to ask how far the growth of science justifies his other hypothesis of xenogenesis.

The progress of the hypothesis of biogenesis was triumphant and unchecked for nearly a century. The application of the microscope to anatomy, in the hands of Grew, Leeuwenhoek, Swammerdam, Lyonet, Vallisnieri, Reaumur, and other illustrious investigators of nature of that day, displayed such a complexity of organisation in the lowest and minutest forms, and everywhere revealed such a prodigality of provision for their multiplication by germs of one sort or another, that the hypothesis of abiogenesis began to appear not only untrue but absurd; and, in the middle of the eighteenth century, when Needham and Buffon took up the question, it was almost universally discredited.

But the skill of the microscope-makers of the eighteenth century soon reached its limit. A microscope magnifying 400 diameters was a *chef-d'œuvre* of the opticians of that day, and, at the same time, by no means trustworthy. But a magnifying power of 400 diameters, even when definition reaches the exquisite perfection of our modern achromatic lenses, hardly suffices for the mere discernment of the smallest forms of life. A speck, only $\frac{1}{25}$th of an inch in diameter, has, at 10 inches from the eye, the same apparent size as an object $\frac{1}{10000}$th of an inch in diameter when magnified 400 times; but forms of living matter abound, the diameter of which is not more than $\frac{1}{40000}$th of an inch. A filtered infusion of hay, allowed to stand for two days, will swarm with living things, among which any which reaches the diameter of a human red blood-corpuscle, or about $\frac{1}{3200}$th of an inch, is a giant. It is only by bearing these facts in mind, that we can deal fairly with the remarkable statements and speculations put forward by Buffon and Needham in the middle of the eighteenth century.

When a portion of any animal or vegetable body is infused in water, it gradually softens and disintegrates; and, as it does so, the water is found to swarm with minute active creatures, the so-called infusorial animalcules, none of which can be seen, except by the aid of the microscope; while a large proportion belong to the category of smallest things of which I have spoken, and which must have all looked like mere dots and lines under the ordinary microscopes of the eighteenth century.

Led by various theoretical considerations which I cannot now discuss, but which looked promising enough in the lights of that day, Buffon and Needham doubted the applicability of Redi's hypothesis to the infusorial animalcules, and Needham very properly endeavoured to put the question to an experimental test. He said to himself, if these infusorial animalcules come from germs, their germs must exist either in the substance infused, or in the water with which the infusion is made, or in the superjacent air. Now the vitality of all germs is destroyed by heat. Therefore, if I boil the infusion, cork it up carefully, cementing the cork over with mastic, and then heat the whole vessel by heaping hot ashes over it, I must needs kill whatever germs are present. Consequently, if Redi's hypothesis hold good,

when the infusion is taken away and allowed to cool, no animalcules ought to be developed in it; whereas, if the animalcules are not dependent on pre-existing germs, but are generated from the infused substance, they ought, bye-and-by, to make their appearance. Needham found that, under the circumstances in which he made his experiments, animalcules always did arise in the infusions, when a sufficient time had elapsed to allow for their development.

In much of his work Needham was associated with Buffon, and the results of their experiments fitted in admirably with the great French naturalist's hypothesis of "organic molecules," according to which, life is the indefeasible property of certain indestructible molecules of matter, which exist in all living things, and have inherent activities by which they are distinguished from not living matter. Each individual living organism is formed by their temporary combination. They stand to it in the relation of the particles of water to a cascade or a whirlpool, or to a mould into which the water is poured. The form of the organism is thus determined by the reaction between external conditions and the inherent activities of the organic molecules of which it is composed; and, as the stoppage of a whirlpool destroys nothing but a form, and leaves the molecules of the water with all their inherent activities intact, so what we call the death and putrefaction of an animal, or of a plant, is merely the breaking up of the form or manner of association of its constituent organic molecules, which are then set free as infusorial animalcules.

It will be perceived that this doctrine is by no means identical with abiogenesis, with which it is often confounded. On this hypothesis, a piece of beef, or a handful of hay, is dead only in a limited sense. The beef is dead ox, and the hay is dead grass; but the "organic molecules" of the beef or the hay are not dead, but are ready to manifest their vitality as soon as the bovine or herbaceous shrouds in which they are imprisoned are rent by the macerating action of water. The hypothesis therefore must be classified under xenogenesis, rather than under abiogenesis. Such as it was, I think it will appear, to those who will be just enough to remember that it was propounded before the birth of modern chemistry and of modern optical arts, to be a most ingenious and suggestive speculation.

But the great tragedy of science—the slaying of a beautiful hypothesis by an ugly fact—which is so constantly being enacted under the eyes of philosophers, was played almost immediately for the benefit of Buffon and Needham.

Once more, an Italian, the Abbe Spallanzani, a worthy successor and representative of Redi in his acuteness, his ingenuity, and his learning, subjected the experiments and the conclusions of Needham to a searching criticism. It might be true that Needham's experiments yielded results such as he had described, but did they bear out his arguments? Was it not possible, in the first place, that he had not completely excluded the air by his corks and mastic? And was it not possible, in the second place, that he had not sufficiently heated his infusions and the superjacent air? Spallanzani joined issue with the English naturalist on both these pleas; and he showed that if, in the first place, the glass vessels in which the infusions were contained were hermetically sealed by fusing their necks; and if, in the second place, they were exposed to the temperature of boiling water for three-quarters of an hour, no animalcules ever made their appearance within them. It must be admitted that the experiments and arguments of Spallanzani furnish a complete and a crushing reply to those of Needham. But we all too often forget that it is one thing to refute a proposition, and another to prove the truth of a doctrine which implicitly or explicitly contradicts that proposition; and the advance of science soon showed that though Needham might be quite wrong, it did not follow that Spallanzani was quite right.

Modern chemistry, the birth of the latter half of the eighteenth century, grew apace, and soon found herself face to face with the great problems which biology had vainly tried to attack without her help. The discovery of oxygen led to the laying of the foundations of a scientific theory of respiration, and to an examination of the marvellous interactions of organic substances with oxygen. The presence of free oxygen appeared to be one of the conditions of the existence of life, and of those singular changes in organic matters which are known as fermentation and putrefaction. The question of the generation of the infusory animalcules thus passed into a new phase. For what might not have happened to the organic matter of the infusions, or to the oxygen of the air, in Spallanzani's experiments? What security was there that the development of life, which ought to have taken place, had not been checked or prevented by these changes?

The battle had to be fought again. It was needful to repeat the experiments under conditions which would make sure that neither the oxygen of the air nor the composition of the organic matter was altered in such a manner as to interfere with the existence of life.

Schulze and Schwann took up the question from this point of view in 1836 and 1837. The passage of air through red-hot glass tubes, or through strong sulphuric acid, does not alter the proportion of its oxygen, while it must needs arrest or destroy any organic matter which may be contained in the air. These experimenters, therefore, contrived arrangements by which the only air which should come into contact with a boiled infusion, should be such as had either passed through red-hot tubes or through strong sulphuric acid. The result which they obtained was that an infusion so treated developed no living things, while if the same infusion was afterwards exposed to the air, such things appeared rapidly and abundantly. The accuracy of these experiments has been alternately denied and affirmed. Supposing them to be accepted, however, all that they really proved was, that the treatment to which the air was subjected destroyed something that was essential to the development of life in the infusion. This "something" might be gaseous, fluid, or solid; that it consisted of germs remained only an hypothesis of greater or less probability.

Contemporaneously with these investigations, a remarkable discovery was made by Cagniard de la Tour. He found that common yeast is composed of a vast accumulation of minute plants. The fermentation of must, or of wort, in the fabrication of wine and of beer, is always accompanied by the rapid growth and multiplication of these *Torulæ*. Thus fermentation, in so far as it was accompanied by the development of microscopical organisms in enormous numbers, became assimilated to the decomposition of an infusion of ordinary animal or vegetable matter; and it was an obvious suggestion that the organisms were, in some way or other, the causes both of fermentation and putrefaction. The chemists, with Berzelius and Liebig at their head, at first laughed this idea to scorn; but, in 1843, a man then very young, who has since performed the unexampled feat of attaining to high eminence alike in mathematics, physics, and physiology—I speak of the illustrious Helmholtz—reduced the matter to the test of experiment by a method alike elegant and conclusive. Helmholtz separated a putrefying or a fermenting liquid from one which was simply putrescible or fermentable by a membrane, which allowed the fluids to pass through and become intermixed, but stopped the passage of solids. The result was, that while the putrescible or the fermentable liquids became impregnated with the results of the putrescence or fermentation which was going on on the other side of the membrane, they neither putrefied (in the ordinary way) nor fermented; nor were any of the organisms which abounded in the fermenting or putrefying liquid generated in them.

Therefore, the cause of the development of these organisms must lie in something which cannot pass through membrane; and as Helmholtz's investigations were long antecedent to Graham's researches upon colloids, his natural conclusion was, that the agent thus intercepted must be a solid material. In point of fact, Helmholtz's experiments narrowed the issue to this—that which excites fermentation and putrefaction, and at the same time gives rise to living forms in a fermentable or putrescible fluid, is not a gas and is not a diffusible fluid, therefore it is either a colloid, or it is matter divided into very minute solid particles.

The researches of Schroeder and Dusch, in 1854, and of Schroeder alone, in 1859, cleared up this point by experiments which are simply refinements upon those of Redi. A lump of cotton-wool is, physically speaking, a pile of many thicknesses of a very fine gauze, the fineness of the meshes of which depends upon the closeness of the compression of the wool. Now, Schroeder and Dusch found that, in the case of all the putrefiable materials which they used (except milk and yolk of egg), an infusion boiled, and then allowed to come into contact with no air but such as had been filtered through cotton-wool, neither putrefied nor fermented, nor developed living forms. It is hard to imagine what the fine sieve formed by the cotton-wool could have stopped except minute solid particles. Still the evidence was incomplete until it had been positively shown, first, that ordinary air does contain such particles; and, secondly, that filtration through cotton-wool arrests these particles, and allows only physically pure air to pass. This demonstration has been furnished within the last year by the remarkable experiments of Professor Tyndall. It has been a common objection of abiogenists that, if the doctrine of biogeny is true, the air must be thick with germs, and they regard this as the height of absurdity. But nature occasionally is exceedingly unreasonable, and Professor Tyndall has proved that this particular absurdity may nevertheless be a reality. He has demonstrated that ordinary air is no better than a sort of stirabout of excessively minute solid particles; that these particles are almost wholly destructible by heat; and that they are strained off, and the air rendered optically pure, by being passed through cotton-wool.

But it remains yet in the order of logic, though not of history, to show that among these solid destructible particles there really do exist germs capable of giving rise to the development of living forms in suitable menstrua. This piece of work was done by M. Pasteur, in those beautiful researches which will ever render his name famous, and which, in spite of all attacks upon them, appear to me now, as they did seven years ago, to be models of accurate experimentation and logical reasoning. He strained air through cotton-wool, and found, as Schroeder and Dusch had done, that it contained nothing competent to give rise to the development of life in fluids highly fitted for that purpose. But the important further links in the chain of evidence added by Pasteur are three. In the first place, he subjected to microscopic examination the cotton-wool which had served as strainer, and found that sundry bodies, clearly recognisable as germs, were among the solid particles strained off. Secondly, he proved that these germs were competent to give rise to living forms, by simply sowing them in a solution fitted for their development. And, thirdly, he showed that the incapacity of air strained through cotton-wool to give rise to life was not due to any occult change effected in constituents of the air by the wool, by proving that the cotton-wool might be dispensed with altogether, and perfectly free access left between the exterior air and that in the experimental flask. If the neck of the flask is drawn out into a tube and bent downwards; and if, after the contained fluid has been carefully boiled, the tube is heated sufficiently to destroy any germs which may be present in the air which enters as the fluid cools, the apparatus may be left to itself for any time, and no life will appear in the fluid. The reason is plain. Although there is free communication between the atmosphere laden with germs and the germless air in the flask, contact between the two takes place only in the tube; and as the germs cannot fall upwards, and there are no currents, they never reach the interior of the flask. But if the tube be broken short off where it proceeds from the flask, and free access be thus given to germs falling vertically out of the air, the fluid which has remained clear and desert for months, becomes, in a few days, turbid and full of life.

These experiments have been repeated over and over again, by independent observers, with entire success; and there is one very simple mode of seeing the facts for one's-self, which I may as well describe.

Prepare a solution (much used by M. Pasteur, and often called "Pasteur's solution") composed of water with tartrate of ammonia, sugar, and yeast-ash dissolved therein. Divide it into three portions in as many flasks; boil all three for a quarter of an hour; and, while the steam is passing out, stop the neck of one with a large plug of cotton-wool, so that this also may be thoroughly steamed. Now set the flasks aside to cool, and when their contents are cold, add to one of the open ones a drop of filtered infusion of hay which has stood for twenty-four hours, and is consequently full of the active and excessively minute organisms known as *bacteria*. In a couple of days of ordinary warm weather, the contents of the flask will be milky, from the enormous multiplication of *bacteria*. The other flask, open and exposed to the air, will, sooner or later, become milky with *bacteria*, and patches of mould may appear on it; while the liquid in the flask the neck of which is plugged with cotton-wool will remain clear for an indefinite time. I have sought in vain for an explanation of these facts, except the obvious one, that the air contains germs competent to give rise to *bacteria*, such as those with which the first solution has been knowingly and purposely inoculated, and to the mould *fungi*. And I have not yet been able to meet with any advocate of abiogensis, who seriously maintains that the atoms of sugar, tartrate of ammonia, yeast-ash, and water, under no influence but that of free access of air and the ordinary temperature, re-arrange themselves, and give rise to the protoplasm of *bacterium*. But the alternative is, to admit that these *bacteria* arise from germs in the air; and, if they are thus propagated, the burden of proof that other like forms are generated in a different manner must rest with the asserter of that proposition.

To sum up the effect of this long chain of evidence:—

It is demonstrable that a fluid eminently fit for the development of the lowest forms of life, but which contains neither germs nor any protein compound, gives rise to living things in great abundance if it is exposed to ordinary air; while no such development takes place if the air with which it is in contact is mechanically freed from the solid particles which ordinarily float in it, and which may be made visible by appropriate means.

It is demonstrable that the great majority of these particles are destructible by heat, and that some of them are germs or living particles capable of giving rise to the same forms of life as those which appear when the fluid is exposed to unpurified air.

It is demonstrable that inoculation of the experimental fluid with a drop of liquid known to contain living particles gives rise to the same phenomena as exposure to unpurified air.

And it is further certain that these living particles are so minute that the assumption of their suspension in ordinary air presents not the slightest difficulty. On the contrary, considering their lightness and the wide diffusion of the organisms which produce them, it is impossible to conceive that they should not be suspended in the atmosphere in myriads.

Thus the evidence, direct and indirect, in favour of *biogenesis* for all known forms of life must, I think, be admitted to be of great weight.

On the other side, the sole assertions worthy of attention are, that hermetically sealed fluids, which have been exposed to great and long-continued heat, have sometimes exhibited living forms of low organisation when they have been opened.

The first reply that suggests itself is the probability that there must be some error about these experiments, because they are performed on an enormous scale every day, with quite contrary results. Meat, fruit, vegetables, the very materials of the most fermentable and putrescible infusions, are preserved to the extent, I suppose I may say, of thousands of tons every year, by a method which is a mere application of Spallanzani's experiment. The matters to be preserved are well boiled in a tin case provided with a small hole, and this hole is soldered up when all the air in the case has been replaced by steam. By this method, they may be kept for years without putrefying, fermenting, or getting mouldy. Now, this is not because oxygen is excluded, inasmuch as it is now proved that free oxygen is not necessary for either fermentation or putrefaction. It is not because the tins are exhausted of air, for *vibriones* and *bacteria* live, as Pasteur has shown, without air or free oxygen. It is not because the boiled meats or vegetables are not putrescible or fermentable, as those who have had the misfortune to be in a ship supplied with unskilfully closed tins well know. What is it, therefore, but the exclusion of germs? I think that abiogenists are bound to answer this question before they ask us to consider new experiments of precisely the same order.

And, in the next place, if the results of the experiments I refer to are really trustworthy, it by no means follows that abiogenesis has taken place. The resistance of living matter to heat is known to vary within considerable limits, and to depend, to some extent, upon the chemical and physical qualities of the surrounding medium. But if, in the present state of science, the alternative is offered us, either germs can stand a greater heat than has been supposed, or the molecules of dead matter, for no valid or intelligible reason that is assigned, are able to re-arrange themselves into living bodies, exactly such as can be demonstrated to be frequently produced in another way, I cannot understand how choice can be, even for a moment, doubtful.

But, though I cannot express this conviction of mine too strongly, I must carefully guard myself against the supposition that I intend to suggest that no such thing as abiogenesis ever has taken part in the past, or ever will take place in the future. With organic chemistry, molecular physics, and physiology yet in their infancy, and every day making prodigious strides, I think it would be the height of presumption for any man to say that the conditions under which matter assumes the properties we call "vital" may not some day be artificially brought together. All I feel justified in affirming is, that I see no reason for believing that the feat has been performed yet.

And, looking back through the prodigious vista of the past, I find no record of the commencement of life, and therefore I am devoid of any means of forming a definite conclusion as to the conditions of its appearance. Belief, in the scientific sense of the word, is a serious matter, and needs strong foundations. To say, therefore, in the admitted absence of evidence, that I have any belief as to the mode in which the existing forms of life have originated, would be using words in a wrong sense. But expectation is permissible where belief is not; and if it were given me to look beyond the abyss of geologically recorded time to the still more remote period when the earth was passing through physical and chemical conditions, which it can no more see again than a man can recall his infancy, I should expect to be a witness of the evolution of living protoplasm from not living matter. I should expect to see it appear under forms of great simplicity, endowed, like existing fungi, with the power of determining the formation of new protoplasm from such matters as ammonium carbonates, oxalates and tartrates, alkaline and earthy phosphates, and water, without the aid of light. That is the expectation to which analogical reasoning leads me; but I beg you once more to recollect that I have no right to call my opinion anything but an act of philosophical faith.

So much for the history of the progress of Redi's great doctrine of biogenesis, which appears to me, with the limitations I have expressed, to be victorious along the whole line at the present day.

As regards the second problem offered to us by Redi, whether xenogenesis obtains side by side with homogenesis—whether, that is, there exist not only the ordinary living things, giving rise to offspring which run through the same cycle as themselves, but also others, producing offspring which are of a totally different character from themselves, the researches of two centuries have led to a different result. That the grubs found in galls are no product of the plant on which the galls grow, but are the result of the introduction of the eggs of insects into the substance of these plants, was made out by Vallisnieri, Reaumur, and others, before the end of the first half of the eighteenth century. The tapeworms, bladder-worms, and flukes continued to be a stronghold of the advocates of xenogenesis for a much longer period. Indeed, it is only within the last thirty years that the splendid patience of Von Siebold, Van Beneden, Leuckart, Küchenmeister, and other helminthologists, has succeeded in tracing every such parasite, often through the strangest wanderings and metamorphoses, to an egg derived from a parent, actually or potentially like itself; and the tendency of inquiries elsewhere has all been in the same direction. A plant may throw off bulbs, but these, sooner or later, give rise to seeds or spores, which develop into the original form. A polyp may give rise to medusæ, or a pluteus to an echinoderm, but the medusa and the echinoderm give rise to eggs which produce polypes or plutei, and they are therefore only stages in the cycle of life of the species.

But if we turn to pathology, it offers us some remarkable approximations to true xenogenesis.

As I have already mentioned, it has been known since the time of Vallisnieri and of Reaumur, that galls in plants, and tumours in cattle, are caused by insects, which lay their eggs in those parts of the animal or vegetable frame of which these morbid structures are outgrowths. Again, it is a matter of familiar experience to everybody that mere pressure on the skin will give rise to a corn. Now the gall, the tumour, and the corn are parts of the living body which have become, to a certain degree, independent and distinct organisms. Under the influence of certain external conditions, elements of the body, which should have developed in due subordination to its general plan, set up for themselves, and apply the nourishment which they receive to their own purposes.

From such innocent productions as corns and warts, they are all gradations to the serious tumours which, by their mere size and the mechanical obstruction they cause, destroy the organism out of which they are developed; while, finally, in those terrible structures known as cancers, the abnormal growth has acquired powers of reproduction and multiplication, and is only morphologically distinguishable from the parasitic worm, the life of which is neither more nor less closely bound up with that of the infested organism.

If there were a kind of diseased structure, the histological elements of which were capable of maintaining a separate and independent existence out of the body, it seems to me that the shadowy boundary between morbid growth and xenogenesis would be effaced. And I am inclined to think that the progress of discovery has almost brought us to this point already. I have been favoured by Mr. Simon with an early copy of the last published of the valuable "Reports on the Public Health," which, in his capacity of their medical officer, he annually presents to the Lords of the Privy Council,

The appendix to this report contains an introductory essay "On the Intimate Pathology of Contagion," by Dr. Burdon Sanderson, which is one of the clearest, most comprehensive, and well-reasoned discussions of a great question which has come under my notice for a long time. I refer you to it for details, and for the authorities for the statements I am about to make.

You are familiar with what happens in vaccination. A minute cut is made in the skin, and an infinitesimal quantity of vaccine matter is inserted into the wound. Within a certain time, a vesicle appears in the place of the wound, and the fluids which distends this vesicle, is vaccine matter, in quantity a hundred or a thousand-fold that which was originally inserted. Now, what has taken place in the course of this operation? Has the vaccine matter, by its irritative property, produced a mere blister, the fluid of which has the same irritative property? Or does the matter contain living particles, which have grown and multiplied where they have been planted. The observations of M. Chauveau, extended and confirmed by Dr. Sanderson himself, appear to leave no doubt upon this head. Experiments, similar in principle to those of Helmholtz on fermentation and putrefaction, have proved that the active element in the vaccine lymph is non-diffusible, and consists of minute particles not exceeding $\frac{1}{20000}$ of an inch in diameter, which are made visible in the lymph by the microscope. Similar experiments have proved that two of the most destructive of epizootic diseases, sheep-pox and glanders, are also dependent for their existence and their propagation upon extremely small living solid particles, to which the title of *microzymes* is applied. An animal suffering under either of these terrible diseases is a source of infection and contagion to others, for precisely the same reason as a tub of fermenting beer is capable of propagating its fermentation, by "infection" or contagion," to fresh wort. In both cases it is the solid living particles which are efficient; the liquid in which they float, and at the expense of which they live, being altogether passive.

Now arises the question, are these microzymes the results of homogenesis or of xenogenesis; are they capable, like the *Torulæ* of yeast, of arising only by the development of pre-existing germs; or may they be, like the constituents of a nut-gall, the results of a modification and individualisation of the tissues of the body in which they are found, resulting from the operation of certain conditions? Are they parasites in the zoological sense, or are they merely what Virchow has called "heterologous growths?" It is obvious that this question has the most profound importance, whether we look at it from a practical or from a theoretical point of view. A parasite may be stamped out by destroying its germs, but a pathological product can only be annihilated by removing the conditions which gave rise to it.

It appears to me that this great problem will have to be solved for each zymotic disease separately, for analogy cuts two ways. I have dwelt upon the analogy of pathological modification, which is in favour of the xenogenetic origin of microzymes; but I must now speak of the equally strong analogies in favour of the origin of such pestiferous particles by the ordinary process of the generation of like from like.

It is, at present, a well-established fact that certain diseases, both of plants and of animals, which have all the characters of contagious and infectious epidemics, are caused by minute organisms. The smut of wheat is a well-known instance of such a disease, and it cannot be doubted that the grape-disease and the potato-disease fall under the same category. Among animals, insects are wonderfully liable to the ravages of contagious and infectious diseases caused by microscopic fungi.

In autumn, it is not uncommon to see flies motionless upon a window-pane, with a sort of magic circle, in white, drawn round them. On microscopic examination, the magic circle is found to consist of innumerable spores, which have been thrown off in all directions by a minute fungus called *Empusa muscæ*, the spore-forming filaments of which stand out like a pile of velvet from the body of the fly. These spore-forming filaments are connected with others, which fill the interior of the fly's body like so much fine wool, having eaten away and destroyed the creature's viscera. This is the full-grown condition of the *Empusa*. If traced back to its earlier stages, in flies which are still active, and, to all appearance, healthy, it is found to exist in the form of minute corpuscles which float in the blood of the fly. These multiply, and lengthen into filaments, at the expense of the fly's substance; and when they have at last killed the patient, they grow out of its body and give off spores. Healthy flies shut up with diseased ones catch this mortal disease and perish like the others. A most competent observer, M. Cohn, who studied the development in the fly very carefully, was utterly unable to discover in what manner the smallest germs of the empusa got into the fly. The spores could not be made to give rise to such germs by cultivation; nor were such germs discoverable in the air, or in the food of the fly. It looked exceeding like a case of abiogenesis, or at any rate of xenogenesis; it is only quite recently that the real course of events has been made out. It has been ascertained that when one of the spores falls upon the body of a fly, it begins to germinate and sends out a process, which bores its way through the fly's skin; this, having reached the interior cavities of its body, gives off the minute floating corpuscles which are the earliest stage of the empusa. The disease is "contagious," because a healthy fly coming in contact with a diseased one, from which the spore-bearing filaments protrude, is pretty sure to carry off a spore or two. It is "infectious," because the spores become scattered about all sorts of matter in the neighbourhood of the slain flies.

The silkworm has long been known to be subject to a very fatal and infectious contagious disease called the muscardine. Audouin transmited it by inoculation. This disease is entirely due to the development of a fungus, *Botrytis bassiana*, in the body of the caterpillar; and its contagiousness and infectiousness are accounted for in the same way as those of the fly-disease. But, of late years, a still more serious epizootic has appeared among the silkworms; and I may mention a few facts which will give you some conception of the gravity of the injury which it has inflicted on France alone.

The production of silk has been, for centuries, an important branch of industry in southern France, and, in the year 1853, it had attained such a magnitude that the annual produce of the French sericulture was estimated to amount to a tenth of that of the whole world, and represented a money value of 117,000,000 of francs, or nearly five millions sterling. What may be the sum which would represent the money-value of all the industries connected with the working-up of the raw silk thus produced is more than I can pretend to estimate. Suffice it to say, that the city of Lyons is built upon French silk, as much as Manchester was upon American cotton before the civil war.

Silkworms are liable to many diseases; and, even before 1853, a peculiar epizootic, frequently accompanied by the appearance of dark spots upon the skin (whence the name of "pébrine" which it has received), had been noted for its mortality. But in the years following 1853 this malady broke out with such extreme violence, that, in 1856, the silk-crop was reduced to a third of the amount which it reached in 1853; and, up till within the last year or two, it has never attained half the yield of 1853. This means not only that the great number of people engaged in silk-growing are some thirty millions sterling poorer than they might have been; it means not only that high prices have had to be paid for imported silkworm eggs, and that, after investing his money in them, in paying for mulberry-leaves and for attendance, the cultivator has constantly seen his silkworms perish and himself plunged in ruin—but it means

that the looms of Lyons have lacked employment, and that, for years, enforced idleness and misery have been the portion of a vast population which, in former days, was industrious and well-to-do.

In 1858, the gravity of the situation caused the French Academy of Sciences to appoint commissioners, of whom a distinguished naturalist, M. de Quatrefages, was one, to inquire into the nature of this disease, and, if possible, to devise some means of staying the plague. In reading the report made by M. de Quatrefages, in 1859, it is exceedingly interesting to observe that this elaborate study of the pébrine forced the conviction upon his mind that, in its mode of occurrence and propagation, the disease of the silkworm is, in every respect, comparable to the cholera among mankind. But it differs from the cholera, and, so far, is a more formidable disease, in being hereditary, and in being, under some circumstances, contagious as well as infectious.

The Italian naturalist, Filippi, discovered in the blood of the silkworms affected by this strange disease a multitude of cylindrical corpuscles, each about $\frac{1}{6000}$ of an inch long. These have been carefully studied by Lebert, and named by him *Panhistophyton;* for the reason that, in subjects in which the disease is strongly developed, the corpuscles swarm in every tissue and organ of the body, and even pass into the undeveloped eggs of the female moth. But are these corpuscles causes or mere concomitants of the disease? Some naturalists took one view and some another; and it was not until the French government, alarmed by the continued ravages of the malady, and the inefficiency of the remedies which had been suggested, dispatched M. Pasteur to study it, that the question received its final settlement, at a great sacrifice, not only of the time and peace of mind of that eminent philosopher, but, I regret to have to add, of his health.

But the sacrifice has not been in vain. It is now certain that this devastating, cholera-like pébrine is the effect of the growth and multiplication of the *Panhistophyton* in the silkworm. It is contagious and infectious because the corpuscles of the *Panhistophyton* pass away from the bodies of the diseased caterpillars, directly or indirectly, to the alimentary canal of healthy silkworms in their neighbourhood; it is hereditary, because the corpuscles enter into the eggs while they are being formed, and, consequently, are carried within them when they are laid; and for this reason, also, it presents the very singular peculiarity of being inherited only on the mother's side. There is not a single one of all the apparently capricious and unaccountable phenomena presented by the pébrine but has received its explanation from the fact that the disease is the result of the presence of the microscopic organism, *Panhistophyton.*

Such being the facts with respect to the pébrine, what are the indications as to the method of preventing it? It is obvious that this depends upon the way in which the *Panhistophyton* is generated. If it may be generated by abiogenesis, or by xenogenesis, within the silkworm or its moth, the extirpation of the disease must depend upon the prevention of the occurrence of the conditions under which this generation takes place. But if, on the other hand, the *Panhistophyton* is an independent organism, which is no more generated by the silkworm than the mistletoe is generated by the oak or the apple-tree on which it grows, though it may need the silkworm for its development in the same way as the mistletoe needs the tree, then the indications are totally different. The sole thing to be done is to get rid of and keep away the germs of the *Panhistophyton.* As might be imagined, from the course of his previous investigations, M. Pasteur was led to believe that the latter was the right theory; and guided by that theory, he has devised a method of extirpating the disease, which has proved to be completely successful wherever it has been properly carried out.

There can be no reason, then, for doubting that among insects contagious and infectious diseases of great malignity are caused by minute organisms, which are produced from pre-existing germs, or by homogenesis; and there is no reason that I know of for believing that what happens in insects may not take place in the highest animals. Indeed, there is already strong evidence that some diseases of an extremely malignant and fatal character to which man is subject are as much the work of minute organisms as the pébrine. I refer for this evidence to the very striking facts adduced by Professor Lister in his various well-known publications on the antiseptic method of treatment. It seems to me impossible to rise from the perusal of those publications without a strong conviction that the lamentable mortality which so frequently dogs the footsteps of the most skilful operator, and those deadly consequences of wounds and injuries which seem to haunt the very walls of great hospitals, and are even now destroying more men than die of bullet or bayonet, are due to the importation of minute organisms into wounds, and their increase and multiplication; and that the surgeon who saves most lives will be he who best works out the practical consequences of the hypothesis of Redi.

I commenced this address by asking you to follow me in an attempt to trace the path which has been followed by a scientific idea, in its long and slow progress from the position of a probable hypothesis to that of an established law of nature. Our survey has not taken us into very attractive regions; it has lain chiefly in a land flowing with the abominable, and peopled with mere grubs and mouldiness. And it may be imagined with what smiles and shrugs practical and serious contemporaries of Redi and of Spallanzani may have commented on the waste of their high abilities, in toiling at the solution of problems which, though curious enough in themselves, could be of no conceivable utility to mankind.

Nevertheless you will have observed, that before we had travelled very far upon our road there appeared, on the right hand and on the left, fields laden with a harvest of golden grain, immediately convertible into those things which the most sordidly practical of men will admit to have value—namely, money and life.

The direct loss to France caused by the pébrine in seventeen years cannot be estimated at less than fifty millions sterling; and if we add to this what Redi's idea, in Pasteur's hands, has done for the wine-grower and for the vinegar-maker, and try to capitalise its value, we shall find that it will go a long way towards repairing the money losses caused by the frightful and calamitous war of this autumn.

And as to the equivalent of Redi's thought in life, how can we over-estimate the value of that knowledge of the nature of epidemic and epizootic diseases, and consequently of the means of checking or eradicating them, the dawn of which has assuredly commenced?

Looking back no further than ten years, it is possible to select three (1863, 1864, and 1869), in which the total number of deaths from scarlet-fever alone amounted to ninety thousand. That is the return of killed, the maimed and disabled being left out of sight. Why, it is to be hoped that the list of killed in the present bloodiest of all wars will not amount to more than this. But the facts which I have placed before you must leave the least sanguine without a doubt, that the nature and the causes of this scourge will one day be as well understood as those of the pébrine are now, and that the long-suffered massacre of our innocents will come to an end.

And thus mankind will have one more admonition, that "the people perish for lack of knowledge; and that the alleviation of the miseries, and the promotion of the welfare of men must be sought, by those who will not lose their pains, in that diligent, patient, loving study of all the multitudinous aspects of nature, the results of which constitute exact knowledge, or science.

It is the justification and the glory of this great meeting that it is gathered together for no other object than the advancement of the moiety of science which deals with those phenomena of nature which we call physical. May its endeavours be crowned with a full measure of success.

CONDITION OF THE INDUSTRIAL

(*Continued from*

Name of country.	No. of persons belonging to the industrial classes, and their rates to the whole population.	Educational advantages.	Condition, &c., of the industrial classes.	Nature of their employment, and hours of work.
PORTUGAL.	Total population ... ...4,288,955 Industrial population (?) 186,684 Operatives in Lisbon ... 7,000 In Aveiro, Coimbra, and Leiria 75,296		Industrial interest not very strong. Workmen's wants easily supplied. Attendance on the Monday as regular as on other days. Drunkenness very rare. No trades unions. Strikes also of unfrequent occurrence. No restrictions between employers and employed.	Woollen cloth and shoes (the latter exported chiefly to Brazil), with the wine and other factories.
PRUSSIA.	Total population ... ...24,000,000 157 workmen to every hundred employers—the largest proportion in Silesia, Westphalia, and the Rhenish provinces. 199 labourers to every hundred landowners—the smallest percentage in the Rhenish provinces and Brandenburg. Weavers 30,000	Primary education obligatory for children from 6 to 14 years of age; 14 per cent. only absent from school; only 4 per cent. of the soldiers not educated; and only 12 per cent. who cannot read print. A second advanced school for apprentices (not compulsory) Various industrial establishments, and carefully arranged rules for the guidance of operatives, &c.	Many agricultural labourers live in comparative indigence. Fresh meat an exceptional luxury, yet they are generally contented. The factory operatives less contented as a rule, but wanting in proper ambition. Weavers the poorest, worst fed, and the least capable of the working classes. Miners and iron-workers most prosperous. Dwellings overcrowded.	Iron, coal, slate, glass, and other great industries. Sugar factors, Tile makers, Masons } migratory. Munich—Brewers and saddlers. Dresden—Tailors. Cologne and Munich—Stone-cutters. Elberfeld—Fringe makers. Berlin—Locksmiths & bronzers. Leipsic—Polygraphic art in all its branches. All travel after apprenticeship. More than one-fifth of all the factory operatives are females.
RUSSIA.	Hands employed in the cotton, wool, flax, hemp, cloth, silk, iron, sugar manufactures, &c., 725,000.	Several mill schools. Some free. In some a small charge made just to cover the expenses.	No comfort or cleanliness in their homes.	Various manufactures. Hours of work, 13 per day.
SAXONY.	Total population .. ...2,225,240 Industrial classes 555,000	Education for children to 14 years of age compulsory. Good evening schools for apprentices and workmen; also improvement associations.	Quick and apt. Second to none in moral qualities. Contented and fairly prosperous. Working contracts strictly enforced. 70 per cent. of the least paid married workmen are depositors in the savings banks.	General industries.
SPAIN.	Total artisans in Catalonia 600,000 Manufacturing hands ,, 18,000	In Andalusia ignorant though intelligent. 80 per cent. unable to read or write.	In Andalusia, discontented and irregular in their habits. Generally idle, proud, and independent. Moral and physical condition bad throughout the kingdom. Food scanty. Pay insufficient. Clothing coarse and common.	Wine, ore, soap, tobacco, quicksilver, copper, manganese, and other manufactories. Hours of work, 12 per day.

CLASSES IN FOREIGN COUNTRIES.

page 829.)

Rent.	Cost of living.	Rate of wages.	State of labour market, &c.
Houses generally poor; deficient in arrangement and healthiness,		Rate from 10½d. to 5s. 4d. per day. Weavers (a large class) 2s. 6d. ,,	Fairly stocked. Only open to the foreign agriculturist, or a few French dyers and English engineers of the first class.
Some agricultural labourers lodged gratis, or allowed from ¾ to 1⅓ acre of land. Dwellings poor and inadequate—one room, 18s. to 45s. per annum. In large towns, 3 or 4 rooms, £4 10s. to £15 ditto. In smaller towns, £2 ditto. Sleeping accommodation for one person, 3s. to 4s. 6d. per month. A dearth of houses in Minden (Westphalia), rent £6 to £7 10s. per annum. In other parts, only £1 10s. to £2 8s. ditto. In Berlin, there are 152,641 houses for 674,400 persons.	Annual sum for working man and family of 3 persons:— Largest at Cologne... ... £61 10s. Medium in circle of Essen 33 9 Smallest at Posen ... ... 8 18 Rate of cost for food in circle of Essen:— Wheat flour ... ... 2¾d. per lb. Bread... ... ... 1d. ,, Rice ... ... 4¾d. ,, Meat ... ... } 6¾d. ,, Bacon ... ... } Butter ... ... 9½d. ,, Vegetables, £1 11s. 2½d. per annum. Coffee, 18s. ,, Pulse, 3d. per measure. Milk, 1¾d. per quart.	Wages of lodged agricultural workmen too various for generalization: those not lodged 20 per cent higher than the others. Artisan, 4s. 6d. to 18s. per week. ,, specially skilled, 24s. ,, JOURNEYMEN. Silk, india-rubber, chemical, and other operatives, 12s. to 18s. ,, Masons, 10s. 6d. to 15s. ,, Tailors, 6s. to 15s. ,, Carpenters 13s. 6d. to 14s. 6d. ,, Shoemakers 4s. 6d. to 7s. 6d. ,, Bakers, 4s. 6d. ,, Brewers, 6s. ,, Watchmakers, 6s. ,, Millers, 13s. 6d. & higher ,, Silesia— Miners, 2s. to 3s. per day. Ironfounders, 2s. to 3s. ,, Glass workers, 15s. to 18s. per week. Metallurgy, 6s. to 30s. ,,	Sufficiently well supplied. Good competition.
Agricultural labourers live in log-houses, rude and cheap. Houses erected by mill owners at— For unmarried men, 3s. to 6s. per month. For married men, 6s. to 9s. ditto.	In the towns, working classes live better than those in the country. Town rate ... ... £1 per month. Country rate 5s. to 6s. ,, Rates of food— Beef ... ... 3½d. to 4½d. per lb. Small fish ... ... 3½d. ,, Butter ... ... 9d. ,, Flour, black ... 9s. 1d. per cwt. ,, white (middle) 16s. 6d. ,,	Good mill hands, 30s. to 60s. per month. Ordinary mechanics, 3s. to 6s. per day. Skilled mechanics, 6s. to 10s. ,, At Moscow— Day labourers, 30s. per month.	Room only for skilled labour. Germans more suitable than Englishmen. Employment precarious.
		Per week. Miners, 3s. to 12s ,, Iron founders, 7s. 6d. to 30s. ,, Brass founders, 6s. to 18s. 6d. ,, Glass workers, 7s. 6d. to 60s. ,, Masons, 7s. 6d. to 18s. ,, Tailors, 6s. to 18s. ,, Shoemakers, 6s. to 10s. 6d. ,, Engravers, 6s. to 24s. ,, Clockmakers, 7s. 6d. to 30s. ,, Carpenters, 7s. 6d. to 18s. ,,	No great opening for foreigners. The trades unions exert a freemason influence.
In Catalonia and Valencia, houses consist of flats, called barracks: rent, 8s. 4d. to 10s. 5d. per month. Larger houses are sublet in apartments. In Andalusia, houses small, poor, and uncomfortable.	In Valencia the food consists of— Dried fish. Capsicum. Bread. Fruit. Red wine. Thick soup. In Andalusia— Bread. Vegetables. Cold soup of cucumber and bread.	Catalonia— Weavers, 12s. to 16s. per week. Andalusia— Workmen, 1s. to 1s. 5d. per day. Valencia— Ordinary workmen, Per day. In town, 1s. 5½d. to 1s. 8d. ,, In country, 1s. 0½d. to 1s. 8d. ,, Masons, 1s. to 1s. 3d., and 2s. 1d. to 2s. 6d. ,, Carpenters, Smiths, } 2s. 1d. to 2s. 6d. ,, Weavers, 1s. 3d. to 1s. 8d. ,, Shoemakers 1s. 10½d. ,, Tailors, Cigar makers, } 2s. 1d. ,,	No opening in Catalonia. General stagnation in Valencia.

These tables will be continued in next "Journal."

THE HERRING FISHERIES IN THE NORTH.

Mr. Joseph Mitchell, of Inverness, whose evidence before the Food Committee was published in *Journal*, No. 856, in a letter forwarded to the *Journal* for publication, says:—

I notice by the newspapers that this unhappy war has had a disastrous effect on the herring fishing and on the fishing population around our north-eastern shores. The difficulty of approaching the usual markets for cured herrings at Stettin and other Prussian ports has made curers indifferent about purchasing the herrings as they are caught—hence the price has dropped down (I have heard in some cases) to 6s. a cran, and although the fish was never so abundant on our shores as at the present time, the low price is disheartening to our poor fishermen, and by all accounts there are much fewer men than usual engaged along the coast. I think the present year and circumstances present a favourable opportunity for altering beneficially for the country the disposal of the vast quantities of herrings caught annually in the Moray Firth. These herrings are cured and salted for the foreign markets at a cost of seven shillings a barrel; and the profit of the curer is only one return per annum on the capital he has invested. The profit is always fluctuating, and often very small.

Now, instead of this expense of curing and export, if these herrings, or a good portion of them, could be sent in good condition to the teeming populations of our southern cities, the fishermen might procure double the price for his labour, and the curer or fish merchant might turn over his capital, instead of once, as by the present system, four or five times in the year. When I brought this subject under the notice of the public some two years ago, the railway authorities stated that the thing could not be done, and that, at any rate, they were not fish-merchants, which no doubt was true; and some curers repudiated any plan which disturbed their usual course of business. It so happened, however, last winter, that large shoals of sprats were discovered to frequent the upper part of the Moray Firth at that season, and their attention having been directed to it, some enterprising fish-merchants establised a trade, by which many thousand tons of sprats were caught and conveyed in a fresh state to the English markets in perfectly good condition, and with great profit and advantage to the poor fishermen along our coasts, and with some advantage to the railway. It will be argued, however, that this cannot be done in the present hot weather, or during the autumn months. I maintain that it can be done. I suppose most of the inhabitants in this locality are aware that before the east coast fishing commences, cadgers from Lochcarron and Lochbroom come down early in July, with carts of herrings for sale at Dingwall and Inverness. I have known them leave Lochcarron, and take four or five days before reaching Inverness, and yet the herrings were perfectly good and palatable food, as many inhabitants of Inverness can testify. The other day I met a man in Glen-Urquhart with a cart loaded with fresh herrings. I said, you are from the West Coast, I suppose. No, he said, the herrings come from Burghead, and I am selling them through the country. They will keep very well four or five days. The process of preservation is simply to load the cart from the boat, sprinkling salt over the herrings, and then covering them with two folds of rough blanket or other woollen cloth. In fact, there can be no doubt but by this process herrings may be preserved in the hottest weather for about a week, and as it only takes twelve to eighteen hours to travel from the Moray Firth to London and the other great cities in England, you will see that there is ample time, even in the hottest weather, to convey and distribute the fish in these markets. It will be said, however, that if you send fish forward in such great quantities to Billingsgate, the market will be glutted, and no profit made; and this is quite true. Billingsgate is attended by fishmongers who have a certain set of customers, and these men will not purchase beyond a certain quantity. But as not one-tenth of the inhabitants of London ever taste fresh fish, it is nonsense to say that the markets are glutted, as the poor people would be too happy to have fish, if it could be conveniently had at a moderate price, but this plan would entirely fail if the distribution were left to the usual Billingsgate process of sale—in fact a new organisation must be established by parties who have an interest in doing so. The railways are the proper parties; and I pointed out how successfully the coal monopoly was broken down in London by Mr. Seymour Clarke, by some such arrangement. Of course the fish traffic is a small item to the great railway companies of the South, but to our Highland Railway an increase from this source of £10,000 to £20,000 a year would be no small boon to the shareholders. Apart from the advantage to the fishermen of the Moray Firth, recollect, Mr. Editor, it is only the surplus fish, that now go abroad; that need be sent to our great cities. The Skye Railway opens up a new market for the inexhaustible fisheries of the Hebrides, and this subject is well worth full inquiry by those whom it concerns.

MEAT PRESERVING.

Continued prosperity, says the *Melbourne Argus*, attends those engaged in the prosecution of this industry. The increasing favour with which Australian preserved meats are received at home have encouraged some of the principal companies to extend their operations, and new manufactories are projected in various parts of the country. A considerable demand has also arisen in the colonies for the new description of food, and confident hopes are entertained of its increasing, for in proportion as the good qualities of the preserved meat become known, so are they appreciated. The first of a series of periodical sales of preserved meats has already taken place in Melbourne, and the result was so encouraging that the experiment will shortly be repeated.

The desirability of establishing in the country districts branch factories in connection with the Melbourne Meat-preserving Company had attracted some attention, especially at Ballarat. Since then the matter has been energetically taken up in that enterprising town. The directors of the Melbourne Company are at present divided in opinion as to the general policy of establishing branch factories, but they have called an extraordinary general meeting of shareholders for 2nd June, to consider a proposition on the subject emanating from certain gentlemen at Ballarat, who are anxious to have an establishment there, and who have expressed themselves as being able to obtain 5,000 shares subscribed for in this company at a premium of 20s. each, say in all £30,000, of which sum £25,000 is to be employed in working a branch factory in their district, and £5,000 to go to the general profit and loss fund of the company, so that the old and new shareholders may be placed on tho same footing. Should, however, the proposal fall through, the matter has now gone so far that in all probability an independent company will be established, and a circular to that effect has been signed by most of the principal stock agents in the town. Some spot on the line of railway, about three or four miles from Ballarat, it is thought, would be a good place for the new company to build its manufactory. It is expected that the government will make such allowances in the cost of freight that the cost of sending the company's produce to the sea-board will exceed by a very small amount the cost of shipping the produce of the Melbourne Company from the establishment on the Saltwater River. It is also said that the Deniliquin people propose to raise so much capital among themselves, and to place it at the disposal of one of the Melbourne companies, on the condition that a meat-preserving

depôt is placed at Deniliquin. The operations of some of the companies are so extensive, that the expense of paying an inspector of abattoirs so much for every head of cattle or each skin inspected by him is felt to be a serious burden, and an effort is being made in the legislature to do away with inspection fees in the case of meat-preserving companies.

A somewhat novel method of disposing of a portion of its meats has been adopted by the Echuca Meat-preserving Company, viz., by public auction, and so far the experiment has been attended with success. At the first sale, which took place a few days ago, at the stores of Messrs. R. Goldsborough and Co., about 150 persons attended, many of them being gentlemen largely interested in squatting pursuits. The quality and manner in which the meats were preserved met with general approbation, and all the lots offered were speedily cleared off at satisfactory prices. 900 cases of mutton, of 12 tins, each 6 lb., brought 4d. per lb.; 500 cases realized $3\frac{7}{8}$d.; and 500 cases, $3\frac{3}{4}$d. Sheep's tongues sold at $7\frac{1}{2}$d. to $7\frac{3}{4}$d. All the kidney soup was placed at 7d. per lb. Should the preserved meat be sold open in London as well as the samples exhibited, no doubt a higher price will be obtained. The tallow from this establishment already commands the highest price in the market. Although the company has been only eight months in existence, and only four months at work, no less than 6,000 sheep per week are disposed of by preserving and boiling down. A proposal has been made to start a meat-preserving company and tannery at Sandhurst, with a capital of £15,000, in shares of £1 each. When the share-list was opened no fewer than 5,250 shares were subscribed for at the meeting convened to initiate the scheme. Shares in the Victorian Company are being taken up in a satisfactory manner. This company, in addition to continuing the old process of preserving the meat in fat, also intend to revive the process of tinning meat and soups, and of making extracts, which had to be discontinued by the old company for want of proper accommodation. The Warnambool Company is getting on very well, and sent off lately 500 cases of preserved meats for shipment to London, per the *Dover Castle*, and 750 more, per the *Loch Earn*. The operations of the company are being extended. The premises are being altered, so as to admit of beef being utilised as well as mutton, and it is intended before long to preserve wild rabbits, as orders for supplies have been already sent in. The company has received, by the incoming mail, an order from a large mercantile firm in London for a supply of meat. In reference to the cost of boiled mutton, &c., the directors, last week, resolved to reduce the price one penny per pound on all articles except sheep's tongues. Some beef preserved on Mr. Manning's (New South Wales) system was tested the other day. Before it was cooked it looked very fresh, although it had been opened for some months, but on being tasted its flavour was not considered palatable, though not so bad as to prove uneatable.

The recently formed Goulburn (New South Wales) Meat-Preserving Company, whose machinery is now being manufactured in Melbourne, propose to introduce some slight novelty into their tinning process, the presumed improvement being an alleged assimilation to the machinery used at the government meat-preserving establishment connected with her Majesty's dockyard, Deptford. The main differences are only two in number, and include a different scalder and cooling-trough, and a new lifting apparatus. In the new scalder, the use of coils is abandoned, and the pan is "jacketed" instead. The purpose of this variation from the former pattern is to secure the meat from over-heating, and consequent over-cooking. The difference in the lifting apparatus does not seem to be of very great importance, but the result of the change in the scalding and cooling will doubtless be watched with some interest. All the shares of the Sydney Meat-Preserving Company have been taken up, and operations will, no doubt, be quickly commenced.

SCIENCE AND ART.

The Committee of Council on Education have issued their seventeenth report, which, for the sake of clearness, has been arranged under seven different heads. These comprise the aids given towards the promotion of instruction applicable to industry, and to elementary drawing as a part of national education; the administration of the South Kensington Museum, with the other museums, institutions, and societies which are subject to the control of the department; the geological survey, and finally a general summary of the operations during the year.

A very satisfactory increase has taken place in the number of the science schools, and also in the number of the students:—In 1865, the schools were 120, and the pupils 5,479; and in 1869, there were respectively 516 and 21,500. The 516 schools, in 1869, comprised about 1,456 different classes; 12,988 students of these classes came up for examination in May, besides 246 self-taught students; the number of papers worked was 24,085, and the number passed, 14,550; the prizes given, 1,969. The examinations were held at 437 centres, 389 provincial, and 48 metropolitan. It was owing to the great exertions of the local committees that the examinations, to the number of 2,000 in 1869, could be held in all parts of the country, entailing as they do much personal inconvenience on the part of the committees. Advantage also was taken of the teachers' visits to London, to give special instruction in the methods of teaching certain branches of science, and this consisted of courses of lectures on physiology, by Dr. Michael Foster; and on light, by Dr. Guthrie; with a short course of laboratory practice under Dr. Frankland. 253 students availed themselves of the lectures. In the advanced scientific instruction, besides the Metallurgical Laboratory, in Jermyn-street, and the Royal School of Mines, the privilege of attending the royal dockyards and factories was, as usual, accorded to the private students during the five summer months from June to September, and with excellent results.

According to this report, there are now 107 schools of art in operation, giving instruction to 19,864 students, an increase in the year of 1,390. New schools have been established at Swansea, Dublin, Inverness, Leeds, Leith, and Manchester. The number of schools for the poorer classes and the children under instruction has increased, and the progress made has been such as to allow the standard for prizes and payments to be raised. In 1,094 schools which were examined, 120,928 children are taught drawing, an increase of 316 schools and 27,515 children as compared with the previous year. Through the agency of the department, the grand total of persons taught was 157,198, and the fees paid were £20,200.

The South Kensington Museum continues to attract numerous visitors; these had reached 1,043,654 in 1869, a considerably greater number than in any previous year since the opening of the museum, with the exception of 1862, the period of the International Exhibition, showing also about 52 per cent. more than the average attendance. The collection of works of art and paintings continue to be enriched by donations and purchases, including, amongst the most important, the donations from the trophies of Abyssinia, the modern Egyptian musical instruments (presented by His Highness the Khedivé), and a series of Chinese musical instruments (the gift of the directors of the Alexandra-park Crystal Palace Company), also the munificent bequest of the late Rev. Alexander Dyce, including many thousands of volumes of books, pictures, water-colour drawings, &c., among which are the well-known copies of the first and second editions of the plays of Shakespeare. The collection of ancient arms and armour belonging to Colonel Meyrick has been permitted to remain for exhibition, and upwards of 80 students have availed themselves of the permission to make drawings from any of the objects. Mr. Layard has recently contributed, on loan,

the whole of his valuable collection of paintings in oil and fresco, chiefly of the Italian schools, and examples of art-manufacture in majolica and glass.

The demand for loans of pictures, &c., in the provinces, in connection with local schools, continues to increase, and upwards of 5,490 objects have been lent during the year past to 32 different localities. Besides, upwards of 1,400 publications, water-colour drawings, and oil paintings, selected for circulation as studies to the number of 368, have been lent to the various schools throughout the kingdom. The number of readers in the art-library has been 18,772, and in the educational library 11,097.

Upon a general review of the operations of the department, it becomes apparent that its influence is extending year by year in a rapid manner. The number of persons who have, during 1869, attended the schools, museums, and other institutions receiving aid from the Parliamentary vote, are considerably greater than hitherto, and it is especially satisfactory to hear that persons receiving instruction in science applicable to industry, have increased from 15,010, in 1868, to 21,500, in 1869. The number of individuals instructed in art have also increased from 123,562 to 157,198. Including the attendance at lectures in Dublin and Edinburgh, the total who have received direct instruction as students, or by means of lectures, in connection with the Science and Art Department, is upwards of 187,000, an excess of 41,300 over the previous year. The attendance at the art and educational libraries reached 48,241 in 1869, and the visitors at various local exhibitions show upwards of 338,000 persons. The total aggregate number of persons who have availed themselves of all the different means afforded by the Department, or obtaining instruction in science and art, may be taken at 2,372,000 in 1869, and 1,775,400 in 1868. The expenditure during the financial year 1869-70, exclusive of the vote for the geological survey, was £201,552, or £2,851 more than in 1868, when it amounted to £198,701, showing proportionately less expenditure to the extent of the beneficial influence of the Department.

CORRESPONDENCE.

ENTERPRISE IN THE EAST INDIES.

SIR,—The letter of Mr. Thomas Briggs comes as a timely corrective of my friend Mr. Dadabhai Naoroji's ingenious paper. While some of us have urged the Society of Arts to promote the establishment of Englishmen in India as the most efficient means of advancing the development of its populations, Mr. Naoroji has, without intending any offensive course, held up our "foreign" dominion as a heavy burden, and, consequently, as something to be remedied. The principle involved is an important one, for it is that of the promotion of Arts, Manufactures, and Commerce among the people of India. This we have assuredly done, and are doing; but it is now discovered that ours is a foreign rule and mischievous, and this statement will be circulatted through the native papers of India, and perhaps believed by some people here.

The doctrine is a strange one, for India is a country of foreigners, and of the descendants of conquerors. The only true Indians, in this sense, are the wild tribes of the hills, then comes the Dravidian populations, then the Aryans, and afterwards the Mussulmans; and we are not worse foreigners or conquerors than these. It is strange, too, that these reproaches come from the Parsees, who are equally foreigners in their relations to the other races, and who owe their present freedom to us. India can only be protected in its development from the conflict of its populations by the strong arm of a government like ours, and Mr. Briggs has done good service in enforcing it.—I am, &c.

HYDE CLARKE.

THE WANTS AND MEANS OF INDIA.

SIR,—In a letter, signed T. Briggs, in your *Journal*, the following sentence occurs:—"Mr. Grant Duff, with his three and a-half millions a-year 'spent and lost' in making railways, will never, &c."

As it is of such extreme importance that the public should know what is really the state of railway finance in India, I should feel obliged if you could find room for the following exact statement, taken entirely from the best Blue Book, excepting only the cost of land, &c., which is not given there, and I have the estimate from other sources, but it is only a small part of the whole cost:—

Capital expended up to 1870	£83,500,000
Present debt for interest........	20,750,000
Land, &c.	5,000,000
Total, without compound interest	£109,250,000

Results of 1869.

Gross receipts in 1869............	£5,480,000
Expenditure	3,130,000
Net receipts	2,350,000
Interest on capital	4,000,000
Deficiency	1,650,000
Total interest on debt of £20,750,000	1,050,000
" on cost of land......	250,000
Total loss in 1869....	£2,950,000

This omits compound interest, which, of course, has been and is really paid by the State. The actual sum paid out of taxes to cover the demands of the railway is thus certainly not under £3,000,000 a-year.

The results on the most productive line, the East India Railway, last year, were as follows:—

Total capital to 1870		£30,000,000
Gross receipts in 1869		2,520,000
Expenses		1,150,000
Net receipts......		1,370,000
Interest paid on capital		1,460,000
Deficiency		90,000
Interest of debt £7,600,000	£380,000	
Interest of cost of land, &c., about £2,000,000	100,000	
		480,000
Total loss in 1869, exclusive of compound interest ..		£570,000

Thus the most productive railway in India costs the country much more than £500,000 a-year, paid out of taxes.

The total estimated cost of the sanctioned railway is £97,800,000, and the debt and cost of land will, when the whole is complete, have amounted to not less than

Debt..........................	£25,000,000
Land, &c......................	6,000,000
Total	£31,000,000

making a total of £129,000,000, the interest of which will be £6,500,000, and as there is not the least probability of the net receipts exceeding £3,000,000 for some years to come (the net receipts for the year ending December, 1869, were less than those for the year ending June, 1869, by £200,000), we cannot hope that the charge will be less than £3,500,000 a-year for several years, and it is much more probable that it will continue to increase, thus adding £3,500,000 or £4,000,000 a-year to the debt of £31,000,000.

It is impossible to over-estimate the importance of this

being thoroughly considered in the present alarming state of the finances.

I find that the cost of land is estimated in the Blue Book, and the total for it and other sundries is £7,000,000; I have allowed only £5,000,000.—I am, &c.,

A. Cotton.

September 3rd, 1870.

FRIENDLY SOCIETY ASSOCIATION.

Sir,—Having been very kindly aided by the Society of Arts, in the use of its rooms, in promoting the important objects of this association, will you allow us, through the pages of its *Journal*, to draw the attention of the well-wishers of the cause of friendly societies to the meeting about to be held on October 26th, at Maidstone. A variety of papers will be read on the different branches of the subject, under the auspices of the association. Those taking an interest in the promotion of sound principles in those very important institutions, are invited to give notice to us, as its secretaries, of their wish either to read papers or to address the meeting on any subject connected with friendly societies. An agenda paper will be published as soon as the arrangements are complete, and sent by post to all members, and to every one sending his name to us as wishing to receive it.

It is very much to be desired that the leading societies should be represented in the free discussions which it is proposed shall follow the reading of the papers.—We remain, &c.,

S. Best, Abbotts Ann, Andover
J. Y. Stratton, Ditton, Maidstone } *Secretaries.*

September 9th.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

GENERAL NOTES.

Female Telegraph Operators.—The telegraph lines in Russia are almost entirely worked by female operators.

Prize Essay on Tea.—The Agricultural and Horticultural Society of India offer to any person who shall produce, on or before the 1st March, 1871, the best practical treatise on the culture and manufacture of tea in India, the sum of 500 rupees and the Grant Gold Medal. The treatise must afford full information on the following points, and be founded on the writer's own observations or experiments, and not be merely a compilation from books:—1. Selection of sites, soil, and climate. 2. The laying out of a garden. 3. Preparation of the soil, sowing of the seed, either in nurseries or *in situ*. 4. Transplanting, and the effects of the use of manure. 5. Hoeing and weeding. 6. Pruning, the best mode of. 7. Plucking, the best mode of. 8. Labour, management of, with details as to apportioning of work, payments, and advances. 9. Manufacture in all its branches, including the use of mechanical inventions and contrivances, as tending to reduce the cost of production generally. 10. Box-making, machinery to simplify and cheapen its cost; packing, leading, stamping, and preparing for shipment. 11. Seed, plucking, drying, transport, best mode of preserving, and its utilisation when not saleable. 12. Management, best mode of, as respects labour, accounts, forms, adjustment of advances, &c. 13. The cost of cultivation in full detail. 14. The cost of manufacture in full detail. The copyright of the essay shall become the property of the society, for publication in their journal or otherwise. The successful competitor may, however, arrange with the society's printers for the printing, at his own expense, of a number of extra copies for sale on his own account. The society are not bound to award the prize, unless they consider the essay deserving of it, but may award such part of the premium as the essay may be adjudged to deserve.—A. H. Blechynden, Secretary, Metcalfe-hall, Calcutta.

The Fall of an Ærolite in Fezzan.—At a meeting of the Geological Society, a communication has been made touching the fall of the aërolite or bolide, which took place on the 25th December, 1869, at Mourzouk, in Fezzan (lat. 26° N., long. 12° E. of Paris) in the presence of a group of Arabs. The bolide is described as a globe of fire, nearly a metre in diameter, which, on falling, exploded with a sound resembling pistol-shots, and with a strong odour. It was also stated that the poignards, sabres, and lances of the principal people of Waddai are constructed of meteoric iron, much of which has fallen in that district.

Experiments in Cotton Hybridisation.—Mr. R. Trevor Clarke, writing to the editor of the *Cotton Supply Reporter*, says:—"On my return home, after a brief absence, I found some cotton pods ripe upon one or two of my last Indian hybrids. As they are the realisations of certain hybrid combinations that I have frequently recommended and written about in your columns, I send you small samples of each, that you may judge to what extent my anticipations have proved to be correct. Hingunghât was crossed by the pollen of a fine (Indian) kind sent by you to me, as grown at Mandanarah, in Mytilene. This Greek Island cotton is of the close-podded breed, which requires that the staple should be freed from the boll by machinery. It is the same sort as that grown in the Dhollerah district, and, as the picker is obliged to gather pod leaf and all, the cotton too often appears in Manchester as the 'leafy Dhollerah.' The staple is longer and more plentiful than in any other cotton I know, but the quality harsh. In this and No. 2 (the converse cross), the quality is intermediate between the parents, and the length and bulk but little diminished. The bolls open as freely as the pure Hingunghât. If this cross retains its qualities in cultivation, it will be the nearest approach to Uplands that I have yet seen, though still decidedly inferior in general good qualities. I do not despair of gaining bulk and silky properties bye-and-bye. No. 3 is the result of the cross between the Assam cotton of the Currybarry hills and Mr. Rivett-Carnac's best Hingunghât, the former being the seed-bearing parent. This very remarkable cotton (the Assam) bears, for Indian cotton, immense bolls, each containing from thirty to forty seeds. The staple, however, is so coarse, harsh, and woolly, and adheres so tenaciously to the seeds, as to render it almost useless. You will see the extraordinary change that has been effected by the infusion of Hingunghât blood. No. 4 is the Assam cotton itself, as received by me lately from the Agri-Horticultural Society of Calcutta, through my friend Mr. Arthur Grote. Other interesting hybrids will now be ripening daily, of which I will give you due notice." In a postscript, he says:—"Since I posted the above, several of my last crosses have ripened. Hingunghât crossed with Burmah is a very pretty cotton, not inferior to the Ghât cottons, and with apparently an excellent habit. The great coarse Assamese sort, which bears sometimes thirty-nine seeds to the boll, but is almost useless from extreme harshness, has become a presentable cotton by the cross with Hingunghât. It bears twenty-seven seeds to the boll, giving a mass of cotton as big as most Uplands, but immeasurably inferior. At last, I have crossed a fine Peruvian sort with Sea Island. The effect is almost startling; you can scarcely tell it from Sea Island. Upland green seed, crossed with long, good, white seed Orleans, has produced an exactly intermediate sort—if this is any object gained. Can anyone tell me the difference, for good or evil, between the Upland and white Orleans cottons? Why do they grow Uplands in preference to the longer-stapled white seed? I enclose specimens of the above to verify my descriptions."

French Telegraphic Administration. — The report for 1869 shows it to be probably the most complete and well-organised system in the world. The following official figures will give some idea of its extent:—Number of miles of line (exclusive of railway lines), 25,441; wire, 70,635; submarine cables, 360; whole number of stations, 3,142; *employés*, 4,989; number of instruments:—Morse, 2,951; dial, 1,797; Hughes (printing), 342; Caselli autographic), 13; Neyer, 10; total, 5,113. Whole number of messages of all kinds transmitted, 6,309,305.

The Tea Trade.—During the past year, 139,223,228 lbs. of tea were imported into the United Kingdom, 99·23 per cent of which was taken by London. The quantity of tea entered for home consumption amounted to 111,887,458 lbs.; the amount of duty received thereon amounted to £2,797,219 sterling, making the average rate of duty paid on the year's consumption 6d. per lb. The per-centage of duty collected in the port of London was 68·69, and in ports other than in London 31·31. There is a progressive increase since 1860 in the quantity of tea entered for home consumption, but from a comparison of the last ten years, it appears that the gross quantity of tea imported into the kingdom reached its maximum in 1868, and was at a minimum in 1860.

The Patent Office.—The annual report presented to Parliament has just been made public. From it we learn that the number of applications for letters patent recorded within the year 1869 was 3,786; the number of patents passed thereon was 2,408; the number of specifications filed in pursuance thereof was 2,367; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months' of protection, was 1,378; the number of patents void, the patentees having neglected to file specifications in pursuance thereof, was 41. Twenty-one thousand three hundred and seventy-six patents bear date between the 1st of October, 1852, and the 31st of December, 1862. The additional progressive stamp duty of £50 was paid, at the end of the third year, on 6,034 of that number, and 15,342 became void. The additional progressive stamp duty of £100 was paid at the end of the seventh year on 2,078 of the 6,034 remaining in force at the end of the third year, and 3,956 became void. Consequently, about 72 per cent. of the 21,376 patents became void at the end of the third year, and about 90 per cent. became void at the end of the seventh year. By a rule of the Commissioners of Patents, dated 17th December, 1866, it is ordered that after the 31st of December, 1866, every applicant for letters patent shall deliver at the office of the commissioners, with his provisional specification, or (when a complete specification is filed with the petition and declaration) with his complete specification, an abridgment of such provisional or complete specification. The abridgments delivered in pursuance of this rule are printed and published in quarterly volumes after the expiration of the six months' protection. In the quarterly volumes of the year 1869, the addresses of the applicants for letters patent and of the communicants (in cases where the invention has been communicated from abroad) have been added, so as to give all the information hitherto furnished in a separate form by the chronological index. The title has, therefore, been changed to "Chronological and Descriptive Index of Patents applied for and Patents granted." The chronological index is no longer published in a separate form. It is also intended to publish these abridgments in classes as soon as the abridgments of all the specifications from the earliest period to the end of 1866 have appeared in a classified form. Until that takes place, the inventor (by the aid of the subject-matter index for each year) can continue his examination of the abridgments relating to the subject of his invention in the chronological and descriptive index. The report also contains the correspondence relative to the new Patent-office library and museum. How much longer is this to be seen embodied in the reports? When are we to have a building worthy of the nation?

Corn Sugar.—Large factories for the manufacture of that quality of sugar known as grape sugar from corn have recently been established in New Orleans, Buffalo, and Brooklyn. The corn is steeped in weak soda lye, for the purpose of softening the husk and gluten, and is then ground wet, and run through revolving sieves, to separate impurities; afterwards it is made to flow through ways or troughs, in which the starch gradually settles as a white powder. The wash water is run into a large cistern, and allowed to ferment and produce a weak vinegar. The starch from the troughs is put wet into the mash-tub, and treated with water containing one per cent. of sulphuric acid for eight hours. The acid is neutralised with chalk or carbonate of lime, and the liquid evaporated to get rid of the gypsum, and afterwards further evaporated in vacuum pans, and run into barrels ready for crystallization.

First Steps towards a National Army.—By a War-office circular, dated 29th August, schools of instruction are to be established as follows:—1. Schools of instruction for officers of the reserve forces will be established at the following stations, viz.:—For the Artillery, at Woolwich; for the Engineers, at Chatham; for the Infantry, at Aldershot, Glasgow, London, and Manchester. 2. Officers will be expected to remain under instruction for one calendar month, unless considered by the officer commanding the school to be qualified for certificates before the expiration of that period. 3. When ten officers at least are ready to join, a class will be formed. The class will assemble on the first day of the month, or on the second if the first be a Sunday. 4. After a class has been formed, officers will be allowed to join from time to time, so long as the requirements of the service permit. 5. An officer wishing to join a class must send his application or permission to do so through his commanding officer to the Inspector-General of Reserve Forces, War-office. The application will specify the school which he wishes to join, and the time when he will be able to attend. It is desirable that each officer should name as many months as possible. The officer will sign the declaration at the foot of the form, to the effect that he will conform to the rules of the school of instruction, and will not leave before the termination of one month from the date of his joining, without the written sanction of the officer commanding. The form contains a certificate, to be signed by the adjutant, and countersigned by the commanding officer of the regiment, brigade, or battalion to which the officer belongs, that he has been properly instructed in the subjects mentioned in the form of certificate. 6. Officers will receive an allowance of 5s. a day for a period of one month, whilst under instruction. They will be allowed to remain at school for a further period not exceeding one month, if the requirements of the service permit; but during the extension of their stay they will not be entitled to the above-mentioned allowance. Application for the allowance will be made after the receipt by an officer of his certificate. If he fails to obtain a certificate, no allowance will be made to him, unless he has been obliged to leave from sickness. 7. Available quarters will, as far as possible, be assigned to officers both of militia and volunteers, and when quarters are thus assigned, fuel and light will be granted. When quarters are not available, an allowance of 2s. 3d. a-day, in lieu of lodging, fuel, and light will be given. 8. Candidates for commissions in the reserve forces may be attached to schools of instruction if they should desire it. The application of any such candidate will be forwarded to the Secretary of State by the Lord Lieutenant who intends to recommend him for a commission, the application giving the information and enclosing the certificates specified in section 5. The certificate in regard to knowledge of drill may be signed by the adjutant, and countersigned by the commanding officer of the regiment for which the candidate is to be recommended, or by the adjutant and commanding officer of any other regiment, brigade, or battalion of regular or reserve forces in which he may have received instruction.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 23, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

THE MAINTENANCE OF MACADAMISED ROADS.

What with the extensions of our railways, above and underground, broad, middle, and narrow gauge; of horse tram roads in town and country; of our river and canal navigation; improvements in the common roads of Great Britain have certainly, since Macadam's time, been comparatively neglected. As was lately remarked in public by Sir Joseph Whitworth, the application of steam on common roads has been almost entirely disregarded, and it is only quite lately getting popularly known that a certain form of the steam engine affords a peculiarly powerful means of cheapening the maintenance and improving the surfaces of roads. And yet the mere statement that there are more than 200,000 miles of common roads in this country is enough to demonstrate the importance of the subject.

Now tramways, paved with setts to prevent the formation of ruts by the horses' hoofs, cost about ten thousand pounds per mile, so that two thousand millions of pounds sterling would, at this rate, be required to make horse tramways universal in Great Britain. The cheapest narrow gauge line, say of three feet, costs £3,500 per mile; so that the universal introduction of a 3 ft. narrow gauge, with its rolling stock, would require six hundred millions of capital—another simply impossible sum. There has been much talk of late about asphalte pavement; but the first outlay it requires amounts to eighteen shillings per square yard, and it does not wear so well as stone setts, which cost about as much. There are at least forty millions of square yards of roadway within only twelve miles of Charing-cross; and it may well be doubted whether the thirty-six millions needed to asphalte this area will ever be forthcoming.

In its well-known properties of comparative cheapness in first cost and maintenance, universal applicability, safe foothold for horses, freedom from noise, ease in repairing, and other qualities, we doubt whether the macadamised, or broken-stone road, will ever be surpassed. In our common roads, ready formed for the common vehicles of all guages, and horses of all kinds, now used on them, we clearly have an immense aggregate of vested and accumulated capital, the efficiency of which it would be a national benefit to increase. This could clearly be done to an enormous extent by any process enabling us to diminish road-maintenance by 50 per cent., or even more, and horse draught by 500 per cent. It may well be doubtingly asked whether such a means is really in existence. Now it is always extremely difficult to demonstrate by argument the efficiency of any mechanical process. Even a machine for (say) weaving carpets cannot be said to have proved its economical efficiency before it has worked at least six months. The only mode of proving that rolling roads by horses is really an economical mode of road-maintenance, and that, *a fortiori*, steam-rolling must be still better, would be by the collation of a mass of cumulative evidence extending over a series of years. This has been done for the first time in a work by Mr. Paget, to which we have lately drawn attention, "On the Economy of Road-maintenance and Horse-draught through Steam Road-rolling." He aims at proving his case by first of all collecting a number of estimates showing the economy in maintenance by horse-rolling.

In 1843, Colonel, now Field-marshal, Sir John Burgoyne, in a work on the subject, estimated the saving in material, produced by horse road-rolling, as at least 25 per cent. The engineer of the Department of La Seine, wrote, in 1868, "that, by the use of horse-rolling, there is realised on the road metal an economy of 20 per cent. to 30 per cent." Mr. Lovegrove, surveyor of roads for the Hackney district, wrote, in the same year, "that road material, properly consolidated by the roller, will save at least one-fourth of its bulk." These estimates only take the saving of metalling into account, though the cost of labour must clearly be at least proportionately diminished. Mr. Mitchell, of Melrose, who has managed the roads in the districts of Earlston and Lauder for more than twenty years, comes to the conclusion that on roads now costing £24 per mile per annum to keep up, the expense would be reduced, by careful rolling, to £13 8s. per mile, or that a saving would be effected of £10 12s. per mile. In the same district, the total cost of a six-ton roller, assuming for it a life of twenty-five years, is calculated at £1 8s. 5½d. per mile per annum, leaving a clear gain of more than £9 per mile per annum, or 37·5 per cent. M. Schérer, *Ingénieur des Ponts et Chaussées*, estimates it at not less than two-thirds, or 66·5 per cent. The borough surveyor of Sheffield writes to Mr. Paget that he "has used a horse-roller for about twenty years; he has not the least doubt that the saving it effects is from 20 to 30 per cent. Upon a road requiring a new coat once a-year, the saving would be even greater." The Prussian and Hanoverian surveyors consider that there is an economy in material of at least 40 per cent. Leaving entirely on one side the saving in labour, we see that Sir John Burgoyne, the engineer of the Department of La Seine, Mr. Lovegrove, and Mr. Holmes, of Sheffield, independently arrive at the conclusion that horse-rolling effects a saving in metalling of 25 per cent.; the other three estimates range from 37·5 to 66·5 per cent. An average of the four figures therefore gives more than 40 per cent. economy, in materials alone, effected by horse road-rolling.

It is clear that steam-rolling must be cheaper and more efficient than horse-rolling for all the reasons that steam is necessarily cheaper and more efficient than horse labour. The results obtained on the numerous roads steam-rolled in Paris for the last seven years have led to the belief that a broken stone road, rolled by steam, lasts double the time of that rolled by horses. Mr. Heaton, an engineer of Birmingham, calculates that an annual saving of £5,700 to that town would be effected by the use of the steam-roller. The Liverpool Borough engineer wrote in 1867, with respect to his experience of steam road-rolling, that his roads were in much better order, and easier kept clean, than before its use, while his bills for macadam were not so heavy. He expects that "the saving in macadam by every coating being at once consolidated layer by layer, will eventually be very great, though he cannot at present put a value on it." During the last two years, the borough surveyor of Sheffield has used a steam road-roller, finding the saving in the cost of macadamised roads to be much greater than when rolled with the horse-roller. He estimates that it "increases the saving at least 40 per cent. over unrolled roads." The borough surveyor of Maidstone considers that the constant use of a steam road-roller would effect an economy in road-maintenance of "at least" twenty per cent. Mr. Howell,

of the St. James's Vestry, Piccadilly, considers "that the use of a heavy roller ought to reduce the cost of maintaining roads from one-third to one-half, with a better road." He says that two-thirds of the material are saved, remarking that "in favour of the use of a sufficient roller in the formation of broken granite or gravel roads, the reason the most potent is economy, not only to ratepayers, but to every owner of a horse." Mr. Tomkins, surveyor to the St. George's Vestry, Hanover-square, says that one-third of the material is saved. Mr. Mann, the superintendent of the department of her Majesty's Commissioners of Works, concludes, from his experience in Hyde-park, that the estimate of a comparative economy of one-third in material and labour "would be much below the mark." There are many other competent opinions extant as to the economy of the process, but without the statement of definite figures such as we have quoted. It has been stated by a correspondent to a daily paper, that in 1866 a steam-roller tried in Islington, between Highbury and the omnibus-yard, made an excellent road, which "remained one year and three months apparently quite good, without one spadeful of granite being put upon it, although other portions of the same road within the same time required three coats of granite to keep it in equal repair." As evidence of the great proportion that the price of the metalling enters into the expense of road maintenance, especially in London, we may note that Bond-street cost, during the past year, £245 for maintenance, not less than £216 of which were for metalling. That macadamised portion of Piccadilly which is kept up by the vestry of St. George's, Hanover-square, cost £1,384, of which £1,359 were spent on metalling. According to the 1868-69 published return of expenditure of the Board of Works for the Westminster district, Bridge-street cost 3s. 6½d. per square yard, or a total of more than £341, of which more than £305 were spent on granite alone; Parliament-street, £528, of which £473 for metalling; Victoria-street, £869, of which £744 for broken granite; and Kensington-road, £1,588, out of which as much as £1,414 were spent on the cost of the granite.

The data upon which the Parisian engineers have founded the statement that steam-rolled roads last twice as long as horse-rolled roads, are that roads they had to roll by steam once every six months have been, layer upon layer, so much improved by the operation, that they have only to be rolled once a year. The traffic in Paris is also annually increasing, as in London.

It is difficult to resist such an accumulation of evidence, though, on the other hand, it is as difficult to believe that, while millions of pounds are annually spent on our roads, road-making, in spite of its universal and authoritative adoption in France and Germany, should have been so long looked upon as a mere luxury. We must conclude that they have neglected a plan which, on carrying it out by horse-power, would have reduced an annual expenditure of (say) one hundred to sixty pounds; and which, by applying steam-power, would again have reduced the sixty pounds expenditure to only thirty pounds per annum.

A demonstration of the great hindrance to traffic, caused by the present plan of merely throwing down and barely spreading the metalling, can be simply based on the results of experiments with a draught dynamometer. Thus, General Morin found that, while the draught in proportion to the load, is as one to twelve, on a road newly-laid with five inches of flint, it was one to seventy-five on a road in a good state; and Count Rumford, that the resistance to draught on loose stones is three times more than when they were partly rolled down by the traffic. According to Gordon, and to Bokelberg, the resistance to draught, on a road in a bad state, is more than three times that on a good road. Some experiments, made by Mr. Bevon, on the force of draught of carriages, have shown that it is one-fifth of the load on a loose, sandy road; one-seventh on a turnpike-road, newly-laid; one-ninth on an ordinary bye-road; one-nineteenth on a hard, compact loam; one-twenty-fifth on dry, hard turf; one-twenty-ninth on a turnpike, rather muddy; and on a clean turnpike-road only one-thirty-third. The resistance to draught is, therefore, nearly five times more on freshly-laid metalling, than on a road in a fairly good state. One ton draught, on a road in a fairly good state, is raised to five tons on an unrolled patch of road.

That road-rolling is not more generally adopted in England can only be due to the general ignorance of the economy it produces. It is at present generally regarded as merely a luxury for the rich, and not as a powerful means of economy in the maintenance of the road itself and in horse-draught. The popular recognition as an economical process in keeping up roads would raise it to the rank of a necessity, and a means of diminishing local rates. The main feature, therefore, of Mr. Paget's work consists in its concentrating into one focus, so to say, a great amount of information and argument up to the present disregarded because dispersed, on a process of road-maintenance, ignored in our country, but adopted for many years, and on a most extensive scale, by the most civilised and progressive nations of the European Continent. As we see from the daily press, the facts he has put forward are considered of sufficient weight to form the basis of a company for steam-rolling by contract the roads of the metropolis.

THE PROGRESS AND CONDITION OF INDIA.

The statement just published by the India Office, exhibiting the moral and material progress and condition of India during the year 1868-69, contains some valuable information which we gather from the introductory portion. In addition, it furnishes details of twelve great divisions, under which the separate facts are arranged, and each accompanied with an explanatory map. There are three topics which give an individuality to the period under review, they are—the retirement of the late Sir John Lawrence at the end of his term of office, and the advent of his successor, Earl Mayo; the drought which occasioned distress throughout the greater portion of the peninsula, with the bordering countries; and the serious deficit that became apparent at the end of the financial year.

The drought caused thousands of the famine-stricken people to pour into British territory in search of food, greatly aggravating the burden already felt. In the central provinces, the visitation, though less severe, was universal; in the north-western provinces, the northern districts, and those bordering on Rajpootana, suffered most; in the Punjab, those south of the Sutlej; in Madras, there was slight anxiety; and in the lower provinces still less. For its future policy, the State has announced its responsibility for the life of the least of its subjects, and has proved its good faith by liberality upon the recent occasion. The gross revenue of the empire realised £49,262,691, and exceeded that of 1867-68 by £728,279. The expenditure amounted to £52,036,721, or £2,494,614 more than in the previous year. There was thus a deficit of £2,774,030, or, if the expenditure be made to include public works extraordinary, one of £4,144,643. On the expenditure side, the chief item of increase was "public works ordinary," which had allotted to them £6,433,517, and exceeded the estimate, the employment of the distressed being the principal cause of the unfavourable difference. The cost of the army, which is divided into 16 divisional and 25 brigade commands, and numbered 61,837 native and 121,021 European troops, was £16,269,581.

On the side of the receipts, there was an increase under nearly all the heads, but in three of the four principal feeders of the revenue—land, salt, and opium, which together produced close on £34,000,000 out of the £49,000,000—there was a falling off.

The trade is recovering from the reaction which followed the unusual state of affairs induced by the American war, and the extravagant price of cotton while it lasted. In 1866-67, the year of the panic, the foreign trade, including imports and exports, fell from £123,813,004 to £95,440,109; in the following year, it rose to £99,927,157; and in the year under notice, ending March, 1869, it sprang to £107,687,637, an increase of £8,000,000 sterling in one year. That amount of produce was conveyed by 5,103 vessels, of 2,036,522 tons, against 5,843, of 2,090,191 tons, in the previous year. The exports of cotton from the Bombay Presidency, in 1868, amounted to 1,294,291 bales, and exceeded those of 1867, which was itself an exceptionally favourable year, by more than 70,000 bales. The extent of land under cotton cultivation, in 1868-69, was, for the northern division, 803,634 acres; southern, 1,171,827; Sind and native states, 190,252, making a total of 2,165,713 acres—as compared with the previous year, a diminution of 15,460 acres. The estimate shows 245,824 bales, being a deficiency of 78,154 bales in the yield also, compared with 1867-68. In almost every division of the north-west provinces there was a falling off in the area under cultivation, and in the out-turn the average crop for the preceding seven years was rather more than 90,000,000 lbs., so that the yield was less than half the average. The deficiency is due to the long-continued drought, and experiments in foreign seeds were alike prevented from having a fair trial.

The tea cultivation originated in Assam, in 1830. From thence it was introduced into Cachar and Darjeeling; thence into the hills of North-Western India, where the first crop obtained, in 1843, in Kumâon, was so successful as to lead to further extensions of the government plantations. We find the total out-turn of tea in the tea-producing districts of Assam, Cooch-Behar, Dacca, Chittagong, and Chota-Nagpore is stated to have been 9,491,600 lbs., about 2,000,000 lbs. more than in 1867-68. The statistics furnished for Assam, 4,351,772 lbs., are considered very imperfect, but those for Cooch-Behar and Cachar are more reliable. According to the figures given, the Cachar plantations, in the Dacca division, produced 4,006,835 lbs., or nearly as much as the whole of Assam. In the Kangra valley, where the experiment was first made in 1852, under the orders of Lord Dalhousie, the only plantations remaining in the hands of the government were two of small extent in Kumâon, which, in 1868, produced an out-turn of 22,857 lbs.; these, like the rest, will be sold at a favourable opportunity. The whole area under cultivation was 2,635 acres, and the gross aggregate produce, in 1868, amounted to 241,332 lbs. of tea. The average produce is 91·6 lbs. per acre, and the price realised by sale 2s. 2d. per lb. Labour is described as abundant, 8s. a-month being the pay for an able-bodied person. A difficult and costly road is in course of construction by government. The most important market for the sale of Kangra tea is in Central Asia. The great mart is Umritsur, from whence is the easiest route, *viâ* Jumoo and Cashmere, to Ladakh and the eastern provinces of Central Asia, *viâ* Cabool, to the great marts of Herat, Khiva, Bokhara, and Samarcund, and *viâ* Kurrachee, to the ports in the Persian Gulf. The exports of tea from Calcutta were 11,434,000 lbs., against 8,789,344 lbs. in 1867-68, showing an increase of 2,644,658 lbs.

There was an unusually large revenue derived from the post-office; the receipts, including official postage, were £608,447, in 1867-68; in 1868-69, they amounted to £686,072. The disbursements were respectively £475,494 and £537,020. Since the year following the meeting there has not been so large an amount of private correspondence; for the nine years from 1858-59 to 1867-68, the average yearly increase was £15,000; in 1868-69, it was £30,109. The re-arrangement of the postal service between India and Europe, under which Bombay became the port of embarkation and disembarkation of the mails, has been followed by a system of sorting on board the steamer, whereby the delay of a whole day is saved. Notwithstanding the enhancement in the rates, the correspondence has greatly increased under the new arrangements. The first number of a postal guide was published on the 1st of April, 1869. During the year, 551 new post-offices and letter-boxes were opened, and 227 messengers were besides added, who collect as well as deliver letters. The number of letters were, in 1867-68, 69,154,847; and in 1868-69, 75,987,617. The increase in the value of stamps sold was 12·4 per cent. The persons permanently employed in the post-offices number 23,257, or about 2,000 more than in the previous year.

The educational branch has occupied the attention of the government. From the figures for eight years, it appears that the sum spent upon education, science, and art, has increased from £342,593 in 1861-62, to £836,990 in 1868-69. And while, in 1852-53, there were only 413 institutions, with 28,179 pupils, on the 31st of March, 1868, there were 16,261, with an average attendance of 662,537 pupils. Greater care has of late years been bestowed on the forests, which is apparent from the increased revenue. The gross receipts have risen from £304,440 in 1863-64, to £420,700 in 1868-69, and the requirements of the railways, it is expected, will raise this to £596,180. The present system of preparing a certain number of young men for this service in India, by a two years' course of training in the forest schools of Germany and France, it is hoped, will hereafter furnish a corps of efficient and experienced conservators.

Under the geological department, the investigations of the Chanda coal-fields, in the Valley of the Godavery, were continued during the year; and when these are finished it is expected that the survey will be continued down the valley, at detached points, in which small basins are known to exist. At Umballa, where the insufficiency of water has always been felt, the much needed supply was immediately forthcoming upon the first trial made for that object. In Madras, a report has been completed on the area occupied by the quartzites, slates, limestones, &c. In Bombay, the examination of Kutch was completed, and an excellent map prepared, and it is now intended to transfer these researches to the Punjab, which promises well for valuable mineral products. The total quantity of coal raised in all India, during 1867, was 479,233 tons; and in 1868, 547,971 tons. The chief customer is the East Indian Railway, which, in 1868, consumed nearly half the total raised.

The work of the trigonometrical survey, during 1868-69, comprises the measurement of a base line in the neighbourhood of Cape Comorin, of 72 principal triangles, which cover an area of 6,508 square miles, and would, if united, form a chain of 320 miles in length; and of secondary triangles covering 6,615 square miles. The new routes explored will, when combined with former explorations, add much to our knowledge of the Eastern Himalaya.

The revenue survey reports for 1868-69 show an area of 19,369 square miles surveyed during the year, at a total cost of £89,000. Summing up the work accomplished by this department, it appears that during the last quarter of a century, the enormous area of nearly 600,000 square miles has been surveyed, an area five times as large as that of the whole of the British Islands. Besides all these undertakings, it is the desire of the government to preserve all the remains of Indian archæology, and, as far as possible, to diffuse throughout Europe and India an intelligent acquaintance with them; and by the means of photography, a very large number of objects of beauty and interest have already been revealed to those who possess no opportunity for visiting the originals. In a recent dispatch, the Secretary of State suggested that the time had now arrived for instituting a regular archæological survey of India, to be carried out in a systematic manner, and the supervision to be concentrated in one department.

CONDITION OF THE INDUSTRIAL

(*Continued from*

Name of country.	No. of persons belonging to the industrial classes, and their rates to the whole population.	Educational advantages.	Condition, &c., of the industrial classes.	Nature of their employment, and hours of work.
SWEDEN.	Total population (1860) 3,859,728 Persons in employment 1,036,997 or 27 per cent. Manufacturing and artisan population ... ... 90,698 or 3 per cent.	Attendance at Sunday and technical schools compulsory for those who do not possess the fixed minimum amount of knowledge.	No one employed under 12 years of age. Character industrious and moral. Workmen's societies general—five of them, comprising 1,500, 1,100, 1,680, 2,000, and 1,519 severally.	Agricultural, watchmaking, mining, and other industries.
SWITZERLAND.	Agricultural classes, 44·4 per cent. Industrial ,, 34·5 ,, Workmen employed in the several factories 91,719	Much attention paid to education, good schools, and sound educational schemes. Attendance at primary schools compulsory from 6 or 7 years old to 15 or 16. Except at Geneva, every commune has its school.	Much mutual sympathy and good-will between employers and employed. A widely spread network of associations, called societies of public utility, also international workmen's associations, and a watch and clock institution. Cases of ill behaviour rare. Winter soup-kitchens. Wood is distributed gratuitously in the forest districts, from 120 to 180 cubic feet annually. Several associations supply fuel at reduced rates. Clothing dear, but washing appliances numerous. Machinery introduced for bleaching, dyeing, and ironing linen, at 1½d. the hour for washing, 1d. for ironing, and ¾d. for bleaching. Small-pox the only prevalent disease. Loans easily effected by the working classes.	Watch and clock, glass blowing, straw plaiting, dyeing, cotton spinning, weaving, and other industries. Some of these found to be injurious to health in Switzerland.
TURKEY.	Total population in Constantinople ... ...1,060,000 Working classes in do. ... 120,000 (but they fluctuate greatly in numbers). Total population in province of Macedonia ... ... 700,000 Of these four-fifths are employed in agriculture. During the winter 5,000 to 6,000 itinerant artisans go there from Albania. In Syria, the proportion of artisans to other classes ... 25 per cent. In Smyrna... ... ... 80 ,, In Aleppo ... ... 8·7 ,, In Broussa... ... 10 to 12 ,,	Education very imperfect.	Well clothed, but not over clean. The Mussulman less thrifty and industrious than the Christian, the latter very economical. Guilds general.	Various important industries, but not flourishing. Shoemakers and saddlers' work always done by the piece; jewellers and tailors by the day or week. Hours of work, 9 in summer, 8 and 7 in winter, but 12 hours in some parts.

CLASSES IN FOREIGN COUNTRIES.

page 845.)

Rent.	Cost of living.	Rate of wages.	State of labour market, &c.
Houses built cheaply, in consequence of the abundance of timber. In some districts clay is used to fill in with, and bricks more generally of late years. Some houses sold to the workmen at from £110 to £170 each. Some built on a large scale, containing 24 lodgings for married workmen, with library or reading room. At Gottenburg, good houses carefully provided. Rent of lodgings arranged in blocks or sets, 5s. to 12s. 7d. per month. For skilled workmen, 14s. ditto. For second class ordinary workmen, inferior houses. Rents in Stockholm, £6 to £14 per annum.	Food chiefly vegetables and salt herrings; also much milk for country labourers and miners. The Stockholm workman's food is better, and tolerably cheap at the eating houses. Cost of food, clothing, and other necessaries, generally double that of lodgings. A careful and industrious man may save half his earnings.	Agricultural labourers, 7d. to 1s.5d. per day. Do., at piece work, 2s. 4d. ,, Miners and iron workers (rough) 11d. to 3s. ,, Wood cutters, 10d. to 1s. 3d. ,, Lucifer match makers, 1s.2d. to 3s.4d. ,, Steam flour mill hands, 2s. 5d. ,, Skilled smiths, 2s.3d. to 3s.4d. ,, Charcoal burners, 5s. 6d. per ton. Skilled workmen in Stockholm $2\frac{1}{2}$d. to 3d. per hour. Ordinary do., $1\frac{1}{2}$d. to $1\frac{3}{4}$d. ,, Shop builders, $1\frac{1}{2}$d. to $2\frac{3}{4}$d. ,, Skilled workmen (average) 2s. 10d. per day. 25 per cent. more when working by the piece. Skilled labour paid highest in Gottenburg.	No room for the introduction of labour from other countries. All manufactured articles in Sweden are also consumed there, the supply scarcely equalling the demand.
At Zurich— Houses with 3 or 4 rooms, cellar and loft, 13s. 4d. to 18s. 4d. per month, or £7 15s. to £10 11s. 8d. per annum. At Geneva— 1 room and kitchen, £6 per annum. 1 kitchen alone, 8s. per month. At Lode, in the Jura— Numerous blocks of houses subdivided into smaller holdings at £6 to £16 per annum. At Berne— 1 room and kitchen, £9 16s. to £11 per annum.	Foreign workmen obtain a home in "pensions" or boarding-houses, where they can procure cheap food and lodging at 5s. 10d. to 6s. 8d. per week. Wheat the staple of the working men's food. Provisions and lodging for 1 man in the different cantons, 5s. 5d. to 7s. 6d. per week.	Weavers ... ...12s. 10d. per week. Dyers ... ... 7s. 6d. ,, Silk spinners ...10s. 0d. ,, Printers ... ...13s. 4d. ,, Labourers ...10s. 0d. ,,	The difference of the different dialects of the cantons place a great obstruction in the way of the foreign artisan.
A separate house never less than 25s. per month. An apartment of two rooms, 16s.8d. The migratory artisan lives in odas or caravanserais. In one of these 5 men were living in one room, at 10s. per month. Food is supplied on the premises. At Haskieni, the naval arsenal, houses let at £25 up to £50 per annum. At Aleppo, 1 room at 4s. to 10s. per month. The average price of a house built with sun-dried bricks is £25 per room.	Vegetables largely consumed in Asia Minor. Many workmen chiefly eat bread, to the amount of 4 lbs. or 5 lbs. per day. Meat, wine, and spirits, are only taken on festival days.	In Constantinople— English engineers, 13s. per day. Skilled workmen in arsenal, 2s. to 5s. ,, Ordinary do., 1s. 2d. ,, Mason, 1s. to 3s. ,, Tailor, 10d. to 3s. 4d. ,, Shoemaker, 10d. to 2s. 6d. ,, Syria— Beyrout, labour, 1s. to 3s. 6d. ,, Aleppo, ,, 10s. per week. Asia Minor— Smyrna, labour, 4s. per day, also £6 to £12 per annum, with food, lodgings, and clothing. Broussa— Mason, 2s. 8d. to 3s. 4d. per day. Carpenter, 3s. 2d. to 4s. 8d. ,, Cabinet maker, 5s. to 6s. ,, Blacksmith, 2s. 6d. to 4s. ,, Tailor, 1s. 4d. to 1s. 10d. ,, Shoemaker, 1s.10d. to 2s. 2d. ,, Turkey in Europe— Monastir— Carpenter, 1s. 6d. to 2s. ,, Mason, 1s. 6d. to 2s. ,, Shoemaker, 2s. ,, Tailor, 2s. ,, Unskilled labourer, 8d. to 10d. ,, Salonica— Agricultural labourer, 1s.8d. ,, Mason, 1s. 10d. ,, Carpenter, 1s. 10d. ,, Shoemaker, 2s. ,, Tailor, 2s. ,, Unskilled labourer, 1s. 6d. ,, Italian workmen in Constantinople, earning £4 per month, can put by half that sum.	No opening for the skill or enterprise of the labouring classes, except, perhaps, in connection with the development of mining. Good land can be purchased between the Bosphorus and Varna at £2 per acre. There is possibly room for a few iron-workers in European Turkey. In Asiatic Turkey labour is wanted for the cultivation of the soil. In Smyrna work is precarious. Many Frenchmen are employed in the arsenal at Constantinople, and in the fez-cap factory. Of the Greeks there— The shoemakers number 3,000 ,, cartwrights ,, 1,000 ,, tailors ,, 500 ,, distillers ,, 500 ,, watchmakers ,, 100 ,, blacksmiths ,, 200 ,, jewellers ,, 200 The European artisans at Pera and Galata number 8,500.

Name of country.	No. of persons belonging to the industrial classes, and their rates to the whole population.	Educational advantages.	Condition, &c., of the industrial classes.	Nature of their employment, and hours of work.
UNITED STATES	Total population (1865) in New York ... 3,827,818 Working classes, do. 940,141 or 26 per cent. Total population in Massachusetts ... 1,267,031 Working classes, do. 445,746 In Alabama, one-third of the population are artisans and labourers. In Georgia, five-eighths belong to the industrial classes. In South Carolina, two-ninths do. In Virginia, three-fifths do.	Sound system of education.	Working men held in good repute. Very prosperous, but more restless and fond of change than formerly. Of the 30,000 miners in the Pennsylvanian coal districts, nearly all are English, Welsh, or Irish. The German element preponderates in the great clothing trades. The "tenement" house system very unhealthy. In one particular square (6,143,312 feet), 196 families, or 889 persons, are settled. The American excels in business qualities, but is deficient in patience and mutual confidence. Powerful trades unions and co-operative associations. Savings banks in a flourishing state. Amount of deposits— In New York ...£150,970,068 In Brooklyn ... 3,265,161 In other cities of New York State ... 5,896,154	Various and important industries. The trade of a florist very remunerative. More bouquets are made in New York in a month than in a whole year in London. Hours of work— Working man, 8 hours per day. Agricultural labourer, 12 " "
WURTEMBERG.	Total population ... ...1,780,000 Industrial classes ... ... 270,000 or 1 to 7 persons.	Good. Large industrial schools	Character steady. Generally sober, except in the wine-drinking districts. Many of the working classes possess a small amount of landed property. They are fond of saving their earnings In all Wurtemberg there are 71 savings banks, at which the extent of transactions may be set down at £3,000,000. There are also productive clubs, and good industrial laws.	The usual trades and manufactures.

Rent.	Cost of living.	Rate of wages.	State of labour market, &c.
In the Pacific States— £30 to £48 per annum. In the United States— Working classes well lodged. 3 or 4 rooms in a tenement house for best skilled workmen, £2 5s. to £3 16s. per month. Mechanics (better class), 2 rooms, 18s. to 39s. per month. Mechanics (lowest class), 1 room, 9s. to 18s. per month. 18,582 tenement houses in New York, with an average of $21\frac{1}{2}$ persons to each house.	Prices at Massachusetts— Meat ... ... $7\frac{3}{4}$d. per lb. Flour ... ... $1\frac{1}{4}$d. ,, Fish ... ... 3d. ,, Butter ... ... 1s. $5\frac{3}{4}$d. ,, Bacon ... ... 6d. ,, Rice ... ... $6\frac{1}{4}$d. ,, Tea ... ... 4s. 0d. ,, Sugar ... ... $6\frac{1}{2}$d. ,, Coffee ... ... 1s. 9d. ,, Single men live in boarding houses at from 12s. to 18s. per week. Board and lodging also at from £1 4s. to £1 12s. per week.	In the United States— Skilled labourers, 9s. to 15s. per day. Unskilled labourers, 2s. 6d. to 7s. 6d. ditto. In California— Workmen, 4s. to 12s. ditto. In cities— Labourers, 8s. per day without board, or £6 per month with board. Miners, 12s. to 13s. per day, and 20s. ditto. Northern States— Bricklayers, Carpenters, Masons, £3 17s. 1d. to £4 5s. 8d. Per week. Painters, £3 to £3 8s. 4d. ,, Plasterers, £4 5s. 8d. to £5 2s. 10d. ,, Plumbers, £2 11s. 5d. to £3 8s. 6d. ,, Watchmakers, £4 5s. 8d. ,, Shoemakers, £2 11s. 5d. ,, Tailors, £2 11s. 5d. ,, Compositors, £2 17s. 1d. to £3 8s. 6d. ,, Blacksmiths, £2 17s. 1d. ,, Coopers, £2 17s. 1d. to £3 8s. 6d. ,, Engineers, £2 11s. 5d. ,, Labourers, £2 2s. 10d. ,, Southern States— Bricklayers, 9s. per day. Carpenters, 11s. 3d. ,, Painters, 9s. to 12s. ,, Plasterers, 9s. ,, Tailors, 6s. to 12s. ,, Blacksmiths, 9s. to 10s. 6d. ,, Engineers, 13s. 6d. ,, Labourers, £2 5s. to £6 per month. Watchmakers, £225 to £300 per annum. California— (Non-Unionists.) Bricklayers, 18s. to 24s. per day. Carpenters, 12s. to 16s. ,, Masons, 16s. to 20s. ,, Painters, 10s. to 16s. ,, Plasterers, 16s. to 24s. ,, Plumbers, 14s. ,, Engineers, 16s. to 20s. ,, Shoemakers, £7 to £12 per month. Blacksmiths, £12 to £20 with board ,, Labourers, £6 to £8 ,, (Unionists.) Carpenters, 14s. to 16s. per day. Bricklayers, 20s. ,, Blacksmiths, 16s. ,,	Abundant openings, especially in Philadelphia, Alabama, and Virginia; but in Chicago 10,000 are out of work. Unskilled labourers only supplied at the rate of 12 per cent. of the demand. Foreign is every day replacing native skilled labour. The leading industries of the United States yield an annual product of £1,365,000,000.
In Stuttgardt, £6 15s. per annum. In country towns, £4 4s. ,, In villages, £3 8s. ,, Sleeping accommodation for an ordinary working man, 1d. per night.	Great facilities for enjoying life. The ordinary workman lives well on 8d. per day. Meat generally eaten, or, in the case of the poorest artisan, sausage. Bread at $1\frac{1}{4}$d. per lb. Very fair beer at $1\frac{1}{4}$d. to $1\frac{3}{4}$d. per quart.	Workmen from 14 to 18 years old. Highest, 6d. to 1s. per day. Lowest, 6d. to 8d. ,, Or, Highest, £10 to £15 per annum. Lowest, £7 10s. to £10 ,, Workmen above 18 years. Highest, 2s. to 3s. 4d. per day. Lowest, 1s. 4d. to 1s. 8d. ,, Or, Highest, £30 to £50 per annum. Lowest, £20 to £25 ,,	Room only for the high-class skilled English workman, to give instruction in newly-established branches of industry.

LEGISLATION TO PREVENT ADULTERATION.

The following is an abstract of a paper read at the Social Science Congress, at Newcastle-on-Tyne, on "Legislation to Prevent Adulteration of Food and Drink," by Mr. Phillips Bevan, F.R.G.S. :—

Although it is one of our most important social questions, the apathy and ignorance of the public on the subject of adulteration is astonishing. As each person thinks that all others are mortal except himself, so he imagines adulteration affects any class but his own; and although we acknowledge its prevalence, and cry shame when we read of any particularly bad case, the sensation is but momentary, and we go on our way as before. What is adulteration, and what does it mean? It means the lowering of the physique of the nation, the poisoning of the people, the deterioration of our constitution; and, morally, a fraud practised by the seller on the buyer, a cheating to which we have become so callous that it has hardened our conscience for honesty in other and bigger things. The great difficulty in dealing with it is, that the Government is so slow to move; and even men in high places practically defend it, by declaring that it is not so bad as it might be; that the buyer must look to himself, and so on. It is also a very common argument that people bring adulteration on themselves by buying such very cheap articles; so cheap, that they cannot be good for the money. But they do so in ignorance; and if the seller were compelled to label the goods with the names of the real ingredients, such as "best butter mixed with starch, mashed potatoes, and horse-bone oil;" "coffee, with bread-crumbs and sand;" "tea, with iron filings;" "sugar, with chromate of lead;" "beer, with salt and coculus indicus;" it is not the least likely that their cheapness would tempt the buyer; and, if a certainty of detection and punishment followed, we should find that the sellers would think twice before they offered such articles. It is strange that, in all our sanitary machinery, the food question and its purity have been so overlooked; but pure food is as necessary as pure air, good drainage, or wholesome water; and it ought not to be left to the philanthropist to remedy the evil, with the tolerable certainty that he will only get snubbed for his pains. It is a government question, as important as that of education or the Irish Church; and it ought not to be the duty of a private member of the House of Commons to bring in a Bill.

With a view to arouse public interest, in conjunction with Messrs. J. M. Johnson and Sons, of Castle-street, Holborn, in February last I established the *Food Journal*, feeling that there was a great want of some public organ to discuss these matters; and so convinced was I that no bill could properly be passed without the knowledge of the legislation which prevailed in other countries, that the late Earl of Clarendon was applied to for permission to address the various British legations and consulates abroad on the subject. His Lordship not only gave that permission, but evinced his great interest in the matter by requesting that a circular should be drawn up, embodying all the inquiries on food matters that it was desired to make. A thousand of these were accordingly issued through the Foreign Office; and Earl Granville, who has taken up the subject in the same warm and earnest spirit as evinced by his predecessor, has forwarded for publication in the *Food Journal* a mass of valuable information, which has never before reached this country. To detail even an epitome of these answers, would take up far too much of the time of this meeting. I will, therefore, only briefly touch on some of the main points of the question of the circular, viz., "What legislative enactments at present exist in the country to which you are accredited respecting the adulteration of food and drink? Are these laws actively enforced; and how far do they appear to meet the evil?" Very valuable information comes to us from the United States, in Mr. Thornton's report; which adverts to the difficulty of getting systematic information, even through the well-arranged machinery of official correspondence. The State legislation varies very much in the different states, some possessing no legislation at all, and others inflicting very severe penalties. Each state legislates independently; and, in so doing, often delegates the regulation of these matters to the various town or county authorities within their borders. As a general rule, the adulteration of alcoholic liquors is almost universal.

In Rhode Island, the penalty for adulteration of food, drink, and drugs, or for selling unwholesome food, is imprisonment up to six months, or a fine up to 200 dollars.

In Vermont, for adulteration of medicine, imprisonment up to two years, or a fine up to 400 dollars. For selling adulterated intoxicating liquors, from 10 to 300 dollars for each offence. For selling unwholesome provisions, imprisonment up to six months, or fine up to 300 dollars. For adulterating bread or any food with impurities injurious to health, imprisonment up to two years, or fine up to 300 dollars.

In Ohio, for adulterating spirituous liquors, a fine of 100 to 500 dollars, and imprisonment for ten to thirty days.

In Indiana, for adulterating any food or drink, a fine of from 50 to 500 dollars, and, at discretion of the court, imprisonment up to three months.

In Illinois, a fine up to 100 dollars, or imprisonment up to three months.

In Missouri, it is a misdemeanour, punishable with imprisonment up to one year, or a fine up to 500 dollars; but adulteration of intoxicating liquors with strychnine or any other injurious substance is a felony, punishable by imprisonment from two to five years. Every liquor seller has to appear before the county clerk, and enter into a bond of 500 dollars, with good security, not to mix or adulterate his liquors with any material, not even water; the penalty for non-compliance is a fine from 50 to 500 dollars. There is also a very rigorous inspection and testing of all spirituous liquors imported into that state.

In Mississippi, adulteration is punishable by an imprisonment from one year to five years.

Cincinnati appears to turn its attention more to milk, for the sale of which the rules are extremely strict. Each milk-seller has, under a penalty of 100 dollars, to have his milk inspected and tested, that it should not be watered, nor the produce of diseased cows, nor of cows kept in stables and fed upon garbage. The address of the dairy, whence the milk came, must be legibly painted on each stall.

In Georgia, every baker, brewer, distiller, grocer, merchant, or other person selling pernicious or adulterated food and drink, and also all accessories after the fact, are liable to a fine up to 1,000 dollars, imprisonment up to six months, whipping up to thirty-nine lashes, and to work in a chain-gang up to twelve months.

In Texas, the fine for adulteration is from 20 to 500 dollars.

These laws generally work well throughout the States, but all the reports show that there is generally a pretty high standard of reputation among the dealers, although it is at the same time true that the system of comprehensive laws, and the knowledge that they will be strictly enforced, tends to preserve this feeling.

The Prussian penal code provides that any person selling adulterated or spoiled goods shall be liable to a penalty of 50 dollars, or imprisonment for six weeks, with confiscation of goods. In these cases, it is not necessary that the seller be aware of the adulteration, for he is liable just the same. If death ensue, the seller is punished with death; but if only severe bodily injury, the penalty is imprisonment from ten up to twenty years, At Konigsburg there is an additional law respecting the sale of damaged meat, and particularly of pork containing *trichinæ*. At Leipzig the same regulations are in force,

but the police are not active. At Hamburg, if any injury happens to the buyer, the seller is liable to be imprisoned for from three months to four years.

In Holland, the Dutch law is very similar to the Code Napoleon, and inflicts a punishment of imprisonment for from six days to two years, with a fine of from 16 to 500 francs. The adulteration of bread with copperas or vitriol is dealt with by an imprisonment of from two to five years, and a fine of from 200 to 500 florins. Not only is punishment provided for people who mix ingredients for adulteration, but also for those who manufacture or sell the ingredients, knowing that they were to be used for adulteration.

Any fresh legislation on this subject should be compulsory in its character, and not permissive. All articles of consumption which are manufactured should have their ingredients declared, for there is a feeling prevalent amongst manufacturers, as, for instance, cocoa makers, that as long as their articles contain nothing hurtful, they are at liberty to call them by the general name of cocoa. Still, a sophistication is, to a certain extent, a fraud, and every purchaser has a right to know what he is purchasing; and, although we might be safe in the hands of the largest and most respectable manufacturers, there is a considerable class of unprincipled makers who are not above taking advantage. Differences of opinion sometimes occur as to the relative hurtfulness of certain common adulterants; and an eminent authority has assured me that he had grave doubts as to whether alum was not a good thing instead of a bad one. I would suggest that there should be a Food Sub-department formed, which should take cognisance of all food legislation and supplies. To it a board of two or three of the most eminent analytical chemists should be attached, who should examine and pronounce upon all disputed chemical questions, and whose opinion should be law. The sub-department should have the election of, and a certain amount of control over, the county and borough analysts, whose appointment should be compulsory and not permissive; neither should it rest with vestries or corporations, many of the members of which are often largely concerned in adulteration. Inspectors should have the power to visit and take samples from all dealers in articles of food, subject to certain checks, so as to prevent any risk of tyrannical domiciliary visits. They should also have the power of testing the supplies furnished to public bodies, such as union contracts; for guardians have frequently a habit of accepting tenders for food at a price at which the real article cannot possibly be supplied; as a London Union Board did the other day in the case of butter. In cases where a petty dealer declares his ignorance that the goods which he sells are adulterated, I should make the onus of proving this fall upon him, and then it would be for the Food Sub-department to take the matter up, and prosecute the manufacturer. When adulteration takes place before importation, as in the case of the Maloo tea mixture, the department might well provide the machinery for setting consular and other influence to work to prevent it; and might also step in as the proper arbiter between conflicting interests. In this very case, a great fraud on the public was allowed to go unpunished, because the Customs could not legally forego the duty.

As to offences, when proved, I am no believer in either a very small or a very large fine; but I would have no sliding scale at the option of the magistrate. For the first offence, the penalty should be sufficient to make the offender smart in his pocket; for the second, I would double it, and have an *affiche* detailing the offence put outside his door, as also outside the door of the church, police-station, and town-hall, for a month. The case should also be advertised in the local papers at the offender's expense. For the third offence, there should be imprisonment for one month, with hard labour. Adulteration is either a fraud or it is not, and it should be punished like any other cheating.

RUSSIAN FOOD.

The Science and Art Department have placed in their annual report, recently issued, an account supplied to them by Mr. Andrew Murray, of the food of St. Petersburg, which city he visited last year, when the International Horticultural and Botanical Congress was held. The breads, he says, resolve themselves into modifications of three chief kinds:—tschernoi-chleb, black bread made of rye; kalatsch, white bread made of wheat; and saika, white bread enriched with raisins or other accessories, equivalent to our buns or the Scotch "cookies." Ices are made in great perfection in St. Petersburg. A very good kind is flavoured by the hazel-nut; and still better is a water-ice made from the juice of the clucva or cranberry (gathered after the berry has been touched by frost), sweetened, and slightly flavoured with vanilla. This is much used for invalids, and in our own country its refreshing coolness and slightly sub-acid flavour would be found inexpressibly grateful to the fevered palate. In the summer, a great traffic in beverages is carried on in the principal streets, and the most common is a rose-coloured drink, which owes its colour and its virtues to the clucva. St. Petersburg is well supplied with fresh vegetables. The vegetable staple of the is the cabbage. At the beginning of the winter every family lays in a store. The plants are then chopped up into thin slices, and packed into barrels with vinegar and salt; a certain amount of fermentation ensues, and the cabbage becomes a sort of sour krout. From these barrels a portion is taken as required, and made with meat into a cabbage broth, called "shtshi." This is the most characteristic national dish in Russia, and is the daily food of the mass of the people. Meat is only about half the price paid in England, and consequently is much more freely used. In the shtshi there is always a number of lumps of the boiled meat of which the bouillon is made. At a restaurant, for 40 kopecks (about 1s.) Mr. Murray had a plate of shtshi with three large pieces of meat in it sufficient to make a copious dinner for any average Englishman, so that although St. Petersburg may to some be one of the most expensive cities in Europe, to others it may be one of the cheapest. To enable the consumer to give to shtshi the degree of acidity which may suit his taste, a small dish of sour cream is placed at his side. Sometimes also (for the Russians are great in accessories) a small plateful of fried or roasted groats—a substitute for bread—is eaten with a spoon alternately with the shtshi. Another accessory of dinner, of which the Russians are fond, is music. Every restaurant of any pretensions has a barrel organ to play during meals—a large, handsome instrument, generally occupying the whole of one end of the room, and from which is heard the rolling of the drum, the thundering of the kettledrum, the clashing of the cymbal. Every popular new air is at once added to its repertory. A food product which figures largely in the consumption of the upper classes is mushrooms and fungi, which are found in great abundance in Russia. The preparations of milk and curd appear more various than in this country. Sour cream is a favourite accessory to many dishes. It is used with pork as we use apple sauce; pork seems to be regarded in all countries as requiring some accompaniment of more or less piquancy. The mutton in Russia, as in all the plains of the north of Europe, is much inferior to our own. The red-legged partridge is common and cheap in Russia, but not equal to our own partridge. The pigeon is never eaten; it is a sainted animal to the Russians. The fishes of Russia supply some of the most peculiar and best national food products. The sterlet is the fish *par excellence* of the rich, and is esteemed, and rightly esteemed, a great delicacy. It is a small sturgeon, about as large as a middle-sized pike, is a mud-fish like the eel, and tastes something like it, but is more delicate in flavour, and not so oily. The consistency of the flesh is like that of the thin part of the belly of the salmon, but white. As

the phrase is, it has no bones—that is, the bones are gelatinous, like those of other cartilaginous fishes. It is taken in immense numbers in the Volga. There is no reason why we should not succeed in introducing it into our own waters. A fish that can accommodate itself to the Arctic Ocean, and the Caspian, and the Black Sea, must surely do in our English lakes, rivers, or seas. It is transported alive for long distances. In St. Petersburg you are always sure of getting your fish fresh; they are brought to the city alive in welled fishing boats, and at the fishmongers' doors they are moving languidly about in large tubs. At the restaurants, their lives are prolonged to the latest possible moment, and they swim in a large aquarium until they are wanted. Notwithstanding their high price (in a restaurant's bill 8s. each), very large numbers of sterlets are daily consumed in St. Petersburg. At the banquet given to the Horticultural Congress there was an entire sterlet upon every man's plate. Their introduction here by spawn would be easy, as they spawn in the winter time. The introduction of the sturgeon itself would be as important. Though not so delicate a fish, it weighs 200 lbs. often, while a sterlet weighs but 1 lb. or 2 lbs.; and the sturgeon would supply us with caviare, which the sterlet will not. At present, that delicacy cannot be tasted in perfection fresh anywhere nearer than the banks of the Volga. That is pronounced by experts to be the greatest delicacy in existence. Mr. Murray says he should never have thought it. In its preserved state it is a bottle-green sort of moist granular paste, composed of pellets of roe as large as swan-shot, and its taste is a good deal like that of any other fishy compound, as, for example, anchovy paste; in the fresh state, the green pellets of roe swim in a rich, gelatinous substance, which disappears in the dried or compressed state. Another favourite fish in St. Petersburg is the schnepel, which is cured and smoked, and tastes something between a fresh salmon trout and a kippered herring. It is an exceedingly palatable and rich fish. The monks are said long ago to have introduced an allied species, the vendace, into Lochmahen, where it survives without trouble to the present day. It does not require to go to the sea, and any proprietor could introduce it at a trifling expense if there is upon his estate a mountain rivulet coursing to a mountain lake. There are other fishes peculiar to the Caspian deserving attention, as the berchenka and the vobla, a cyprinoid fish, but they would not bear the change to our seas. With regard to the drinks of Russia, it is said that the water at St. Petersburg causes diarrhœa to new-comers using it freely, until they become acclimatised. The coffee, "when made with care, under the superintendence of the ladies of a household," is not to be surpassed. The tea used is a light, delicate-flavoured tea, from the north of China, never, at the strongest, getting beyond a light amber colour. The Russian's hours are late, and his last meal is usually a cup of tea. Of the fermented drinks made in Russia, there is, first, a poor beer called "quass," manufactured from the remains of the rye used in making bread. It is much like what is known here as "treacle beer." Hydromel, an undecided beverage of a mild character, is a fermented mixture of honey and water, not unlike rather flat and ungingered ginger-beer. The wines of the Crimea, Bessarabia, and the Caucasus are gradually improving, and acquiring a character of their own. The "vodka" includes all sorts of liqueurs. The practice of the Russians is to take a vodka before dinner, and with it, by way of whet, a mouthful or two of caviare and bread, or sardines, or "shimaiah," which, if not a salt herring, is a very good imitation of one. The guests saunter up to the sideboard or side-table to take this. Strangers unacquainted with the custom may sometimes be misled by it. A large party of the horticultural guests at St. Petersburg were invited to one of the Imperial Palaces, and received by one of the Emperor's great officers in a room where all the materials for a vodka were set out. The visitors mistook it for a standing luncheon; and the servants interchanged comical glances when relays of caviare, bread, wine, and liqueurs were again and again required. A triple-serried phalanx surrounded the table, and the shy and the late-comers could not penetrate it. When the most courageous had thoroughly appeased their hunger, and were breaking into open order, they were amazed to find that the banquet awaited them in another room. As will be observed, Mr. Murray's report is confined to what may be called normal food; but he was shown specimens of articles eaten only on occasions of great scarcity—lichens, sawdust cakes from the north, and different kinds of clay from Central Russia. These we hope we may not need; but he has described some articles which would be welcome on our tables.

CORRESPONDENCE.

SPELLING REFORM.

Sir,—There is at length a prospect that something will be done, and that very shortly, in the direction of amending and simplifying our proverbially difficult, lawless, perplexing, education-hindering orthography. Sadly too long has this most necessary spelling reform been postponed, but at last there is hope for it, in the practical attention which the subject is receiving simultaneously at the hands of influential societies and individuals.

"This grand stumbling-block to the rapid march of human intellect," says Dr. Gilchrist, referring to our orthography, "is by no means irremediable, were people only to set heart, head, and hand about it, by boldly thinking and acting for themselves or the common weal of mankind."

Important discussions on "the spelling difficulty" have recently taken place in London, at the Philological Society, the Society of Arts, the College of Preceptors, and the Social Science Association, and various proposals for the amendment of spelling have been brought forward; but much further discussion of the subject, in the provinces as well as in London, is necessary, before any definite and satisfactory results can be expected.

The schemes proposed at the above meetings have reference chiefly to the amendment of spelling "without adding new letters to the alphabet." I am of opinion, however, that the solution of the spelling difficulty must be looked for in a direction different from that indicated in Mr. Ellis's English glossic, or Mr. Jones's analogic spelling, in both of which the present deficient alphabet is employed.

To my mind it seems a hopeless task to attempt orthographic reform without alphabetic reform as a preliminary step. Orthographic reform without alphabetic reform is indeed less than what is needed, effectually to remedy the evils of the present spelling.

It is assumed on some hands that the public are averse to new letters being added to the alphabet; but this assumption has no better foundation than the other assumption, that no modification of the present historic (chaotic) orthography will be acceptable. The fact is, the public mind is only just awaking to a consideration of the subject of orthographic reform; and, as in the case of other reforms that have been practically realised, the public will eventually accept whatever is most likely to conduce to its advantage, if this is only placed before it in a proper light.

The English alphabet is incomplete and inadequate to the requirements of the language. Let it then be completed. This, indeed, is the first practical step to be taken in seeking to amend our wretched, education-hindering spelling.

The Greek and Roman alphabets, from which our English alphabet has descended, originally consisted of but sixteen letters; other letters were afterwards added, according as signs for proper sounds were found to be wanting. Surely we may follow this precedent, and thus rid ourselves easily of "a mass of irregularities, incoherences, equivoques, and double uses" in our orthographie system, which, whilo our alphabet remains incomplete, can be got rid of satisfactorily in no other way.

The alphabet need not necessarily be remodelled, as Mr. Isaae Pitman would have it, to accord with his phonetie shorthand alphabet; but it might very easily be extended, so as to bring it up to the lovel of English requirement for the expression of English sounds and words, without materially disturbing the A B C arrangement.

Much, undoubtedly, ean be urged in favour of a rearrangement of the letters, as in Mr. Pitman's phonotypic alphabet; but this is a matter of only secondary importance, a question of theory rather than of practical utility; and considering that the A B C order is that commonly in vogue among civilised nations, we may very well adhere as closely as practicable to this arrangment, till such time as the nations, meeting in congress, shall agree upon "an international and invariable alphabet, in which each sign should stand for one single sound in all the languages in the world—a boon to society second only in importance to that of steam, and superior even to that international uniformity in weights, measures, and coins, which the exigencies of our age have at length rendered imperative."

I shall be glad to forward to any applicant copies of an enlarged English alphabet, which I am having printed for distribution, and which seems to me more nearly to meet the requirements of our language than any other that has been proposed. Whatever may be its merits or defects from a typographic point of view, it will serve very well as a basis for the discussion of the general question of alphabetic reform, pending the establishment of a spelling commission, which we may hope shortly to see instituted under the auspices of the Society of Arts or the Committee of Council on Education. The advantages and probable results of the adoption of an enlarged English alphabet would be very great.

By its aid, the art of reading would be attained in a few weeks, because each letter and syllable with a true orthography would invariably represent the same sound.

Any individual, though but a child (to use the words of the late John Faulder, of Bristol,) would, in the same short time, and for the same reason, be able to teach others correctly.

In consequence of this facility of learning and teaching afforded by a true orthography, a supply of entertaining and instructive tracts and books, well illustrated by engravings, and stereotyped to reduce their price as much as possible, would of itself excite amongst the uneducated the desire to learn. They would consequently instruct one another in reading, even where no schools exist, as they now do in other matters which present but little difficulty, and from which they derive entertainment.

And if the humbler classes are thus brought to become their own instructors in this elementary foundation of intellectual improvement, the obstacles which now prevent the adoption of an effective system of universal popular education, penetrating into the very depths of society, would in a considerable degree be avoided. The people themselves, in consequence of having taken this step forward in improvement, would be better able, and therefore more likely, to appreciate the elementary schools, useful public lectures or addresses, or any other sources of instruction that may be provided for them.

There would also be this immense moral gain, namely, that whereas, with the present mode of spelling, the great bulk of the children pass through the elementary schools without having acquired the ability to read with ease and intelligence, or spell with accuracy—that is, without acquiring the merest rudiments of instruction—these attainments would be so simplified and facilitated that they would be speedily mastered by the youngest scholars, and the real work of education, which at present is sadly hindered, could bo more satisfactorily carried on.

Children taught to read with the enlarged alphabet and amended spelling in the earlier school stages, would, with proper transition-books, pass easily to the attainment of reading in the present spelling in the later stages of their school attendance. They need not, however, be called upon either to spell cr write aecording to the present orthography, any more than we at the present day are called upon to write and spell in the obsolete orthography of byegone times, when "certayn merchauntes in a shipp, for lacke of wynde, taryed att Forland, and wolde have hadde egges, but the goode wyf understode them not." We read this "olde auncyent Englisshe" well enough, without requiring to write it. In like manner, future generations may read our present books, and derive from them the information they contain, without troubling to write or spell according to their orthographic eccentricities.

It is a common remark that, in England, we never get any needed reform until public opinion is fairly enlightened and eager on the subject. It has been proposed that I shall thus devote myself to the necessary work of arousing public opinion in our principal towns on this alphabetic and spelling reform question. This I am prepared to do, if funds ean be raised to enable me to begin, with the prospect of being able to continue the work for a time. The announcement of public lectures, to which admission must be free; the extensive circulation of printed information; the publication of a few elementary books, exemplifying the reformed spelling; postages, advertising, travelling expenses, &c., will necessarily involve much outlay, towards which I shall be glad to receive assistance from all who consider the endeavour to bring about a spelling reform should be encouraged.—I am, &c., GEORGE WITHERS.

91, Falkner-street, Liverpool, September, 1870.

SIR,—What is the object and intention of altering our spelling? Mr. Jones says:—"Practical convenience ought not to be sacrificed to theoretical consistency." But unless we know the object, how can we judge either of tho "theoretical consistency" or the "practical convenience." Mr. Jones says also, that "it would not be desirable to indicate extreme refinements of pronunciation in the new spelling, as the pronunciation varies considerably in different districts, even among educated people." It is presumable that where distinctions of very marked character are made by educated people with scarcely any exception, they should be indicated. Among such may be reckoned the two principal sounds of *g*, of *r*, of *s*, of *th*. But Mr. Jones does not attempt to distinguish them. The position of the accent, one of the greatest difficulties in our language, seldom or ever varies, yet Mr. Jones does not attempt to mark it, although he does not shrink from using diacritical signs. Mr. Jones also says:—"In order to minimise the amount of change, and also to distinguish by spelling words which have a different meaning, though pronounced alike, it is desirable to retain the two most common modes of indicating long vowel sounds," among which he apparently classifies two diphthongs. Here we have an intelligible object in spelling, namely, "to distinguish by the spelling words which have a different meaning, though pronounced alike." But no rule is laid down, no suggestion even is offered, no hint is implied, by which the choice of spelling in connection with the meaning should be guided. Nor is it easy to see what rule should be given. It is presumable that Mr. Jones would distinguish *ball* and *bawl* as "baul, bawl," but how

would he distinguish a *ball* at which people dance, from a *ball* at which they kick? How would he distinguish *light*, not dark, from *light*, not heavy, and both from *light*, descend? The whole principle is utterly fallacious. The distinctions are not now found necessary where they are not made, that is, in nine cases out of ten, and where they are now made, they arose fortuitously and not by design. What is not wanted in speech is not wanted in writing. More than twenty-five years of experience in the daily use of phonetic spelling, either as shorthand or in print, have convinced me of this fact.

Now to see Mr. Jones's application. I take from his examples on pp. 813-14, the different ways in which he expresses the recognised six long vowels, "*ee, ai, aa, au, oa, oo*," the recognised six short vowels, "*i, e, a, o, u, uo*," and the recognised four diphthongs, "*ei, oi, ou, eu*," of the English language (see *suprà*, p. 495, col. 1), omitting the distinctions occasioned by the influence of vocal *r*. The italicised letters in the words represent Mr. Jones's methods of spelling the sounds placed first in capitals, and written in my glossic.

EE—1) b*e*, w*e*, *e*vil; 2) m*e*t*e* (meaning unknown); 3) m*ee*t (meaning unknown, presumably different from m*e*t*e*, but how the three words, *meet, meat, mete*, would be written is not apparent), s*ee* = sea (how would *see* be distinguished?), th*ee* = pronoun, l*ee*d, h*ee*leth, dis*ee*ses, *ee*gels (the final vocal *l* is here written *el*, while in *evil* it was written *il*), gl*ee*ming, br*ee*thd, h*ee*vd.

AI—1) tempt*a*tion (the termination *-tion*, and presumably also, *-sion*, *-ssion*, *-cion*, being retained); 2) ā*n*gel (no explanation of the sign ā is given; as regards *ng*, considering that *-le* is written "*-el*," how would *angle* be written?); 3) g*a*l*e*, n*a*m*e*, p*a*l*e*; 4) m*ae*l = *mail*, w*ae*l = *wail*, B*ae*l = *Baal*, G*ae*l; 5) d*ay*, l*ay*, spr*ay*; 6) d*ai*ly; 7) th*er* = *their*.

AA—1) f*a*ther, *a*rt, st*a*rs, h*a*rts = *hearts* (how would *harts* be written?), bl*a*st, p*a*st, g*a*sping, l*a*nce (perhaps the pronunciation "blast" is meant, but could "fadh·er" be also meant?); 2) c*á*m = *calm* (only used in the example).

AU—1) d*au*b, *au*l = *all*, *au*tum; 2) l*aw*; 3) f*o*r, L*o*rd, dist*o*rted. (Surely if the sound of *o* here differs from that of *au* in *daub*, this must be one of "the extreme refinements of pronunciation" which Mr. Jones deprecates).

OA—1) r*o*ls, h*o*ly (which should mean *holly*, of course, but does not), c*o*horts, s*o*rd = *sword*, gl*o*ry (in these two last words the sound of *oa* is sensibly modified by the following vocal *r*, and in *glory* there is both a vocal and a trilled *r*, in glossic "soard, gloarri"); 2) f*ō*ld, g*ō*ld, r*ō*ld (was *rols*, then, a misprint?) c*ō*ld, h*ō*sts; 3) r*o*s*e*, unsm*o*t*e*, br*o*k*e*, al*o*n*e*; 4) r*oe*s (as this is given only as an example, and opposed to *rose*, we must suppose it different from *rose*, but cannot tell whether it is meant for *roes* or *rows*), s*oe*l = *soul* (how about *sole, soal;* or, if the spelling *soal* be ignored, how distinguish the flat of the foot from the flat fish?), bl*oe*n = *blown*, str*oe*n = *strewn*, sn*oe* = *snow*, f*oe*, f*oe*m, hal*oe*d, wid*oe*s.

OO—1) wh*o* (a misprint?) int*o*; 2) f*oo*d, wh*oo*, thr*oo*, y*oo*th; 3) r*ue*d = *did rue*, bl*ue* (does Mr. Jones say "rood," "bloo," or "reud," "bleu?"); 4) gr*ew* ("groo" or "greu?")

I—1) d*i*n, *i*n, w*i*l, g*i*v, del*i*ver; 2) dail*y*, glor*y*; 3) iniquit*e*s (perhaps Mr. Jones says "inik·witez," but his spelling, if any faith is to be put in his key, should mean "inikweits," whatever that may be), th*e* (perhaps Mr. Jones says "dhee," or "dhu.")

E—1) d*e*n, h*e*ven, br*e*d, d*e*th, spr*e*d, d*e*dly.

A—1) D*a*n, h*a*loed, b*a*ners.

O—1) d*o*n, w*o*s = *was*, f*o*rest.

U—1) d*u*n = *done* (how would *dun* be written? From the keys, presumably in the same way; but then what becomes of the distinction, *dun, done*, which is one of the reasons for retaining more than one mode of spelling one sound, and the only reason assigned, beyond "minimising the amount of change," an end which could be easily effected by making no change at all), c*u*m = *come*, l*u*ving = *loving*; 2) kingd*o*m

UO—1) p*ú*ll (the only normal form, but not used in the examples), 2) g*oo*d, w*oo*lf.

EI—1) th*y*; 2) k*i*ndness, satisf*ie*th (which, according to the key, should be "satisfeith"); 3) r*ī*der, *ī*dols; 4) s*ī*lent (why not s*ī*lent, as in the two last words? neither of the symbols *ī*, ī, are explained in the key); 5) t*i*d*e*, th*i*n*e*, l*i*k*e*; 6) t*ie*d = *did tie*, n*ie*tly = *nightly*, m*ie*t = *might*, *ie*s = *eyes*.

OU—1) *ou*t, *ou*r, p*ou*r = *power*, cr*ou*neth, m*ou*th, l*ou*d; 2) c*ow*, br*ow*, d*ow*n (why not *doun*?)

EU—1) d*ew*; 2) ren*ewe*d; 3) r*ue*d? see OO, 4) r*u*d*e*? see OO.

What is the result of this fanciful variety of spelling? The key does not enable me to read a single line with certainty, and I am utterly at a loss to guess how to spell. That is, if I could not read the old spelling, I should have to memorise the new, and I should have, at any rate, to memorise Mr. Jones's dictionary in order to spell as he does.

What would be gained by adopting such an alteration of our spelling?

It is not necessary to answer this question, or to discuss further a crude scheme, with no discernible object beyond alteration, no "theoretical consistency" beyond perpetuation of error, no "practical convenience" beyond letting the proposer (and no one else) write as he pleases, with the immeasurable evils of exchanging a spelling acknowledged by a hundred million speakers for one which has no historical or scientific claims to advance, which depends upon the "bottomless fancy" of a single man, and, exhibiting the principal vices of the old spelling, possesses none of its advantages.

In the lecture which I had the honour of delivering before the Society of Arts, on 21st April last, I stated (p. 490) that "I would not alter it [our present spelling] in any respect whatever, believing that such attempted alterations and modifications would seriously detract from its value, without in any commensurable degree removing the difficulties it creates." No proposal that I have yet seen has induced me to modify this opinion, and I am sorry to find so many attempts made to solve this insoluble problem by persons who, like circle-squarers, longitude-discoverers, and the like, seem to be equally unaware of the difficulties to be surmounted, and the object to be attained.—I am, &c.,

ALEXANDER J. ELLIS.

Errata.—In my last communication, p. 811, col. 1, last line but one of first paragraph, for "b ŏ o k," "b ŏ o k," read "b ō o k," "b ŏ o k;" and page 811, col. 2, lines 12 and 14, for the English sounds of long I, read "ŭ y," "ŭ u y," for "ŭ' y," "ŭ u g."

BRITISH ASSOCIATION.

Among the papers read in the various sections were the following:—

On Street Dust as a Ferment.—Mr. C. R. C. Tichborne, F.G.S., stated that his researches agreed with some of the ideas put forward by Professor Tyndall in his lecture at the Royal Institution, wherein he pointed out how the particles floating in the atmosphere might assist in the spreading of contagious diseases. Mr. Tichborne gave some analyses of various kinds of street dust,

which were found to consist chiefly of stable manure and stone finely ground. Some dust taken from theatres and public buildings in Dublin was found to consist of from thirty to fifty per cent. of organic matter, and the inorganic matter was rich in iron. He found out that dust acts as a ferment in various solutions, and gave the particulars of experiments made by him to prove this point; the most interesting circumstance he made known was, that the street dust, which enters the throats and noses of dwellers in town, is half stable manure, a substance not conducive to health when taken internally.

Future Railway Guage.—A paper on the subject was presented by Mr. Fairlie, which strongly argued the advantages of a very narrow guage, on the ground that every inch added to the width of a gauge beyond what is absolutely necessary for the traffic adds to the cost of construction, increases the proportion of dead weight, increases the cost of working, and, in consequence, increases the tariffs to the public, and by so much reduces the useful effect of the railway. Even if a 3 ft. gauge line would cost twice as much to make as a 5 ft. 6 in. gauge, in such a case the difference in the cost of working each ton of goods would be so enormous, that the narrow gauge would be by far the cheapest of the two in the end.

New Route for British Commerce.—Viscount Milton' who has lately visited North America, insisted, with much earnestness, upon the infinite value of a railway route across North America being constructed for British traffic, and, by means of a map, pointed out the comparatively small difficulties that would have to be surmounted for the schemes that had been suggested to be effected. From this branch of his subject he passed on to notice the extraordinary fertility exhibited in the district of the Red River. The country abounded in timber, and he had himself seen a coal-bed, with the coal fifteen feet in thickness, through which a river had washed its way. These, and a hundred facts, were adduced as so many proofs of the natural facilities that would be afforded in the construction of railways.

Metric System.—Dr. Farr brought forward the subject of the metric system of weights and measures. He said that a committee of the House of Commons, a Royal Commission, and a committee of this Association, had fully considered the question, and it was now time that some definite action should be taken upon it. Having given a *résumé* of what had been and might yet be done, with a view to the adoption of the metric system, he concluded by moving that the Council of the Association be requested to urge on Her Majesty's government the extreme expediency of proposing to the legislature a measure to ensure the introduction of the metric system of weights and measures into general use in the United Kingdom and its dependencies, within five or some definite number of years. The resolution was ultimately adopted.

Mechanical Improvements in Obtaining Motive Power.—Mr. Eaton recalled to mind his description of the Warsop aero-steam engine at Exeter, and his promise to communicate the results of further trials of the system, which had now been made in several places. A well-known Lancashire firm had built one of the engines for use in their own works, and had used it at a consumption of 60 cwt. of coal per week with the air, as against 86 cwt. per week when the air was shut off. Without the air, an average pressure of $33\frac{1}{2}$ lb. was shown; with it, a pressure of 47 lb. An engine of the best construction, built for himself in London, showed, with the air, a gain of $24\frac{1}{2}$ per cent. in work done at ordinary speed, and a gain of $33\frac{1}{2}$ per cent. at a higher speed. The consumption of ordinary Welsh engine coal was, with steam only, 5·88 lb. per actual horse-power per hour; with steam and air, 4·72 lb., or a gain of 1·16 lb. per horse-power per hour, a very valuable economy. Experiments were at present being carried on with locomotive engines; and some experiments with condensing engines, made at the suggestion of Professor Rankine, showed the vacuum to be much less interfered with than had been expected, and that the extra steam generated counterbalanced the loss of vacuum, while the fuel consumption was alike under the two principles. The inventor was convinced that he could improve the condensing engine proper, and his perseverance has lately been rewarded by a success that he thinks will prove an invaluable boon to all owners of steam vessels.

Cotton Supply.—A paper was read by Mr. R. T. Saunders, Commissioner from the National Commercial Conventions of Louisville and Memphis, on the Physical Geography of the United States of America as affecting agriculture, with suggestions for the increase of the production of cotton. The area of the cotton-growing States of the South was then described as covering 800,000 square miles—a surface larger than the combined areas of Great Britain, France, Prussia, and Italy; and the single cotton State of Texas as being nearly equal in extent to the Austrian Empire. The staple productions of the States, besides cotton, were sugar, tobacco, maize, rice, wheat, rye, oats, beans, hops, peas, vegetables, fruits, flax, hemp, wool, beef, pork, and hides, so that they afforded openings for a very varied and profitable industry. The author gave an estimate of the amount of cotton now required for the use of the world. He made it appear that, exclusive of the United States, the annual demand was now for 5,856,000 bales of 354 lb. each, and stated that the cotton grown in East India, China, Brazil, Peru, the West Indies, Egypt, Turkey, and the Levant was required to be sent back to those countries, for they all imported in the aggregate more cotton in the shape of goods, yarns, &c., than they exported in the raw state Cotton-growing would be followed steadily only in those countries where it could be made more profitable than other pursuits. Where indigo, tobacco, coffee, sugar, or bread-stuffs would bring better prices, or suit the climate or the conditions of the people better than cotton, cotton culture might be forced for a few years under the influence of high prices, and in the interests of resolute, independent, and persistent manufacturing people, but such culture would only be temporary, because in defiance of the laws of true economy. Every nation could and would produce cotton for a time when stimulated by high prices, but what Great Britain and continental Europe required was a regular and sufficient supply of cheap cotton. The author, therefore, advised the Cotton Supply Associations, considering the rapid increase of consumption last year, in Germany and in the north of Europe, to look into the practicability of establishing cotton-growing companies in the Southern States, and to report to Manchester spinners the results of their investigations, and the chances of good investment that might thus be opened up. Proceeding to consider the sources of seed supply, Mr. Saunders stated that cotton grown from seed carried from any of the Atlantic Cotton States into Mississippi or Arkansas will continue to improve upon like soils; while cotton, grown from Texas seed, in Georgia and South Carolina, will, after the first crop, continue to deteriorate. Three years since, he carried from England native Egyptian and East Indian cotton seed into Alabama and Arkansas. These seeds were experimentally used on plantations in both States. The first year the samples of cotton yielded were inferior, but in the second year they very materially improved. As a general rule, cotton seed taken to the United States from its native soils will produce a better cotton than on them, the tendency being continually to a longer and better staple. On the contrary, Mobile and New Orleans seed planted in Egypt, the Levant, or East India, will produce cotton the first year nearly equal to its original, but every year of reproduction from the same seed will exhibit more and more deterioration, and after the third year the imported are no better than the

native varieties. Hence the absolute necessity of frequent renewals from American seeds of good staple when cotton is grown in Egypt or India.

Utilisation of Sewage.—Mr. David Forbes, F.R.S., after describing the processes, mechanical and chemical, by which sewage has been dealt with, called attention to what he said was an entirely novel process, brought forward by Dr. Price and himself. It was founded on the fact that certain mineral phosphates, especially those containing alumina, eagerly combine with the organic matter of sewage. A solution of the phosphates and milk of lime was added to the sewage, and the ammonia was precipitated in the shape of a double phosphate. Mr. Forbes illustrated the process with a bottle of Liverpool sewage, and the result was, that in a few minutes the precipitate was seen falling to the bottom, leaving the water perfectly clear and free from smell. In another experiment he added ink to the sewage, which gave it a black colour, but the colouring matter was at once removed by the addition of the solution of phosphates and the lime-water. In fact, he contended that the sewage water so purified could be drunk without offence, and he caused some amusement by drinking a wine-glass of the water clarified from the London sewage. Before recommending the process, he said they must be prepared to answer two questions—first, whether the water was sufficiently pure to be permitted to flow into rivers; and, secondly, whether the valuable constituents of the sewage had been precipitated. He proceeded to show that the answers to both questions were satisfactory, and, in conclusion, he expressed an opinion that his process would be extremely valuable in such localities as were found unsuitable for sewage irrigation.

Purification of Public Thoroughfares.—Mr. Cooper read a paper on the purification of public thoroughfares by the application of deliquescent chlorides, calling attention to his paper on the same subject read at Norwich, and to the experiments since conducted at Westminster and other places. He showed that the importance, in a sanitary point of view, of the use of the chlorides had been clearly established. The chloride of calcium decomposes the carbonate of ammonia contained in the horse droppings, the results being carbonate of lime and chloride of ammonium, which two salts, combining with the chloride of sodium, form the desirable concreting effect on roads which contain a certain proportion of carbonate of lime in their composition. An effective method of remedying the evils arising from organic matter deposited in the public thoroughfares is becoming daily a subject of serious consideration with sanitary authorities, as much sickness is believed to arise from malaria emanating from this source. Carbolic acid is used in many localities as a disinfectant, and other powerful and poisonous antiseptics have been used lately in watering the streets. The disgusting odour and dangerous nature of some of these deodorising agents are strong evidence that they would not be used at all, if the necessity for some determined action to prevent the spread of contagion and disease was not fully recognised. To completely effect the object of purifying and disinfecting streets and public places, an antiseptic is required which may be used freely and without fear. It should be as powerful a disinfectant as carbolic acid, but free from the unpleasant odour and poisonous nature of that article. The deliquescent chloride of aluminum, recently introduced into public notice by Professor Gamgee, seems to meet all the requirements of the antiseptic of the future. It is non-poisonous, free from any odour; it prevents decomposition, and arrests it when commenced; it absorbs noxious gases resulting from putrefaction, and destroys parasites and germs. It is also not to be surpassed as a precipitant and deodorizer of sewage; added to these advantages, it is only one-third of the cost of carbolic acid. It is necessary to add a sufficient percentage of this chloride to the salts used for street-watering purposes, and thereby afford a means of thoroughly and effectively purifying public thoroughfares, and without additional cost to the ratepayers, the value of the water and labour saved by the action of the deliquescent chlorides being more than sufficient to pay the expenses of their use.

Lead-Poisoning.—Mr. Alexander Gordon read a pape on the prevention of lead-poisoning. He first pointed out that, though medical and scientific men had long been unanimous as to the advantage of abolishing lead as a means for the storage or distribution of water used for dietetic purposes, the conviction as to its danger had not yet fully forced itself upon the public mind. He showed from medical sources that many obscure diseases, as well as diseases which assumed a more palpable form, were due in this country to the impregnation of water with lead; and that both soft and pure, and hard and impure waters were alike, under certain circumstances, contaminated; and that as lead was a cumulative poison, however small the contamination might be, it would in the end, if such waters were employed, act with destructive effect. The only substitute yet manufactured which, while it conserved the purity of the water, was both ductile and cheap, was that invented by Mr. Haines, C.E. It consists of a lead pipe, with an internal tube of block tin, both having been previously welded together so as to form a homogeneous whole. By this process the piping retained all the flexibility of the lead, while the inner tube of tin was strong and thick enough to prevent any access of water to the exterior leaden pipe.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

Inspection of Factories and Workshops.—The factory inspectors report that, in their opinion, the Factory Act (Extension) of 1867, is working satisfactorily, and that they have reason to believe, from an appearance of increased activity on the part of many local authorities with respect to the administration of the Workshop Regulation Act, that this also, when amended, will be of like utility. It is noticed that the tendency of these Acts is to induce masters to dispense with juvenile labour as much as possible, substituting for it machinery if they can, and, if not, the employment of older persons. It is a sad page in the report that tells the number of accidents of which the inspectors receive reports. In the year ending the 30th of April last (for our departments end their "year" at all sorts of dates), no less than 17,693 accidents were reported. The majority of them were lacerations, contusions, and other injuries of no very serious consequence, but it appears that all reported were such as to prevent the injured person returning to work by 9 o'clock on the following morning. No less than 350 of the accidents of the year were fatal, 93 others were such as to require amputation of a hand or arm, materially disabling a person for life, and 1,245 others necessitated the amputation of part of a limb. One of the inspectors, Mr. R. Baker, observes that there is still great carelessness in setting children and young persons to work where there is considerable danger, and there is much mischief caused by the curiosity or the negligence of the workers. The majority in number of the accidents are not caused by machinery, but a majority of the worst arise from machinery. In the year ending the 30th of April, 1870, 176 of the 350 fatal accidents were caused by machinery, 87 of the 90 accidents which made necessary the amputation of a hand or arm, and of 1,041 of the 1,245 which led to amputation of part of a limb. Many of the accidents are caused by falls from platforms, falls under wagons, or the fall of iron or weights upon persons at work at iron mills, shipbuilding yards, machine works, and the like.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 30, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

THE LIBRARY.

The following works have been presented to the Library:—

A Treatise on Fish-ponds. By J. Hoare.

Reports of the Inspectors of Factories for the half-year ending 30th April, 1870.

The Edinburgh University Calendar, 1870-71.

Proceedings of the Academy of Natural Sciences of Philadelphia, Nos. 1, 2, 3, 4.

Cenni Statistici sulla Produzione Mineraria in Italia, 1870.

A Treatise and Diagrams of Mortar Practice, Velocity, Time of Flight, and Range, Small Arms, Theory and Practice, Instruments for Measuring Distances, and other Artillery Subjects. By Lt.-Col. J. W. Croggan.

Elementary Problems in Practical Plane Geometry. By John Lowres.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

ON GERMAN UNITY AS AFFECTING MILITARY ECONOMY, AND THE PROGRESS OF ARTS, MANUFACTURES, AND COMMERCE.

At the Association for the Promotion of Social Science, a request was made to Mr. John Stuart Mill that he would give a paper to open a discussion on the economical questions arising out of the present war, but he recommended that they should open the discussion on the point of view taken by Mr. Chadwick. That gentleman, therefore, brought forward the subject chiefly on the economical grounds on which he treated it in the discussions in the Society of Arts, with the addition, however, of the following statement on the international question:—

Looking at the stationary condition of a large proportion of the population of France amidst surrounding advances in colonisation, it will clearly appear that the absorption of the material means of progress by the maintenance of the standing army, and its employment abroad for such purposes as the expedition to Mexico, with the avowed object of sustaining the Latin race against the Anglo-Saxon race in the New World, has certainly tended to weaken and hasten the decadence of the Latin race at home. And this may be said for the plan of the invasion of Prussia, that if it had succeeded, and brought about the acquisition of more German territory as contemplated, it would have brought under the French dominion more of the advancing element, in increasing industry, and population, to the displacement (with the pressure of four and a half births to three per family) of the Celts, Latins, or whatsoever they be, in arts and manufactures, and indeed in superior influence and position, as we may observe by the German names —the Schneiders, the Haussmans, the Wimpfens, the Dolfusses, the Megs, and others. But is it not deplorable to witness miserable and shortened existences, reared in habitations of cruelty, scourged by the tyranny of preventible disease, enslaved by barbarous ignorance and passion, led forth as chosen combatants for "civilisation and liberty."

Of the foremost legions led for this mission were those from Algeria, which presents the most striking example of the failure of mere military rule of the sort for such a purpose, which we may stay to notice. There is a territory of the finest climate of Europe, and one comprising ancient seats of civilisation and former granaries of Europe, a territory about three times as large as England, inhabited by little more than two millions and a half of a semi-nomadic, barbarous population, of which the Turcos are specimens.

Since the conquest of Algeria, forty years ago, it has been held by an army of French soldiers (about as large as the English army by which we hold India) of from 60,000 to 80,000 effective soldiers, at an expense of between £3,000,000 and £4,000,000 sterling annually of the resources of the French people, and with the result of a mere handful of inferior French colonists, of little more than 100,000, and scarcely increasing. One of our able Anglo-administrators, who visited the province to examine a valuable example of good sanitary work on a small scale, the drainage and reclamation of some marsh land for culture and occupation which has been accomplished there, declared to me that with about half a dozen Anglo-Indian administrators he would undertake to hold Algeria with one-third of the military force with which the French government now occupies it. And there is no doubt that this might be done, and that the expense of the 40,000 or 50,000 of the surplus soldiers applied to the extension of such reproductive works as those examined, and to successful colonisation.

The annual cost, as I have stated, of a soldier in France is 1,000 francs. I do not know how much it may be in Algiers. But the Emperor, in a letter in relation to that territory, written after having visited it, puts down the cost of some proposed immigration by Germans and by Irish—not by French, for he appears not to have thought of them for immigration; and these costs of transport, tools, seeds, and maintenance for three years are given at 900 francs, if done on a scale of forty or fifty thousand immigrants. But he sets the proposal aside as too expensive, having in view probably the assumed necessity of the maintenance of the existing military force in Algeria as a school of practice in active service for the French army!—that is to say, a school of loose practice, in warfare against barbarians, which has led to egregious failure against the German civilised soldiers. But here it appears that a year's cost of a surplus soldier would have served to plant one permanent colonist—or, in other words, the annual cost of forty or fifty thousand surplus soldiers would have served to plant yearly as many emigrants, and during the period of the French occupation might have planted more than 1,000,000 of civilised colonists, and made a real advance in its "civilisation and liberty;" and it would have been hard if our Indian administrators did not obtain a million or two of annual returns to the exchequer of France, as they had done in worse conditions in India.

The instance of our comparative administration of India appears to me to have an economic bearing on the principle of the great questions before us, which I beg leave to notice.

The military force with which we hold India, including the native soldiery, much of which it is to be questioned might be dispensed with, is about a quarter of a million of men altogether. But this quarter of a million, as I stated in my address at the Hague, stands in the place of more than three millions of native war caste of the standing armies of the separate native states before our conquest, that is to say, of standing armies of nearly the number of those of all Europe. Thus our army saves the oppression on the natives of India, and

the exhaustion of their tax-bearing power, of some two millions and three-quarters of force of native standing armies. And the money so saved is available for reproductive public works, or for public benefit, and it may be said it is now being applied with more or less success for the benefit of the people of India, in public works or measures of improved administration—in great works for the increase of production, and for the prevention of famines—in works for the collection, and storage, and the distribution of water—in new railways, in new roads, canals, and means of water-conveyance, stretching from one end of the country to the other, and in works now beginning for the sanitary improvement of towns; in educational institutions, and in police, and in means for the better security of life and property—all of which would have been impossible under the old dominion of standing native armies in the separate native states—impossible except under "Indian unity." Now, does it pass the governmental capacities in Europe to bring about, by agreements of peoples, results similar to those that have been brought about by conquest in India, and that are in progress by a government there in the interest of the people? Is it beyond the statesmanship and the diplomacy of our time to prevent a continuance of the waste on standing armies, which, by wars, incited from France since the accession of Napoleon III., have, it is estimated, cost Europe more than a million of lives and more than five hundred millions of money? Not if the standing army of France be re-established, and the principles of its action, as displayed in the outset of the present war, should be allowed to continue, to the menace and detriment of surrounding states.

By no political economists have the dangers and evils of an armed peace, and of the objections to standing armies, been more forcibly stated than by the leading political economists of France. I might cite their authority, as against those remaining statesmen of the old school, who considered it to be the business of diplomacy, by protectionism, to preserve the balance of trade, and who, on no better grounds, yet talk of it as the great business of the cabinets to preserve by military power the "equilibrium" of the political power of states, an equilibrium which, as they complacently view it, requires for its maintenance three millions of men in standing armies, and between two and three hundred millions sterling of annual peace expenditure. With such disturbances of the equilibrium, nevertheless, as occurred when Italy went with Prussia (or as might have occurred to the oversetting the Austrian Empire by going into Hungary), and as now occurs, in upsetting years of expensive work to France, by her going into Rome. France can present but sorry results of all her incessant labour and grievous sacrifice of life and money in that direction. There stands opposed, however, to the abrogation of the policy of the equilibrium, the notions of those who have no conception of national power, excepting the military power of standing armies, and who on that ground claim the maintenance of the preponderance of France against what is assumed will be an aggressive military preponderance of Germany, as a consequence of the achievement of its unity. But the idea of German unity is not the idea of German governments, but the idea of the people; and to the people, unity means free-trade between the states, free intercommunication—unity of railway and postal telegraphs, unity of civil privileges, unity of educational institutions, unity of weights and measures, unity of coinage, unity of legal procedure and codification, and it may mean, and it is to be hoped it will be made to mean, unity of national military force, not for the sake of offensive warfare, but for the sake of economy of defensive force; and generally and primarily, unity for the sake of economy—topics which are apparently beneath the dignity of the conception and the attention of the old school of cabinets and diplomatists.

To illustrate this subject of German unity, which, in the military point of view only, is so offensive to France—suppose Scotland were even now a separate kingdom, and every Scotchman were a foreigner, and not allowed to leave his own kingdom or to enter this country without a passport; and, as was the case a short time ago in Germany, was not allowed to cross the border without having his trunk searched by a custom-house officer; and as an alien was not allowed to engage in professional pursuits in England, or to officer or to command armies, or to preside over the government of India; and Scotland being not much less than Bavaria, it were to have to maintain an army of some hundred thousand men at its own cost; and that there must be a king of Scotland, of course with a civil list like the king of Bavaria, of about a quarter of a million, and a ministerial and diplomatic service costing more than half a million? Suppose, too, on the other side, that Wales were really a separate kingdom, with its independent monarch, like the Grand Duchy of Baden, with its separate army to be kept up of 20,000 men, and its ambassadors to the English government, to France and Germany, and to foreign States, and its separate expenditure of two or three millions—all grand and sacred to office-bearers, and the theme of bardic song—but grievous to tax-bearers whose means were so absorbed. If we imagine that Ireland, too, had what the repealers profess to look back to and deplore, its independent government, and of course its own army, not less than that of Bavaria, and its king of the sort celebrated in song, we may imagine the work that would be provided for standing armies, and the work that would be given to diplomacy. Very much as we of these islands would be, under such conditions of separate nationalities before they were in great part removed by "British unity," Germany more or less was before the Bund as to customs' regulations, and now very much is, and it is now the real object of German unity that such conditions may remain no longer. The war of France "for civilisation and liberty," as the Emperor phrased it, was a war very much for the maintenance of German disunity, and conditions of excessive expense and weakness, obstructive to civic and economic progress, from which obstructions the German people seek to be relieved. Their objects for unity are not ideal, but real, concrete, and weighty, and they therefore fight with a common and hearty will for unity, against the interference of France with their national development.

On the economic question, there is a large and impartial public opinion which should not be overlooked—the opinion in the economical interests of capital and its productive application—that of the money markets. When the standing army of France advanced, with its promise of a career of progress in civilisation and liberty, the funds of its own Bourse and every other money market in Europe had a ruinous fall. When the German national armies were victorious, the funds that represent opinion in all the markets of Europe rose and were restored. Will they be shaken if material and territorial securities be exacted? Would they not rise with the downfall of standing armies?

BRITISH ASSOCIATION.

Among the papers read in the various sections were the following:—

Steam Boiler Explosions.—Mr. L. E. Fletcher read the report of the committee "On Steam-boiler Explosions," composed of Sir W. Fairbairn, Sir J. Whitworth, Messrs. J. Penn, F. J. Bramwell, H. Mason, S. Rigby, T. Schofield, C. F. Beyer, T. Webster, and L. E. Fletcher. It appeared from the report that an average of 50 explosions occurred in the year, killing about 75 persons, and injuring about as many more. Experience had confirmed the committee's opinion that explosions were not accidental, that they were not mysterious, that

they arose from the simplest causes, and that they might be prevented by the exercise of common knowledge and common care. Having reviewed the various schemes of legislation as to explosions, the committee decidedly inclined to the plan of enforcing inspection by law, rather than indirectly by penalty; and they believed the time had arrived when the government should enforce the periodical inspection of all steam-boilers.

On Air Pollution from Chemical Works.—Mr. L. E. Fletcher proposed that in places where complaints were made against manufacturers by farmers, as to damage to their crops by corrosive smoke, to let the district be called "a manfacturing district," upon the requisition of a certain number of inhabitants. To such district an inspector should then be appointed, who should have power at any time to ascertain the nature and amount of the gases escaping from the various works. At the end of each month, or a longer period, the inspector should publish a list of all the works in his district, with a number indicating the average amount of acid vapour he had found upon his visits. There the inspector's duties should terminate, as he should be neither prosecutor nor judge, but merely publish the facts he ascertained, which the farmer himself could never have gathered. Hitherto legislation had been partial; there was at present an Alkali Act, but it regulated the alkali manufacture only.

Pneumatic Dispatch.—Mr. Robert Sabine, after giving the result of investigations into the motions of bodies through tubes for this purpose, and the formulæ which he had arrived at, said that these would show that small pneumatic tubes could be worked more advantageously than large ones. The great convenience of and practical facilities for working small letter-carrying tubes have been amply proved by the extensive systems already laid down in Paris, Berlin, London, and in other towns, as adjuncts to the telegraph services. Tubes of somewhat larger diameter, such as those proposed some years ago by Mr. E. A. Cowper for the more speedy distribution of metropolitan letters to the branch post-offices, would undoubtedly work satisfactorily. Even still larger tubes, if of moderate lengths, might also be found useful for a variety of special applications, for instance, in the transport of light materials between the different parts of a factory supplied with steam power. He did not believe that a pneumatic line working through a long tunnel could, for passenger traffic, ever compete in point of economy with locomotive railways. A pneumatic railway is essentially a rope railway. Its rope is elastic, it is true, but it is not light. Every yard run of it, in a tunnel large enough to carry passengers, would weigh more than $\frac{1}{4}$ cwt. And it is a rope, too, which has to be moved against considerable friction; and in being compressed and moved wastes power by its liberation of heat. In a pneumatic tunnel such as that proposed between England and France, in order to move a goods train of 250 tons through at the rate of 25 miles an hour, it would be necessary to employ simultaneously a pressure of $1\frac{1}{2}$ lb. per square inch at one end, and a vacuum of $1\frac{1}{2}$ lb. per square inch at the other. The mechanical effect obtained with these combined—pressure and vacuum—would be consumed as follows:—

In accelerating the air ..	29	millions of foot-pounds.
In accelerating the train	12	
By friction of the air ..	5721	
By friction of the train..	330	

The resistance of the air, therefore, upon the walls of the tunnel would alone amount to 93 per cent. of the total mechanical effect employable for the transmission; while the really useful work would be only about $5\frac{1}{2}$ per cent. of it. And to compress and exhaust the air to supply the above items of expenditure of mechanical effect, engines would have to exert over 2,000 horse-power at each end during the transmission, even on the supposition that the blowing machinery returned an equivalent of mechanical effect such as has never yet been obtained. This would not be an economical way of burning coals. It is desirable, nevertheless, from an engineering point of view, that the merits and demerits of pneumatic parcels lines and pneumatic passenger lines, which have been repeatedly suggested during the past half-century, should be thoroughly investigated. The works of the Pneumatic Company in London, which are approaching completion, will happily settle the question as regards parcels tubes; whilst the pneumatic passenger railway, which he was told is in rapid course of construction under the streets of New York, will very soon either inaugurate a new era for city railways, or be written in the long list of unsuccessful experiments.

Breech-Loading Rifles.—Mr. W. P. Marshall stated that more than five years had elapsed since a government commission reported unanimously in favour of arming the whole British infantry with breech-loading guns, and in 1865 a government advertisement invited patterns for the proposed arm. A committee of investigation examined these patterns, and, at the end of 1868, they recommended the adoption of the Martini breech mechanism, with the Henry rifling, and the Boxer ammunition. The breech-closing arrangements in this combination were considered by practical men to be mechanically defective, although the bore of the barrel, the turn of the rifling, and the weight of the projectile gave the best results as regards accuracy, trajectory, penetration, and rapidity of fire. The principle of the falling-block in the breech-action, which was a previous American invention, was generally admitted to be the best that had been suggested, and so far the arm justifies the decision of the committee. The faults said to exist in it were in the spiral striking spring, the lock arrangements, the lever, the stocking, and the ammunition. All these were said to be so defective in principle, that they could not answer when made in large quantities, although a few rifles might be so made that no great fault should be detected in a limited trial while the arms were new. It was considered, however, that to adopt such a rifle would not be a mechanical credit to the country. Since the end of 1868, the committee has been endeavouring to perfect the arm, and several patterns of it have been made at Enfield, but it still retains its inherent defects and objectionable features. The points at issue with regard to the mechanical construction of the two arms had been submitted to some of the most eminent engineers (Mr. Hick, M.P., Mr. Penn, Mr. Barlow, and Mr. Greenwood), in the form of six questions about the relative mechanical merits of rifle A and rifle B, the former being a Martini-Henry, and the latter a Westley-Richards. The questions were as follows:—"On comparing A and B, which of the two breech mechanisms do you consider is constructed on the best mechanical principles, and best adapted to perform the work required of it? No. 1. Which is the best position for the lever used for elevating and depressing the block, and also for holding it in position? No. 2. Which is the best arrangement for imparting the blow required to ignite the percussion cap? No. 3. Which form of spring do you consider most likely to retain its power, with the least liability to deterioration? No. 4. Which is the best position of the sear and pin upon which it turns to make a well-shaped bent in the tumbler, by which a steady and uniform pull can be obtained, so necessary in a rifle arm? Which shaped bent is best adapted to resist wear, and to keep to the weight it was originally made? The weight of the mainspring must be considered a very important element in the work which the sear nose will have to perform. It must be borne in mind that the bent and sear nose in these arms will have much more wear and tear than the top bent in an old gun-lock on the muzzle-loading principle. No. 5. Which is the simplest and most serviceable arrangement of bolt for supplying the place of half-cock in an ordinary gun? No. 6. Which is the strongest and best mode of stocking? On every one of these points all the engineers who were

consulted assigned the palm of superior merit to B, and that without any doubt or hesitation." Messrs. Penn, Barlow, and Greenwood make a joint report, simply answering the questions and stating the reasons for their opinions; but Mr. Hicks reports separately, and has appended the following rider to his answers:—"In conclusion, I beg to remark that, although in the hands of an ordinary user of the weapon A, much inferiority of action would not at first be felt, it is so liable to deterioration and change in power to cock and discharge, as to lead to serious inconvenience in a very short time, even if it did not become altogether useless. Whereas in B, the general mechanical arrangement and application of the various parts are so far superior, and the liability to derangement so remote, that I cannot conceive any competent judges disagreeing on the subject." Having stated these facts, the author went on to argue that as the two kinds of rifle appeared to admit of equally safe and expeditious handling, and to be of equal shooting power, the question between them resolved itself into one of mechanical construction. The military members of the committee had done their work well, the distinctive military requirements were satisfied by either weapon, and accuracy of shooting had probably reached its limit. What was now wanted was a fresh and independent committee, containing some experienced mechanical engineers, for the purpose of determining points of mechanism only. There was, however, another question of almost equal importance, and that was the question of ammunition. The first pattern of Boxer cartridge recommended by the committee had been withdrawn, and another, that was no better, had been substituted for it. This had the great fault of having a case larger than was required to contain the proper charge; and the common solid brass cartridge case, now in general use in America and other countries, would in many respects be preferable to it, especially because it can be readily obtained in large quantities; because its adoption would leave the chamber of the rifle of a minimum size, capable of being made larger if need should arise, and because the cases can be filled over and over again, and their use would thus be a source of great pecuniary saving to volunteers.

The Utilisation of Fibrous Cotton Seed.—Mr. Thomas Rose read a paper "On the Utilisation of Fibrous Cotton-seed." He said, in the present utilitarian age, not a few would be astonished to hear that a vegetable production which should be valuable is wasted, not merely by hundreds and thousands but by millions of tons. He referred to the fibrous cotton-seed, and the extent of the waste was conveyed with the knowledge that for every pound of cotton picked there were three pounds of seed grown; and its magnitude was even more apparent when they remembered that there was raised last year in America alone cotton to the extent of 3,000,000 bales. Taking an average of five bales to the ton, this would give no less than 1,800,000 tons of seed. From this deduct the quantity needed by planters, and there still remained a million and a-half tons available, and which had hitherto been of little value, lying for the most part where it was ginned to rot and spoil. This seed was composed of 50 per cent. kernel, which would yield about one-third oil and 50 per cent. husk (*i.e.*, shell with fibre adhering), and upon which fibre existed in the same relative proportion to the shell as the oil bore to the kernel. From this they gathered that the seed, now all but wasted, would produce no less than 250,000 tons of pure cotton, 250,000 tons of oil, and 500,000 tons of cattle-cake, the pecuniary loss to the community reaching twenty millions sterling. To show how the seed could be rendered available, he showed that the kernel was useful for obtaining oil, and the husk could be sent to the paper-mill, where it underwent a treatment by which the cotton was completely eliminated without injury to the delicate fibre, leaving it in such a condition that it formed a valuable material for paper-making, or other purpose to which cotton of short staple was suited. Now that all paper-making materials were so dear, and supplies of Esparto grass were failing and uncertain in quality, it was important to know that not only was there cotton-seed fibre procurable equal to present or prospective wants, but that the cotton—from which the plant was cultivated—was of such great value that it could afford the heaviest cost of production without any fear of checking supplies; and there was still further security in the fact that cotton could never be grown without yielding two or three times its weight in seed. The reader afterwards went on to show how the kernel could be made to yield oil and a nutritious food for cattle in great quantities.

The Scottish Gold Fields.—This was the subject of a paper read by Dr. Bryce of Glasgow. He said that, up to the time of his visit in July last year, the source of the gold of the alluvial workings of Sutherland had not been determined. Many of the miners had been at other diggings, where the gold occurred in quartz reefs, and accordingly their search was constantly directed to the discovery of such reefs, but without success. In none of the accounts which had been published was there any indication of the origin of the gold. He (Dr. Bryce) had directed his attention mainly to the elucidation of this point, and he found that the banks of the Suisgill Burn consisted of alternating beds of coarse whitish granite, and a highly crystalline mica slate. On crushing the granite and washing the sand, grains of gold were found in every specimen. A similar result came about on crushing and washing specimens of the mica slate, but the gold was less abundant, and was absent from several of the specimens examined. Early in last winter, gold grains were found in considerable quantity in the alluvia of Erricht and Nairn rivers, towards their mouths, and were soon after detected at various points far up the channels of these streams. During the present summer, he had examined the upper valleys of these streams, and found them to consist of granite metamorphic slates. He was accompanied by Mr. M'Gillivray, of Inverness, who had had much experience in gold-washing, and they had found a similar granite to that of Sutherland, and in this granite gold was found in considerable quantity.

England's Preparedness for Invasion.—The president of the Mechanical Science Section, Mr. C. B. Vignoles, after indicating the principal topics which were likely to come under discussion in that section, referred particularly to the position of England in reference to its means and preparedness for military defence, and as to the efficiency or non-efficiency of the military services of England. He would probably be disabusing the minds of many persons who had supposed that the government of this country was not prepared, or was not alive to the necessity of creating the best means of internal communication, in the event of war or of invasion of the country, when he stated that for several years past the military authorities had been in constant communication with the chief engineers of the country, and had formed deliberate arrangements by which, in the event of such casuality as a military invasion of England, the military force of the whole country, say 100,000 men, might be brought down upon any given point of assault within forty-eight hours. He quoted from Mr. Kinglake's "History of the Invasion of the Crimea," to show that, under the most favourable conditions of landing troops and munitions on an enemy's soil, it took in that case five September days to land, unopposed, 26,000 infantry, 1,000 cavalry, and 60 guns; so that not more than 5,000 or 6,000 soldiers could be landed in one day, even when unopposed. Hence we might feel reassured as to our position in the case of an invasion of England. As an old soldier himself, he had, at the request of the government, treated this question, and had demonstrated in the most complete manner that, within twelve hours of the alarm of invasion at any given point, the rolling stock of the railways could be applied for concentrating all the military resources of the country upon the endangered

Point. He had stated in Liverpool, forty-one years ago, that the institution of railways would have this very result, and it had been practically exemplified in the war on the Continent.

Action of Lightning on Telegraphs.—Mr. S. A. Varley read a paper "On the Mode of Action of Lightning on Telegraphs, and on a New Method of Constructing Telegraph Coils." Lightning protectors were very generally adopted in the early days of telegraphy, but subsequently were practically abandoned, as they were found not to save the coils, or only exceptionally. When storms occurred in the neighbourhood of telegraph circuits, powerful electric currents were often induced in the telegraph wires, which in some cases might be strong enough to fuse the coils, but which more often demagnetised or reversed the magnetism of the magnetic needles inside the coils. The interruption which lightning caused on telegraph circuits was more important than the destruction it caused to the apparatus. Needle telegraphs were very generally employed by railways, on account of their simplicity, and communication on railways was consequently liable to serious interruptions when storms occurred. In 1866, the writer introduced instruments which he believed to fulfil most of the conditions of an efficient instrument, and gave the result of direct experiments with electricity of tensions varying from 12 to 700 cells of Daniell's battery, which had furnished the data from which he had designed his lightning-bridge. The construction of the lightning-bridge, which consisted of two metallic-pointed conductors, approaching to within one-eighteenth of an inch, and surrounded with a mixture of conducting and non-conducting matters in a minute state of division, was then described. The action of the lightning-bridge, placed in a circuit struck by lightning, was next described; the lightning found in its direct path a bridge of conducting particles in very close proximity to one another, which were connected under the influence of the discharge, and the matter, rendered highly incandescent, offered a very free passage to the secondary current developed by the demagnetisation. There are upwards of 1,000 of these bridges doing daily duty in this country alone, and not a single case of a coil being fused when protected by them has occurred. The change in the administration of the telegraphs had been inaugurated by the adoption of induced magnets for needle telegraphs, and, consequently, a great impulse has been given to their introduction. This form of coil had been adopted by the government.

On the Duties of the Government of India and of the Merchants of England in promoting Production in India.—Mr. George Campbell, LL.D., read a paper, in which he said that he fully recognised that it was the duty of the government in India, and of the collectors and other officers, to promote the productions of the soil in India by every means in their power. The point to be aimed at was not so much an increase in the area of production as in the productive powers of a given area. In India, the government was the great head landlord, and the collectors were the agents of the great state landlord, and ought to perform a landlord's duties. They had created native landlords, but to suppose that they would perform the duties of a landlord was one of the anachronisms which we English were apt to cling to in the face of fact. The farmers—the ryots—were, in truth, good farmers, but they were all on a small and humble scale, and they had not the education or information to enable them to adopt scientific improvements. He believed it to be wholly and absolutely incorrect to represent them as too conservative to improve. Show them the means of raising better crops, and they would readily adopt them. It was, in his opinion, the duty of the collector of a district to promote agricultural improvements in every way in his power. All that government had been able to do was to facilitate traffic. The secret of improving our Indian cotton cultivation had not been discovered. Government had sent out practical Scotch gardeners, but he doubted if they would have any brilliant success. In his opinion, government made a great mistake in ceasing to maintain a special college for the education of the Indian civil servants. The present examinations were a mistake; the young men were crammed as for a special examination, and had very little practical knowledge. He especially referred to their ignorance of arithmetic. India, too, was too much overridden by the legal system. It was not enough to administer India by a rigid system of law. The Indian civil servants should be more trained for executive government, with a knowledge of agriculture; he even hinted at a department of agriculture in India. He would also advocate improved security of tenure in India, especially in the newly settled districts, many of which were best for agriculture, and which would lead to their development. As to the management of the natives, they were much more easily led than driven.

THE PATENT LAWS.

The following extracts are from a paper read by Mr. W. Lloyd Wise, at a meeting of the Society of Engineers, on the 2nd of May, 1870.

Mr. Wise, having explained concisely the origin and principles of patents for inventions, and noticed some of the objections to them, proposed the following suggestions for the amendment of the patent laws:—

In his opinion, the first cost of letters patent should be reduced to the greatest practicable extent; and there should be a preliminary examination as to novelty, but not as to utility; no patent should be sealed out of its order, and the complete specification should be deposited, and abridgments published, before the sealing of the patent, so that others may know what the applicant proposes to secure, and if any one has previously done the same thing in a public manner, or has been robbed of the invention by the applicant, and can satisfactorily prove that such is the case by the corroborative testimony of respectable witnesses, then the patent should not be granted.

The revenue of the Patent-office might be adjusted so as to make it self-supporting, and in the highest degree efficient, without realising a large annual surplus, as at present, and the bulk of the charges for a patent could be levied say in seven years from its date, when the inventor may be expected to have realised something from his invention. If patents were granted for, say, seven years for a nominal sum, and made subject to a payment of £100, as at present, before expiration of the seventh year, then inventors with moderate means would stand a fair chance at the outset. Even admitting that cheap patents might give rise to some abuses, the good accruing to the public would still more than outweigh the evils.

Every applicant for letters-patent should be compelled, in his provisional specification, to define in precise language the claim or claims to novelty upon which he intends to rely. This would operate as a check against his afterwards appropriating, in his complete specification, any part of any invention forming the subject of a subsequent application for letters-patent by another person.

All applications for letters patent, instead of being referred to the Attorney-General and Solicitor-General, as at present, should be submitted to an acting commissioner, whose official duties should be restricted to the consideration of applications, the appointment of arbitrators, and the examination of specifications, and who should be assisted by an efficient staff of examiners.

The commissioner, when considering a provisional specification, should have authority to require explanations, as at present, so that he may understand what it is proposed to secure, and he should be empowered to reject the application, if he considers the invention wanting in novelty, of course giving the applicant a clear reference

to the prior specification, or other publication upon which his rejection is based. The applicant should have the right of appeal to arbitration, the commissioner appointing one arbitrator, and the applicant another, who might be a barrister, patent-agent, or other suitable person. The arbitrators should then select an umpire, and the finding of these gentlemen should be submitted by the commissioner to her Majesty, as his final recommendation in the matter of the petition.

Any applicant who neglected to appoint an arbitrator within a given time should be taken to have abandoned his application; whilst in the event of the arbitrators in any case being unable to agree upon an umpire, then one should be nominated by the judges and assessors of a special court, which should be appointed for the trial of patent cases, as long since proposed.

Every notice to proceed should be published, and considered in the order of its number, and every complete specification filed at the time of giving notice to proceed, the distinct statement of the claim in the provisional specification being, as already explained, a check upon the appropriation in the final specification of the invention of any subsequent applicant who may have it published on the faith of his provisional protection. Upon the filing of the complete specification, the acting commissioner should consider whether it fully describes the invention, and whether it exceeds the ground covered by the provisional specification, and should order such additions to, and modification in the language of the specification as may seem expedient, with right of appeal by the applicant to arbitration as before. Furthermore, it is proposed that woodcuts should be prepared, on a small scale, and somewhat similar in character to the illustrations contained in the American abridgments, and that electrotypes should be furnished, with claims, &c., to the leading scientific papers, in which, by arrangement, every notice to proceed, and illustrated claim, should be published in its order. This publication should be additional to a like publication in the *Commissioners of Patents Journal*, and possibly also in the *London Gazette*.

By this arrangement any person who had been doing the same thing before, in a practical and public manner, without a patent, would have fair notice, and could avoid future litigation by at once coming forward and proving his case in a simple and inexpensive manner. Cases of opposition might be decided by arbitration, one arbitrator being appointed by each party, and the arbitrators nominating an umpire as before, with final appeal to the patent court.

A register, containing the names of barristers, engineers, and other competent persons willing to act as arbitrators, might be kept at the Patent Office, and a proper scale of fees arranged for their remuneration.

The foregoing suggestions, if carried out in conjunction with more complete indexes and records at the Patent Office; official reports of all cases tried in the Patent Court; the granting of special titles, as "Counsel of the Patent Court" to any barristers who might pass an appropriate technical examination by a competent authority (without, however, restricting the right of other barristers to practise in the Patent Court); more accurate definition of the various issues to be tried in every patent case; and an official registration of all patent agents, would, the writer believes, be found to obviate those evils which patentees and the public have just cause to complain of in the present working of the patent laws.

EDUCATIONAL NOTES.

Both the League and the Union still show signs of life. The objects—in addition to those in the original programme—for which the organization of the former body is to be still carried on, have recently been decided upon, and are as follows:—"1. To assist in putting the Education Act in operation, so as to secure, as far possible, the establishment of unsectarian, compulsory, and free schools. 2. To promote amendments in the Education Act, by converting the permissive into obligatory clauses, and securing the recognition of the principle of equality in rate-aided schools. 3. To resist the increase of Parliamentary grants to sectarian schools. 4. To watch the progress of educational legislation in reference to the Irish system. 5. To influence public and Parliamentary opinion by meetings, publications, petitions, and all other available means, in favour of a national, unsectarian, compulsory, and free system of education; and, with this view, to secure the return of members to the House of Commons pledged to support the principles advocated by the League.

The issue of this manifesto appears to have stirred the rival organization into action, for, at a meeting of the Central Executive Committee of the Union, it was resolved that, considering the position of the Union, the work remaining to be done, and the threatened attitude recently assumed by the League as to the continuance of their agitation and the re-opening of the discussion in Parliament next session, it is in the highest degree imprudent and unjustifiable to dissolve the organization; but, on the contrary, all the friends of religious education should be urged to continue their most vigorous support to the Union. It is proposed that the annual meeting be held in the Town-hall, Manchester, on the 3rd of November, and that Mr. Hugh Birley, M.P., be recommended for election as chairman during the ensuing year. The objects of the Union are now stated to be:—1. To secure the primary education of every child on principles of morality and religion, and to initiate proceedings for the election of School Boards. 2. To counteract the efforts of the Birmingham League and others advocating secular training only, the secularization of our national institutions, and the withdrawal of the annual Parliamentary grant from existing denominational schools. 3. To watch over and protect the interests of existing and future voluntary and national schools, and to thwart the attempts of those who have threatened continued action against the annual Parliamentary grant. 4. To form a union of all school managers. 5. To afford the best and most reliable advice and counsel as to the legal course to be followed under the many contingencies that will arise in connection with the working of the Elementary Education Act, 1870. 6. To circulate reports, pamphlets, and general information on the education question, and to promote meetings and lectures in the various centres of population. 7. To secure the return as members of Parliament of those who are friends of religious education.

In reply to a letter from the Worcester Diocesan Board, with reference to the 5th section of the Act, in which inquiries are made, (1) as to the school provision that will be required for any particular district; (2) as to the accommodation that will be afforded by any particular school; and (3) the superficial or cubical area that will be accepted as sufficient for any child or number of children, Sir Francis Sandford states that no definite answer can be given at present. He says:—"The first point can be determined only when my Lords receive the returns to be made by the local authority of the district, on or before the 31st of December, 1870, and the report of an inspector who may, if necessary, subsequently visit the district. The second point will, in like manner, be determined upon the report of an inspector upon the particular school in question. The capacity of a schoolroom and the number of children it can accommodate depend, not merely upon its area, but also on its shape, on the nature and arrangement of the school furniture, and on the positions of the doors and fireplaces. As regards the third point, Article 51 (*a*) of the Revised Code, prescribes that no school shall receive annual aid

unless it is 'held in a building certified by the inspector to be healthy, properly lighted, drained and ventilated, supplied with offices, and containing in the principal schoolroom at least 80 cubical feet of internal space for each child in average attendance.'" Sir Francis goes on to explain, however, that cubical space does not supersede the consideration of area, and observes that "it is rarely found in practice that a school can be efficiently worked with less than eight square feet per child of area in the main room and class rooms."

Some very useful hints upon these points, and upon the probable working of the Act generally, are given in a letter which will be found at page 871 of the present *Journal.*

Professor Huxley, President of the British Association for the present year, having been invited to preside at the opening of the tenth session of the Liverpool School of Science, referred in his address to the government system of scientific instruction. Having been one of the examiners under that system, he mentioned that there were, in the month of May of last year, sent up to him in his department alone between 2,000 and 3,000 sets of papers, worked for the most part by the boys and young people who go to the primary schools, and out of that immense number were a great many papers which showed that the schoolmasters had not yet understood their duty in this matter, because they seemed to think that science is to be taught by mere book-learning alone. As time goes on, however, he hoped that we should have such a system at work as that there shall be no place in this country in which the primary school shall not possess the means of giving the elements of a sound scientific instruction to every child. There yet remained one branch of scientific instruction to be added, and that was political economy, the addition of which to the government system he strongly urged. It was perfectly possible to instil into the minds of boys and girls of 14 or 15 years of age ideas which would render them infinitely more valuable in communities like ours—especially in the present circumstances, when most important questions might have to be decided by the popular vote. It seemed to him that the State had a vital interest in the question of education, and not only so, but in providing that persons who have shown themselves possessed of distinguished ability should have an opportunity of rising; and he considered that this was met by the system of science examinations. If he had succeeded in putting the case to that audience as he desired to place it before them, he was sure that from that evening he would be able to appeal to that grand public spirit which had done so much to diminish the physical evils of this great town, not indeed to slacken those efforts, but to turn its attention also to the moral and intellectual evils, and to throw itself with the same heart and soul in that direction.

The Earl of Derby, who followed, spoke of the advantage of scientific teaching, especially in a vast commercial and industrial centre like Liverpool. "It is a great thing," said his Lordship, "for men whose business is amongst machinery to have opportunities for cheaply and easily studying steam. It is convenient, to say the least of it, for painters to know where to go to when they want to study theoretically and practically the nature and use of colours. It is not unimportant for artisans in many branches of business to make themselves thoroughly acquainted with the art of mechanical drawing. Mining and shipbuilding also have been mentioned as illustrations of matters in which theoretical study bears in a very direct and useful manner upon practice. I take it that a man or a lad learns more readily when the thing which he is reading has more obvious and direct connection with, and throws some light upon, the ordinary work of his life; and, on the other hand, I suppose a man works with more pleasure, that he puts his heart more thoroughly into what he is doing, when he is not labouring as a mere machine — when he is not merely taught that which he is to do by rule of thumb, but when he has an intelligent comprehension of what he is about, of what is the real meaning and scope of the process on which he is at work. Of course, as the world knows, you cannot have everything. Theory has its use apart from practice; work has its value, even though it is done ignorantly; but the most satisfactory result, as I am sure you will all feel, is obtained when it is possible that the thinking head and the working hand shall be combined in the same individual." With regard to the instruction of women, he expressed his gratification that they were freely admitted to the classes of that institution. He observed:—"The question of what branches of industrial occupation women are fitted to succeed in is one which, in my mind, can only be settled by actual experiment, but then the experiment ought to be fairly tried, and the result ought not to be prejudged. There is a very simple alternative in the matter. Any work of an industrial or scientific kind which women are fitted to do they ought not to be excluded from doing. Any work which they are not fit to do they will exclude themselves from doing, and the shutting out women from any work for which they feel or think themselves competent, or refusing them, if they desire it, the necessary training for that occupation—in effect, shutting them out, though only in an indirect manner—seems to me rather a mean and unworthy piece of policy."

THE EDUCATION ACT.

The following explanation of the probable action of the Education Department, in determining the school provision required for any district, has been taken from a private letter, written by a member of the Society, after a perusal of the forms and circulars hitherto issued by the Department:—

The main object of the Act is to secure that, throughout all England, there shall be within the reach of every child, who wishes to avail himself of it, an efficient and suitable school at which he can receive elementary instruction. As time goes on, he will probably have to make use of the school whether he wishes it or not, and therefore there must further be sufficient school accommodation for all our children.

"All England" is a wide word, and one may lose one's head in thinking "How is all this work to be done?" I had better, therefore, confine myself to one parish, and look at the children by hundreds instead of by millions.

The parish of A. B. contains 3,000 inhabitants. What does the Education Department mean to do with it, or to require from it? The Act says that the school provision for the parish must be—1, sufficient (in quantity); 2. efficient (in quality); and 3, suitable for the population. What is the meaning of these three terms? What will satisfy "My Lords" under each head?

1. The parish will apparently have *sufficient* schools if they provide room for one-sixth of the *entire* population. In some cases much less will be required, according to the circumstances of particular parishes. Leamington and Bethnal-green will not be measured by the same standard. Each parish must be dealt with by itself; and therefore in the returns, which are now being called for from the overseers of every parish, one of the questions asked is—What proportion of the population are of the class whose children will attend public elementary schools?

When this question is answered, and the answer confirmed by subsequent inquiry through an inspector, the number of children in the parish to be dealt with by the Department will be readily ascertained. We will assume, however, that our parish is one of the ordinary type; for 3,000 souls there must, therefore, be found school room for 500 children. Suppose that the overseers' return show that there are five schools in the parish—

1. A Church school, under inspection, and holding	150
2. A British school, also under inspection, for	100
3. A Roman Catholic school, not under inspection, for	100
4 and 5. Dames' schools, holding between them	50
	400

This gives school room for apparently 100 less than the school population. But all these schools may not be *efficient*. How will this be ascertained? As soon as possible after the local returns are received, an inspector (see section 71 of the Act) will probably visit the parish. Schools 1 and 2, being already in receipt of grants, will, it may be presumed, be recognised without further inquiry as efficient; and, if they accept a conscience clause, will be classed as public elementary schools. The inspector will therefore confine his attention to the other schools. He may find that, if certain changes or improvements are made, No. 3 will come up to the standard of efficiency, and he may be able to report to the same effect of No. 4; but No. 5 he may find deficient in every respect; in buildings; in the capacity of the teacher; and in the standard of instruction among the scholars.

The result of his visit to the parish will probably be a notice from the Department that schools 1 and 2 are recognised as efficient, that schools 3 and 4 will be so regarded if certain improvements are made in them; but that No. 5 cannot be recognised as forming part of the national or parochial system. That is to say, the supply recognised, either absolutely or provisionally, will be sufficient for 375 scholars, and 125 will be the declared deficient. This deficiency will be advertised; six months will be given for voluntary effort to supply it; and if this is not done, then (but not till then) the Department will publish its ultimatum, and will cause a school board to be elected by the ratepayers, whose duty it will be at once to provide a school for 125 children. That, I fancy, is how sufficient schools will be found.

But what about their *efficiency?*

2. It will, of course, take a long time to make these inquiries, and reports, and decisions, for every parish in England. While they are going on, the number of certificated teachers will be increasing; but till a much larger supply of such teachers is forthcoming, it is to be presumed that the Education Department (while insisting upon reasonably good buildings) will not exact too high a standard of instruction in a school as a condition of its being recognised as efficient, for the purposes of the Act.

"My Lords" have already stated that they do not intend the certificate to be dispensed with (though for teachers now acting its acquisition may be made more easy) as a condition of annual aid. But they have also stated that schools under uncertificated teachers (including dames) will be accepted as efficient, *i.e.*, if they came up to the standard which will be fixed by the new, or re-revised code.

A parish may thus have two classes of efficient schools:—

a. Public elementary schools, which will be in receipt of annual aid, and worked, under a strict time-table conscience-clause, by a certificated teacher.

b. Efficient schools (within the meaning of the Act), which will not have annual aid, either as being without a certificated teacher, or as refusing to accept the prescribed conscience clause.

Every school will be liable to periodical inspection; those of the former class, to entitle them to receive their grants; the latter to entitle them to remain on the list of efficient schools. As soon as a school falls below the requirements of this latter class, a board school may have to be established to supply its place. General compulsory inspection will, therefore, probably soon lead to the general fulfilment of the conditions of annual aid.

3. It remains to say a few words upon what is meant by *suitable* schools. This term also is explained by a circular from the Department.

The fees charged must be within the means of the children who are to be educated; and the minority in each parish, whether Churchmen or Dissenters, must be able, if they wish it, to receive secular instruction, with the protection of a conscience clause.

It is not meant that every school must admit all comers under such protection. That is required only in the case of schools which seek annual aid. But in every parish there must be some school or other under a conscience clause, within reasonable distance of the home of every child whose parent wishes him to have this protection. A parent cannot present his child to the teacher of any particular school, and demand his admission to the secular instruction alone given in the school, unless the school is in receipt of annual aid. The individual school may form part of the national system, and be recognised as efficient, without a conscience clause. But every parish must have an efficient school with a conscience clause within its borders, if there are none near enough in other parishes, which the children of the minority can attend; and in this school, or in these schools (if one is not large enough or near enough for the population) there must be efficient accommodation for all the children of the minority.

4. There is one other point on which I may add a few words; I allude to the proportion of the population for which schools must, as a rule, be provided.

The Education Department will apparently measure sufficiency by their present practice in regard to building grants, which are made for one-sixth of the *entire* population of a parish. In a parish, therefore, of (say) 700 souls they build for 116 children.

But only about six-sevenths of the population belong to the class who attend elementary schools, as they are now constituted. They build accordingly for 116 children to meet the wants of 600 of the labouring classes. This seems to be enough, for in every 100 of the population there are 18 between the ages of 5 and 13 (the compulsory age under the Act), and 23 between 3 and 13.

In our parish, therefore, which contains 600 poor, there will be 108 children from 5 to 13, and 138 from 3 to 13. A school for 116 will, consequently, be slightly in excess of the number of children from 5 to 13; but, as many children go to school below 5, it will be large enough to give $8\frac{4}{10}$ years of schooling out of its ten years of school life (3 to 13) to every poor child in the parish. This is, probably as much as will be wanted or realised, "either soon or syne."

CORRESPONDENCE.

INDUSTRIAL CLASSES IN TURKEY.

Sir,—The returns as to Turkey, at p. 854, are calculated to do great injustice to many very worthy people. First, it is to be observed that education is stated to be very imperfect. So far as the Greeks and Armenians are concerned, who form so large a proportion of the industrial classes in Constantinople and Smyrna, they have very good schools. Then, it is said, they are "well clothed, but not over clean." The population generally is not less cleanly than that of most European countries, and the Greeks are decidedly a clean people. "A separate house, never less than 25s. per month," applies, I suppose, chiefly to European artisans. The rent generally represents also an exemption from taxes, and includes the supply of water. Many Mussulman and Greek artisans are owners of their houses. I consider the working classes of Smyrna to be in a very fair condition in

ordinary times, and those of Constantinople also. What is meant by there being "no opening for the skill or enterprise of the labouring classes" I cannot understand, for I should say exactly the reverse, knowing that many Europeans, Turks, Greeks, and Armenians have set up new branches of business and establishments, and succeeded. The return states that there are 8,500 European artisans in Pera and Galata alone, all of whom are immigrants, and find employment, and some are making fortunes. So are many of the Greeks and Armenians, and some of the Jews, and there are Turks, Albanians, Arabs, Georgians, and others doing well.

One great reason for there being less scope for European workmen is, that Turkish, Armenian, and Greek workmen are ingenious enough to take up any new trade very soon, and to compete, by their local advantages, with the European.

Turkey is not London or Manchester, but the working classes in the places quoted are industrious, fairly treated, fed, clothed, and, if they like, taught; and they can save money, and do. The Turks have water laid on in their houses, they are cleanly in their closets, have cheap baths and washhouses, more drinking fountains in the streets than we have, and a sufficiency of public privies and urinals. Over a large part of Stamboul there are no places where spirits or wines are sold, as the people do not want them. There are numerous schools, where the "three R's" are taught to all classes, rich and poor, to boys and girls; and in cases where the children do not profit by them, it is because the parents undervalue education, and not because the communities neglect making a provision. There are no poor-rates, but the duty of charity has hitherto been well complied with by all, and each community maintains its own poor by endowments and voluntary contributions. The few beggars are allowed as a religious luxury, Mussulmans and Christians being fond of giving alms. Until lately, there has been no need for poor-rates, water-rates, school-rates, baths and washhouse rates, church-rates, or church clock-rates, as these are provided by bequest, gift, or voluntary contributions.

The new paving of a street or road, or repairs of paving, and the construction of a bridge, of water-works, or of street fountains, have likewise, in many cases, been provided by private munificence as acts of religion, Mussulman piety taking a very practical form. Hospitals and madhouses are provided by endowments. Orphan hospitals have not hitherto been wanted, as orphans have readily found protectors. The charity and public spirit of the Mussulmans have been emulated by the Armenians and Greeks, and an admirable example will be found in Smyrna alone in the churches, schools, and hospitals maintained by the Greek community, and which are as well deserving of approval now as they were when visited by Byron and Cam Hobhouse in 1808. The conduct of the Greek population, recruited from every part of the Levant, and the ready refuge of roughs and bad characters, is equally creditable to the Greek community and the Turkish government. The people are industrious and well-conducted. The amount of crime, chiefly committed by strangers, is small, and the numbers of the police are inconsiderable.

All these circumstances are to be taken into account in estimating the condition of the working man, nor must there be omitted a great degree of municipal liberty and of personal freedom, equal to that of England, and a free career for men of all classes and all sects.

I am, &c., HYDE CLARKE.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

GENERAL NOTES.

Hill Settlement in India.—An endeavour is now being made to extend the hill sanitarium system into English Burmah. For this purpose, Allanmyo is being surveyed as a sanitarium for the English at Thyetmyo, and it is not without the hope of superseding the latter place altogether as a military station.

Poisoned Milk.—The results of an investigation conducted by Dr. Thorne, and detailed in the recently-issued report of the medical officer of the Privy Council, has led Mr. Simon to affirm that the milk of cows suffering from foot-and-mouth disease ought not to be unrestrictedly sold for human consumption. It is well-known that during the prevalence of the above-named disease in cattle, a similar affection has often been observed in the human subject; but it has been difficult to trace the direct connection between the occurrence of the latter and the consumption of the milk of infected animals by man.

Whitworth Scholarships for 1870.—The award of the ten Whitworth Scholarships of £100 each, for the year 1870, has just been made to the undermentioned candidates:—To those examined as students—William Garnett, 19 years of age, student, London; James Taylor, 21, mechanic, Oldham; J. A. Griffiths, 22, engineer student, Middleton; H. W. M'Cann, 17, student, Liverpool; J. Perry, 20, engineer, Belfast. To those examined as workmen.—Edward Tompkins, 24, engineer and draughtsman, Manchester; William Dodgson, 25, mechanic, Manchester; Frank Salter, 21, mechanical engineer, Leamington; William S. Hall, 25, engineering draughtsman, Nottingham; Henry Dyer, 21, mechanical engineer, Glasgow.

Necessity for Foreign Cattle Markets.—Food supply is an imperial question, and the legislature ought to make such broad and general regulations on the subject as would benefit the nation as a whole, without contravening the principles of free trade. The home cattle and meat markets should be separated from the foreign; and special regulations should be made for the latter that are not required for the former. Such a separation would, in the end, be advantageous to both departments of this important trade. The home breeders, dealers, and salesmen are, on the whole, in favour of separate and distinct establishments; the foreign traders would be largely benefited by the increased accommodation for and development of their trade; and the public, always more or less afflicted by the dearness of meat, would gain immensely by a large supply, in better condition, and with improved arrangements for slaughter and distribution.—*Food Journal.*

The Paris Photographic Exhibition.—It is to be feared that the beautiful collection of pictures brought together in the French capital, and opened to the public on the 1st of May last, has been disturbed, and probably damaged to a considerable extent. The interior of the Palais de l'Industrie, in one of the vestibules of which the photographs were exhibited, has been hurriedly cleared out as far as possible, and converted into a gigantic hospital and store for medical requisites, the wife of Marshal Canrobert having organised in the building a central depot for the reception of linen, bandages, and hospital necessaries sent in from all parts of the country. The photographs, therefore, have probably shared the fate of the other art productions included in the exhibition of fine arts which was opened at the same time as the photographic collection, and have been removed and put away in some out-of-the-way locality. Under these circumstances, exhibitors from this country must not be too sanguine of receiving back their show-frames intact or uninjured, but may, indeed, consider themselves fortunate if their property be returned to them under any conditions whatever.

Agriculture in New Zealand.—The *New Zealand Gazette*, published on Wednesday, July 13, states that the total number of acres under crop in 1870 was 900,504, as against 687,015 in 1869, thus showing an increase of 213,489. The number of acres was as follows in the different districts:—In Auckland, 142,996; in Taranaki, 24,714; in Wellington, 184,274¾; in Hawke's Bay, 51,946; in Nelson, 45,333½; in Marlborough, 24,003; in Canterbury, 217,527½; in Westland County, 1,030¾; in Otago, 172,003; and in Southland, 36,675½.

New Purifying Agent.—M. Marix has taken, in France, a patent for the application of fluosilicic acid for the purifying of beetroot and other saccharine juices. The saccharine juices are first diluted with a sufficient quantity of water, to take away the viscosity of these fluids, sufficient fluosilicic acid is then added to precipitate all the potassium salts present; and next, chalk is added to saturate any excess of the acid. The fluid is then filtered, in order to obtain a clear liquid, and this is afterwards treated in the usual manner.

Owens College.—The foundation-stone of the new buildings for Owens College, Manchester, was laid on Friday, the 23rd inst., by the Duke of Devonshire, who has been appointed the first president. For this extension of the college a sum of £102,000 has been raised in Manchester during the past two years, of which £67,000 is available for the building. Accommodation will be provided for about 800 or 1,000 students. The Duke of Devonshire said that, if the object of the college should be fulfilled, it would be only a matter of time that Manchester should be as distinguished for her school of literature and science as she now was for being the great centre of industries. Professor Huxley afterwards spoke, and congratulated Manchester upon having helped herself without waiting upon government aid. He should, he said, most heartily like to see the example copied in every part of the kingdom. Professor Tyndall also addressed the meeting, and expressed his conviction that the future of Owens College would be a thoroughly great one.

Gingilie Oil.—The gingilie (*Sesamum indicum*) is said to be an African plant, and is supposed to have been introduced to the West Indies by the negroes. It is now pretty generally distributed, and in this country it thrives admirably in the Newera Kalawyia district. The plant is cultivated for the seed, which yields a fixed oil. The method adopted in Ceylon of expressing the oil is rather primitive, and consequently it possesses an unpleasant flavour, and a brown, muddy colour. If properly prepared, the oil would form a very good substitute for sweet oil. The best method of preparing the oil is as follows:—First, steep the seeds repeatedly in cold water, or boil them for a short time, till they are divested of the reddish brown colouring matter contained in the epidermis of the seeds; then, when the seeds have become perfectly white, dry them in the sun, and express the oil in the ordinary way. The seed yields from 40 to 44 per cent. of a pale, straw-coloured oil. When thus prepared, the oil is perfectly devoid of smell, and may be used for extracting the perfume of the jasmine, tuberose, camomile, and yellow rose. To effect this, one weight of the flowers should be added to three weights of the oil in a bottle, which should be corked and left in the sun for forty days, when the oil will be impregnated with the perfume of the flowers. The gingilie oil is soluble in alcohol, saponifies with alkalies, solidifies by nitric acid, and combines with the oxide of lead. The gingilie oil is highly esteemed by Egyptian belles for its properties of cleansing the skin, and of imparting to it a bloom and lustre, and also of preserving the beauty and gloss of the hair. In Ceylon, it is used for similar purposes. The negroes also use the seeds for making a sort of beverage something like coffee, by roasting the seeds and infusing them in water. The commercial value of the oil, in England, is £40 per ton.—*Jaffna News*.

Edible Fungi.—The experiment of holding a fungi exhibition proved so successful and interesting last year that the Council of the Royal Horticultural Society have resolved on repeating it, and announce a show of edible and poisonous fungi, to be held on Wednesday next, October 5, when the following prizes will be offered, viz.:—Collection of edible fungi, open, £2 and £1; collection of edible and poisonous fungi, arranged separately (prize offered by Mr. W. Wilson Saunders, F.R.S.), £5.

Failure of Beetroot.—There is great danger that a large proportion of the French production of beetroot sugar, estimated this year at quite 300,000 tons, will be lost. All depends upon the speedy conclusion of a peace, or at least upon such a localisation of the operations of war as to spare the northern departments from ravage, and to leave the rural population in uninterrupted pursuance of their usual labours in harvesting the roots and carrying on operations in the sugar works. We understand that the war has injuriously affected parties in this country who were taking a monetary interest in large beetroot sugar works which were to be established in England. The project, however, has only been delayed, not abandoned; and efforts are being resumed to get at least one large concern going, that the land may be prepared this autumn for the sowing of the beet next spring.—*Chamber of Agriculture Journal.*

Education in Scotland.—The report of Mr. D. Walker, assistant-inspector of factories, for the first half of the year 1870, states that, being in Glasgow, he examined 200 young persons, principally boys of 12 years old and upwards, employed in the tobacco manufactories of the city; they were selected at random, and proved a fair average of their class. Only 46, or 23 per cent., were able to read, and several of these read very imperfectly. It is right to add that many of the children employed in the tobacco manufactories in Scotland belong to "the Arab class," whose parents are either wilfully neglectful or have not the means of attending to their education. Others are orphans, left to provide for themselves in the best way they can. Mr. Walker says that "in Scotland the parochial authorities, generally speaking, do not take much interest in the education of the poor and orphan children; their great object appears to be to keep down the rates." Scotland wants her Education Bill.

Hemp Mowing Machine.—The following has been forwarded to the secretary of the Royal Agricultural Society of England, from the Austro-Hungarian ambassador, with a request to give it publicity:—"The Royal Hungarian Ministry for Agriculture, Commerce, and Industry proposes to award two prizes, of 100 ducats and 50 ducats, for the invention of a hemp mowing or cutting machine, under the following conditions—1. Mowing machines which cut the hemp as short as possible over the soil may compete, as well as plough-like instruments which cut it under the soil. 2. No models will be admitted. 3. The competing machines or instruments will be submitted to a trial on an ordinary hemp field, at a place and date to be fixed hereafter. The results will be examined and the prizes awarded by a committee composed of agriculturists and engineers. 4. The first prize can only be awarded to a thoroughly well-working and efficient machine or instrument. 5. The machines which obtain the prizes remain the property of the competitors." 6. The applications for the competition are to be made till June 1, 1871, to the Royal Hungarian Ministry of Agriculture, Industry, and Commerce at Pesth, to which also all inquiries relating to the details of the trial are to be addressed.—Pesth, August 13, 1870."

MEETINGS FOR THE ENSUING WEEK.

Mon.....Society of Engineers, 7½. Mr. Michael Scfi, "On the Theory of Screw Propulsion."

Journal of the Society of Arts.

FRIDAY, OCTOBER 7, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

THE LIBRARY.

The following works have been presented to the Library:—

A Rudimentary Manual of Architecture. By Thomas Mitchell. Presented by the publishers, Messrs.. Longmans, Green, and Co.

Dictionary of the Works of Painters. By Frederick Peter Seguier. Presented by the author.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

PROCEEDINGS OF INSTITUTIONS.

Birkbeck Literary and Scientific Institution, Southampton-buildings, Chancery-lane.—This institution has just issued its prospectus for the winter session. Arrangements have been made by which a complete course of technical instruction can be obtained. This will be most valuable for students preparing for the examinations for the Whitworth Exhibitions and Scholarships. The list of lectures and entertainments contains the names of several of the most eminent occupants of the platform, and a special course of lectures on the History of Art by Dr. G. G. Zerffi is announced. These will be illustrated by about 3,000 diagrams, plans, maps, and photographs. The library has been greatly improved by several purchases of valuable volumes, and the reading room is well supplied with current literature.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

Some observations on the special principles of the Annual International Exhibitions, for the information of her Majesty's consuls, have been issued by her Majesty's Commissioners for the Exhibition of 1851, in connection with the one to be held next year.

The special object of the exhibition is to exhibit selected specimens, and not anything that a manufacturer can produce, and it will thus be distinguished from previous exhibitions, in which allotments of space were made to manufacturers and others, who filled them as they thought fit. All objects must also be submitted for the inspection and approval of committees of selection.

The exhibitions will be distributed into four divisions, three of which—fine arts, scientific invention, and horticulture, will recur each year. In the other division different classes of manufactures will be included in turn each year, till every branch of industry has been represented.

In the fine art and scientific invention divisions, no object will be entitled to admission unless it be distinguished by some special quality, such as novelty, excellence, cheapness, etc.

In the several classes of manufactures, the goods will be distributed into a sufficient number of subdivisions to bring the different branches of each class together; so that similar productions from different countries and localities will be placed in immediate juxtaposition, in order to facilitate examination and comparison.

The circular also states what is very important to producers residing in countries which have not appointed a commission, that they may send their works direct to the Exhibition, to be submitted to the committees of selection appointed for the United Kingdom.

The Commissioners undertake to provide large glass cases, stands, fittings, &c., thus relieving exhibitors from what has been a source of great expense to them in previous exhibitions. All the objects exhibited will be under the special care of the officers of the Commission.

Reports will be published within a month after the opening of the exhibition, and will thus be rendered much more useful to both the public and the exhibitors. The reports in previous exhibitions were not published till towards their close. Prizes will not be awarded. The fact of selection will constitute a sufficient distinction, as nothing will be admitted unless it be remarkable for merit of some kind.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

The particulars of the fan competition have been announced by the Commissioners:—

Her Majesty the Queen has been graciously pleased to notify to Her Majesty's Commissioners her intention to offer a prize of £40 (1,000 francs) for the best fan exhibited in the International Exhibition of 1871, being either a work of painting or carving, or a combination of both, and executed by a female artist or artists under twenty-five years of age, subject to the conditions mentioned below. Mrs. Herbert Taylor offers a prize of £25 for the second best fan. The Lady Cornelia Guest and Baroness Meyer de Rothschild each offer a prize of £10 for the two fans next in the order of merit. These prizes will be awarded subject to the same conditions as those decided on by Her Majesty for the first prize.

Conditions of Competition.

1. The form, size, material, and mode of decoration of the front and back of the fan-mount, sticks, &c., are left to the judgment of the candidates, but the award will be determined by the artistic merit of the design, and its execution, rather than by the richness and variety of the material.

2. Fan-mounts without sticks, and decorative sticks without mounts, will be admissible for competition.

3. In the case of complete fans, the stick, as well as the mount, unless one of them be perfectly plain, must be the work of a qualified competitor, *i.e.*, of a female artist under twenty-five years of age; but mechanical assistance may be obtained in fitting them together.

4. Each fan, fan mount, or stick, must be accompanied

by a note written on one side of the paper only, and securely attached to the object, containing the name, address, and age of the artist or artists.

5. The fans, &c., will remain the property of the competitors. If, however, they are for sale, prices may be attached.

6. The commissioners of the respective countries must certify that the fans, &c., are the *bonâ-fide* productions of the competitors whose names are attached to them, and that the ages are correctly stated.

7. A prize awarded to the joint production of two or more artists will be paid to the first named in the note sent with it. A prize awarded to a married woman will be paid to her alone.

8. Prizes awarded to fans, &c., received through foreign commissions, will be paid to those commissions.

9. The awards will be made by an international jury, selected by the commissioners of the competing countries.

10. Competitors must be under twenty-five years of age on Friday, the 17th February, 1871, on which day the fans must be delivered at the exhibition building.

11. Any award made to a competitor who shall not be alive at the date of adjudication will be considered null and void.

Her Majesty's Commissioners, as already notified to the public, do not intend to award prizes to exhibitors. They will, however, afford every facility to societies and individuals desirous of offering prizes for the encouragement of art or industry in connexion with the Annual International Exhibitions; and are prepared to receive such offers, and to publish the conditions of competition which the donors may wish to prescribe.

NOTES ON THE MINERAL STATISTICS OF ITALY.

By Commendatore F. Giordano,

Inspector-in-Chief of the Corps of the Royal Mining Engineers.

The total annual value of the principal products of mineral origin which are extracted and worked in Italy with native materials, may be estimated at from 150 to 160 million francs. This estimate includes the ores of iron, copper, lead, zinc, and others, which are exported as such; the metals smelted in the country and worked up in various ways, such as iron, copper, lead, silver, and gold; sulphur, fossil-fuel, salt, various chemical products, marble, and various kinds of stone, porcelain, earthenware, stoneware, and all sorts of pottery, glassware, and, finally, the various cements and bricks. About 130,000 persons are employed in these works, and about 15,000 of them are concerned in actual underground mining.

Sulphur.—First of all, it must be said that, with the exception of about 10,000 tons of refined sulphur from the mines in the Romagna, all the sulphur comes from the Sicilian mines, and is exported unrefined. It represents a value, at the ports of embarkation on the island, of about 26,000,000 francs (about 120 francs per ton), without reckoning the export duty of 10 francs per ton, which adds about 2,000,000 francs a-year to the revenue, and is paid by the foreign purchasers.

The sulphur is principally exported to England, France, the United States, Austria, the Zollverein, &c., where it is used chiefly in the preparation of acids and alkalies, free from arsenic.

In Italy there are about 19,000 workmen dependent upon this industry, of whom 5,000 are miners, and the rest engaged upon the carriage of the stuff, or at the furnaces, or other accessory operations. Another 20,000 are engaged in carrying the stuff from the mines to the coast.

Much has been said about the enormous quantity of chemical products, and especially of soda, that might be made in Sicily, where salt and sulphur are cheap. It must be recollected, however, that in order to make such products, especially carbonate of soda, much coal is needed, and of this there are no traces, either in Sicily or other parts of Italy; that the consumption of soda in Italy is not great, especially of the finer varieties (in all, perhaps, 8,000 tons); that abroad, and especially in England, coal costs about one-fifth of what it costs here; that the pyrites sulphur costs about the half of ours; that the price of the salt extracted from foreign mines exceeds that of ours by a little; that the foreign works have long ago repaid their capital, whilst ours, which have yet to be created, would have to pay it under unfavourable conditions; that, lastly, the apprenticeship or novitiate in these branches of industry is a costly affair. This being the case, it is easy to see how many obstacles there are to the much-desired scheme. Our manufacturers, however, could try the affair if they could establish works near lignite mines.

Iron.—Italian iron, and the articles made from it, represent an annual value of 20,000,000 francs. Part of the ore is exported to works abroad, especially in France, and this ore is mainly derived from the Crown mines of Elba. The rest is smelted in sixteen blast furnaces, of no great size, nearly all in valleys of Lombardy, where wood abounds; others in the Tuscan Maremma, and two in the Aosta Valley.

The amount of cast-iron really made in Italy does not exceed 22,000 tons, which is very little for a country so rich in mines. The reason of this is plain. As proper coal for smelting is wanting, the quantity of iron is limited by the quantity of fuel that can be obtained from the few forests not too far from the mines.

For some time past there has been an increasing trade in working up old iron, rails, and other scrap, besides refining English pig mixed with Italian. In this manner an iron is produced equal in quality to the Italian cast-iron. This trade is very profitable, and promises well for the future. On the whole, the production from native material only reaches one-fifth of the annual consumption.

In 1863-65, the exports had risen to 100,000 tons, and might easily have been multiplied four-fold, when they diminished under the competition with new mines in Africa, which were aided by large capital, and had the advantage of economical and safe shipment in the port of Bona. The Elban mines, on the contrary, are altogether destitute of a port and means of shipment. In 1851, they were mortgaged by the Grand Ducal government as a guarantee for the loan of 10 million francs, and at the present time do not give enough profit to pay the interest. The mines are administered by a board which is interested in the concern, but it is so badly constituted that it leaves no hope for improvement. Reform is most urgently needed, so that Elba may henceforth be confided to the intelligent activity of private industry.

Mechanical Workshops.—As a natural complement of what has been said about iron, we may pass on to the manufactories of all sorts of machinery. With great and small, there are sixty in all in Italy, employing about 7,200 workmen as founders, furnacemen, fitters, &c. The annual product of these establishments is estimated at 24 million francs. In the 19 military establishments for the army and navy, there are about 7,000 workmen employed in metal work.

Copper.—The copper ore exported to England is rich, containing 12 to 20 per cent.. It is obtained from a few mines in Tuscany and Liguria, from rather irregular lodes. The poorer ores are generally smelted at the spot, as in the case of the Alpine mines of Ollomont and San Marcel, in the Val d'Aosta and Agordo mine in Venetia. Not more than 600 tons of copper are made in Italy, whilst the consumption, in kettles and various utensils, amounts to more than four times that quantity.

Lead and Zinc.—The ores of lead and zinc are almost exclusively the produce of Sardinian mines, which employ about 10,000 workmen, and represent an annual value at the port of embarkation of more than twelve million francs. The lead ore is more or less argen-

tiferous, but, on the whole, not highly so. The greater part of it is exported, and only about 16,000 tons are smelted, part at the three works in Sardinia, part at the Pertusola works near Spezia. This ore yields about 5,000 tons of argentiferous lead, from which rather more than 100,000 ounces of silver are extracted at the smelting works at Genoa. Bottino mine, near Serravezza, continues to produce some very argentiferous lead ore.

Zinc ore, carbonate, and silicate is now produced to the extent of about 60,000 tons annually, and is exported to Belgium and England. The ore came into the market only during the last few years, when the mines of Belgium and Rhenish Prussia seemed threatened with exhaustion.

Gold.—Gold is almost exclusively produced from veins of auriferous pyrites in the valleys of Monte Rosa. At one time the production fell very low, but of late years it has risen somewhat, since two English companies bought up many of the old mines, and improved the means of extraction. At the present time about 48 ozs. are extracted per day, or 14,000 ozs. a-year.

Other Metalliferous Ores.—Iron pyrites, produced in small quantities from the old mine of Brozzo, near Ivrea, serves for the manufacture of chemical products.

The production of manganese, antimony, mercury, and nickel is insignificant.

Fossil Fuel.—We have far too little coal. The anthracite of the Alps is small in amount and of very bad quality. We have several mines of lignite at Monte Massi, Monte Rufoli, and Val d'Arno, in Tuscany; at Sarzana, near the gulf of Spezia; at Monte Pulli, near Vicenza, and others less important in various points of the Apennines and Sardinia, which could furnish annually, and for several years to come, from 150,000 to 200,000 tons. But, for well-known reasons, they cannot compete with English coal. At the present time not more than 60,000 tons are sold.

Numerous basins of peat are found, especially along the foot of the Alps. It can be employed economically for various purposes, for instance, in the manufacture of iron. The present consumption is more than 100,000 tons yearly. It may be calculated that our peat basins, which cover 6,000 acres, still contain six to seven million tons of peat.

Fire-wood (57,000 tons) and charcoal (42,000 tons) are exported from our coasts, especially from Tuscany and Sardinia, to the value of more than 3,000,000 francs. They are both carried to Malta, Africa, and France, generally for domestic purposes; some is used in Corsica for metallurgical operations. On the other hand, there are imports of wood and charcoal from Istria and the Pontifical States which nearly equal the exports.

The Pescara valley seems very rich in natural asphalt, which is used for pavements. About 700 tons of it are produced yearly.

Common Salt.—With this article of prime necessity Italy is abundantly supplied, not only from the vast salterns of Cagliari, Trapani, Barcetta, Comacchio e Cervia, but also from its rich mines of rock salt of Sicily and Calabria. Besides what is consumed in Italy, salt is exported to Sweden and America.

Other Salts, Acids, and Chemical Products.—Boracic acid, that singular product from gaseous emanations in the Tuscan Maremma, is exported to the amount of 1,600 tons yearly, and mainly to England.

Our chemical products of mineral origin are of no great importance, and consist in a little alum from Montioni and Pozzuoli; of sulphuric, nitric, and hydrochloric acids, and small quantities of sulphate and carbonate of soda from Milan, Naples, and Rimini; of sulphate of iron and of copper from works at Turin, Agardo, Milan, &c.; of white lead from the coast of Liguria, and of other minor products. In all, they amount to 12,000 tons of the value of about five millions of francs.

The granite from the Lago Maggiore, and the products of numerous other quarries of building and ornamental stones in the Alps and Apennines, and the working up of these materials, represent a value of 11 millions of francs. Quite two-fifths of this sum are due to exports. Finally, exports are made to the value of about two million francs in coloured earths, whet-stones, and other minor products.

Glass.—This industry is now reduced in Italy to a few manufactories of bottles, window glass, and other common glass. There are glass works in Piedmont, on the Lombard Lakes, at Verona, Venice, Colle, in Tuscany, Naples, &c. Large pieces, such as large panes for shop fronts and large mirrors, the best and second best flint glass, come from abroad, costing us about 8½ millions of francs.

Pottery.—Porcelain is made in Italy almost exclusively at Milan and Florence, at the two manufactories of Ginori and Richard, which are obliged, however, to import nearly all the kaolin which they require. The kaolin, found in the mountains near Vicenza and Sardinia, has not yet been found sufficiently good for the finest ceramic works.

There are manufactories of earthenware of good quality at Laveno, at Campione, on the Lake of Lugano, at Sassuolo, near Modena, in the neighbourhood of Vicenza, and at Naples.

Common earthenware and terra-cotta, for stoves, jugs, pots, &c., are made at numerous manufactories. On the whole, there are at least a thousand kilns for various kinds of pottery.

Bricks, Tiles, Lime, and Cements.—The manufacture of bricks and tiles is carried on all through Italy; there are about 7,000 kilns, furnishing products of the value of 24 million francs. Excepting a few kilns heated by coal, the rest are kilns that are not continuously heated, and they are fired with wood, faggots, or brushwood.

The same may be said of the lime and of the cements, which are more or less hydraulic, and of the gypsum, which is very abundant, especially along the Apennines, and in Sicily. The number of the small kilns used in preparing these products amounts to 5,000. It must be recollected, however, that at Genoa, Leghorn, Palazzoto, in Lombardy, and other places, there are continuous kilns of some importance; they are fired with small coal, and furnish considerable quantities. For the last few years our production has been 7 million tons, valued at about 14 million francs.

The manufacture of bricks and cements, which is still carried on among us in a humble way, usually with intermittent kilns, is spread over all the provinces pretty equally, and occupies 50,000 workmen. It is remarkable for the enormous amount of fuel that it requires, which is calculated at 100,000 tons of small coal, lignite, and peat, and more than 800,000 tons of wood in billets and faggots. This mass of wood represents the annual production of nearly a million acres of ordinary forest land. At the present moment, the large round kilns on Hofmann's system are being introduced. They can be used either for burning bricks or cement, and only use about half the amount of fuel which is necessary for the intermittent kilns. It is to be hoped that their use will soon become general so as as to save, as much as possible, the consumption of fuel, with which we are badly provided.

To sum up in round numbers what has been set forth, the value of the mineral ores and metals is 36,000,000 francs; and if we include the sulphur, salt, and various chemical products, it will be 76,000,000 francs; and, finally, taking in marble, stone, glass, bricks, lime, and cements, the total value would reach 155,000,000 francs.

The principal kinds of exports are the ores of lead, zinc, and iron, to the amount of 14,000,000 francs; sulphur, 22,000,000 francs; marble, 7,000,000 francs; glass-ware, salt, chemical products, and sundries, for more than 10,000,000 francs. On the whole, our exports reach a value of 60,000,000 francs.

On the other hand, we have the imports. First of all, there is iron in various forms, to the amount of at least 36,000,000 francs, without reckoning iron ships, and the large supplies that may be necessary in time of war;

coal and coke, 24,000,000 francs; various metals, such as copper, bronze, tin, &c., about 15,000,000 francs; petroleum, asphalte, and various products, 9,000,000 francs; fine pottery, especially porcelain, 2,500,000 francs; flint glass in various forms, 8,500,000 francs; and, finally, chemical products, more than 11,000,000 francs. On the whole, the imports may be valued at 112,000,000 francs; to this may be added another 10,000,000 francs for machines and implements which are imported every year, and consist of steam-engines, machines of various sorts driven by water, marine engines, portable engines, agricultural machines and implements, spinning machinery, &c.

The want of coal is the principal reason of our inferiority as regards the production of metals, which is far too much below our needs, especially in time of war. This can be remedied, as has been already said, partly by importing every year the necessary quantity of fossil fuel, which nature has denied us, and partly by employing our own fuel, lignite, and peat, in specially-adapted furnaces, such as the Siemens' furnaces, the use of which is extending among us.

We might become independent of foreign aid, as far as regards general machinery, by distributing the work a little better in our workshops, and perhaps by increasing a little the duty on machinery. Finally, we might reduce very considerably the large imports of glass-ware of all sorts, and chemical products. The want of balance, save as regards coal, might then be reduced to very small proportions.

TRADE WITH JAPAN.

The foreign trade with Japan, direct and local, may be estimated at about £10,000,000 sterling per annum, and more than half of it is in British hands. In 1869, it afforded employment to 1,043,405 tons of foreign shipping. More than half the vessels were British, but not half the tonnage, the immense size of the Pacific mail steamers placing the American tonnage at the head of the list. In the direct trade, the imports into Japan from foreign countries, in 1869, amounted to 17,356,923, dollars, and the exports to foreign countries to 11,485,465 dollars; the local trade shows, imports, 6,924,465 dollars, and exports, 2,975,626 dollars, but this is not to be regarded as wholly additional to the direct trade, as it includes the distribution of foreign imports between the ports, and also some portion of native produce intended for re-shipment, and included in the exports to foreign countries. The direct foreign trade in 1869 shows a decline of nearly nine million dollars in Japanese exports as compared with 1868, an increase of more than two million dollars in the imports, and leaves a heavy balance against Japan, which was met by large shipments of native coin sent to India and San Francisco. The money thus parted with was replaced by paper. The import trade of the year suffered severely from disturbances in the currency, but it is hoped that Japan is on the eve of important currency reform. The decline of the exports, in 1869, is due chiefly to the diminished export of silk, partly ascribable to the carelessness of Japanese manipulators, and partly to the large shipment of silkworm's eggs from Japan to Europe, by which the productive power of the latter is increased, and that of the former diminished. The increase in the imports is chiefly in Eastern produce—food from China, Saigon, and the Straits, required in consequence of two bad harvests, and thus the means of purchasing foreign fabrics have been reduced. A return relating to the three great exports—silk, silkworm's eggs, and tea—shows that, in 1869, these articles were exported to England to the value of 3,545,828 dollars (raw silk being the chief item); to France, 4,637,160 dollars; to the United States (chiefly tea) 2,246,347. The export trade to France includes Italy, which takes at least half the silkworms' eggs sent to France. The return does not show what portion of the shipments to England may have been sent thence to other countries. The production of tea for export is increasing; a very large proportion is exported raw to China, where, in that form, it passes under a low scale of duty, and whence it finds its way to Europe. It is not surprising that the foreign trade of Japan should have received some check from the civil war; but if order should now be preserved, there is reason to hope that the industry of the country will experience considerable development. The ports open are Kanagawa, Hiogo, and Osaka, Nagasaki, Hakodate, Nügata. Hiogo is thought likely to be the shipping port of Osaka, which is the market. The foreign settlement of Hiogo bids fair to become one of the best in the far East. On the rising land at the rear, nice bungalows are being erected on picturesque spots, protected from the north winds by a beautiful chain of high mountains, and commanding on either side the view of magnificent scenery, overlooking in front the lake-like bay of Osaka. The number of foreigners at Osaka, in January, was 64, and at Hiogo 185. At Sakai, the port of Osaka for the largest junks, a cotton-mill has been erected by the Prince of Satzuma; it has a 12 horse-power engine, driving 2,000 spindles, and is capable of making 150lb. of yarn per day, but there are no looms. The imports into Japan, in 1869, included cotton manufactures of the value of 5,251,324 dollars; and woollen manufactures, 2,010,553 dollars; arms and ammunition, 1,857,625 dollars. Imports of machinery into Japan continue—machinery for mining, rice-cleaning, cloth-weaving, sugar-refining, and the like, but not agricultural machinery; the primitive instruments of field labour are still used. The production of coal is increasing. Last year has witnessed the opening of the first coal-mine worked upon European principles, the Takashima mine. Mr. Madden, chief engineer of her Majesty's ship *Ocean*, after a severe trial of the coal on board his steam launch, says he considers it equal in general steaming properties to English north country coal, and five best Welsh equal to seven Takashima. Mine products are likely to prove of great importance in Japan. A great part of the country is evidently full of underground treasures of petroleum. The Japanese are making progress in the art of printing. Hitherto they have only been acquainted with the Chinese mode of printing from engraved wooden blocks, but typefounding, electrotyping, and printing on the Western method are now being introduced. A school has been established at Nügata by the government for instruction in the English language, under the superintendence of an American gentleman. The pupils are chiefly children of officials and others of the two-sworded class, but the school is open to all, and the mercantile classes have availed themselves of the opportunity of sending their children for instruction. The number of pupils in January, children and young men, was about 28, but a considerable increase was expected after the Japanese new year.

THE MANUFACTURE OF BEET-ROOT SUGAR.

Mr. Arnold Baruchson, at the meeting of the Social Science Association at Newcastle, read a paper, of which the following is an abstract:—

I request your attention to two questions of great importance, viz., shall we in this country grow the white Silesian beet extensively as a root crop; and shall we urge forward the production of the sugar and other articles which may be extracted therefrom? The large importations into the United Kingdom of beet sugar for refining purposes, which commenced in 1855, has of late seriously arrested public attention. Through the correspondence columns of the *Times*, and other influential journals and publications, much important evidence to the value of the root has been educed, and the experience of those gentlemen who in various ways have tested it, has been collected and collated. The impression of its unprofitableness has given place to

a firm belief that, as a root-crop, it will pay better than the mangolds, which are a considerable item on most farms, and will be available for many purposes to which mangolds cannot be applied. Nor has this growth of opinion been fruitless, for there are now at least one beet sugar factory and one beet distillery in successful operation in this country; and the expectation, publicly expressed by me some years since, seems approaching its fulfilment, viz., that ere long England, like France, Belgium, the Zollverein, and Austria, will produce within her own coasts a large portion of the sugar she consumes. The subject has fairly taken hold of the public mind; we are beyond its initiatory stage, and, consequently, assuming that to a considerable extent you are acquainted with its outlines, I shall omit much preliminary matter which some time ago was indispensable. First, then, shall we in this country grow sugar beet extensively as a root crop? With a large and increasing number of both theoretical and practical men, I answer, yes, because, in the first place, as a root crop it is directly and indirectly preferable to many; and in the second, its extensive cultivation will lead to and facilitate the successful manufacture in these islands of sugar, spirits, and potashes, and other of its valuable products. In round numbers, we devote 300,000 acres to the growth of mangolds, on the value of which, as a rotation crop, and as food for cattle, I need not dilate. Beyond this, however, it is of little use. Heavy crops are obtainable, and our farmers are increasingly disposed to its production, as live-stock yearly becomes more and more important. Now the position which the mangold occupies here is, on the Continent, occupied by beet, though it does also far more for its producers. Fiscal considerations cause, in Germany, a small root with a large per-centage of saccharine matter, and in France a larger root with a less per-centage, to be preferred; but in both countries the farmer sells it to the sugar manufacturer, retaining the leaves as manure, and receiving, on favourable terms, a considerable quantity of pulp, which becomes cattle-food of remarkable efficacy, it being deprived of the large per-centage of moisture, which the root, both beet and mangold, in their natural state contain. Being a triennial crop generally, although in rich land it may be grown every other year, it is alternated with wheat, oats, clover, potatoes; and, preceding wheat it is found to prepare the soil, and increase the yield of wheat. Thus the production of meat, bread, and sugar, the leading necessities of man's existence, may be promoted. The continental preference of beet to mangolds has undoubtedly had its chief source in the connection of beet with the production of sugar and distillation of spirits; but the farmer finds also that the advantage of the heavier crops of mangold is fully compensated by the superior value of its rival, as preceding wheat, and its beneficial effects on the cattle who use it as food, both on the quality of their milk and on their fitness for market. It is very natural that mangolds must be inferior in their nutritious qualities, as they contain 91 per cent. of water, and only 9 per cent. of solid matter, whilst beet contains only 82 per cent. of water and 18 per cent. of solid matter; and sugar, an important element for the purpose of feeding in both roots, the per-centage in beet is from 8 to 12, and in mangold never more than 4 per cent. A small crop of beet equals thus in ultimate usefulness a larger or heavier crop of mangold, so far that 1 cwt. of the one is commensurate with 2 cwt. of the other, or at the lowest, 1½ cwt. Another advantage in growing beet in preference to mangold is the fact that the former only takes one per cent. of salt out of the ground, whilst the latter removes two, and thus is more exhausting to the soil. That our climate and soil admit of sugar beet taking the place of mangold, the experiments which have been made by many landed proprietors in England, Scotland, and Ireland, sufficiently confirm; the roots which have been grown in the United Kingdom have not been surpassed either in weight or quality elsewhere. In the French beet districts pauperism is scarcely known; and here, as there, while labour would be in greater demand, its market would not be disorganised. Employment would be furnished to large numbers at the exact time when most required. For the beet harvest commences at the termination of the wheat harvest, so that there is no interference with what most demands abundant labour. Its manufacture into sugar, &c., goes on during the inclement months, when many artisans connected with the building and other trades are unemployed. Consequently, these can practice two handicrafts, as they do in France and Germany. There the approach of the beet harvest is hailed with general delight, just as in the south of France, that of the vintage excites universal activity. The financial results of these beet industries are of considerable magnitude, such as in other beet countries have transformed entire provinces. Thus, previous to 1830, the northern and adjacent departments were comparatively devoid of manufacturing industry. They now contain, besides a large number of distilleries, 470 beet sugar manufactories, against 282, in 1860, expending in wages and salaries about two millions sterling annually. Last year, 280,000 tons of sugar were made; this year, the crop on the ground is sufficient to yield 350,000 tons of sugar, and its sterling value may be estimated at ten millions in all, viz:—

Sugar........................	£7,700,000
Pulp returned to the farmer (one million tons at 15s.)	750,000
120,000 pipes of strong spirit at £8	960,000
25,000 tons potashes at 20s.	500,000
Sundry manures, &c.	90,000
	£10,000,000

The effect of this on trade and commerce generally cannot but be excellent, whilst scientific agriculture is promoted, iron works, copper works, and chemical works are increased, collieries are developed, and railways are multiplied, so that since this new branch of commerce was established therein, these districts have become the pride of the nation, and amongst the most wealthy in France. In the Zollverein, where these results excite vigorous emulation, changes not less gratifying have followed. In 1840, 14,000 tons only were manufactured, but, in 1860, there were 126,000, last year 200,000 tons, and this season probably 250,000 tons will be produced. The impetus given to collateral branches of industrial enterprise has even exceeded that of France. In Austria, which made only 10,000 tons in 1850, 1866 saw this quantity multiplied eightfold. So much has the cultivation of the root been extended, and new factories erected, that 150,000 tons are expected to be made this season. Holland, notwithstanding her rich sugar colonies, Belgium, Russia, and Sweden, are also zealously doing their utmost in this direction. Belgium alone will make this year not less than 50,000 tons. America (the United States) have commenced this profitable industry in good earnest, and with great success, the root grown in Illinois and California possessing, on the average, 12 per cent. of sugar. But, without entering further into these details, I may summarise them by the statement, that of the sugar produced in the world, about 2,500,000 tons annually, one-third was raised last year in Europe from beet; and, if not impeded by the war now raging, nearly one million of tons will be manufactured this year. During the last 12 months, we imported in raw and refined beet-sugar not less than 100,000 tons, paying for these purchases, in round numbers, three millions sterling; this money might have gone to native producers, nay, more, the whole of the sugar consumed in these islands, viz., 600,000 tons, representing a yearly value of £15,000,000 sterling, might have been supplied by our own countrymen, and that without abstracting scarcely any land from the cultivation of wheat or other farm produce; we might also have become exporters on a large scale to the East of Europe and Mediterranean, which trade is now mainly

carried on by the French and Dutch refiners. We might have been enriched by the further vast outlay thus called for, and our neglect of this prolific source of national wealth provokes constant wonder from the Continental observers who are best acquainted with the elements of success. It is also worth taking into account that, to manufacture the sugar we need in this country, 600 establishments, which would have to be erected, of 1,000 tons each (average), no small boon to our engineering workships. Why, then, do we lag behind, and do not adopt this industry in our land? The certainty that our soil and climate are highly suitable, that farm labour costs no more here than abroad, and (that) as manure, rent, and taxes are no higher, coals much cheaper, and facilities for transport not inferior, there are no difficulties to hinder us growing the root and manufacturing the sugar and other products, on equally, if not more advantageous terms than in France, Germany, and elsewhere.

SIR WILLIAM ARMSTRONG ON THE PATENT LAWS.

At the recent meeting of the Social Science Association, at Newcastle, Sir William Armstrong, C.B., said, in his address on "Economy and Trade":—"There is yet another kind of restrictive legislation to which I refer with hesitation, because in doing so I know that I tread upon very debatable ground—I allude to the laws for the protection of inventors. My own opinion is, and always has been, adverse to patent laws. Not that I think that the authors of valuable inventions should go unrewarded, but because I believe that, in the great majority of cases, a successful inventor makes for himself a position which carries a sufficient pecuniary reward, and because I maintain that the State could well afford to be liberal in special cases of hardship, in consideration of the vast saving that would accrue to the public if relieved from the burdens of the present system. Whatever question there may be as to the policy of abolishing patents, it must be admitted that the law of patents, as it now stands, is disgraceful to legislation. If we are to have patents, they should at all events be granted with discrimination. The transaction should be in the nature of a bargain, in which the public, in consideration of submitting to the disadvantages of a monopoly, are to acquire the use of a valuable invention, which would otherwise be lost to them. Before such a bargain is concluded, an investigation should be made, to ascertain whether the offered invention is worth its price. It may have little novelty, or even none at all. It may be, and very commonly is, so crude and incomplete as to be almost valueless in the proposed form, and the inventor himself may be quite incapable of bringing it to maturity. It may be one of that numerous class of so-called inventions which are so obvious as to be sure to present themselves whenever attention is directed to the subject; or there may be a fair presumption, from the circumstances of the time and the nature of the subject, that the idea proposed to be patented is occupying the minds of other persons, who, by the granting of the patent, would be unjustly deprived of their natural right to follow up their own conceptions. But these and all other considerations are ignored in the granting of patents. It is deemed sufficient that the assumed inventor asks for a monopoly, and he receives it as a matter of course, without reference either to the validity of the claim or the policy of the concession. The result is that patents exist in thousands which are utterly unworthy of so grave a privilege as a monopoly. Many of them are absolutely untenable. Many others are of doubtful validity, but in either case they can only be set aside by a lawsuit, which is generally deemed a greater evil than submission to the exactions of the patentee. Thus a bad patent often answers its purpose as well as a good one, and a spurious protection is acquired in defiance of law and justice. But it is the obstructive effect of the multitudinous patents that is chiefly to be deplored. Framed without check or criticism, they are purposely made to cover as much ground as possible, so as to prevent other inventors from even approaching the subject; and so great is the number of patents, and so doubtful their construction, that it has become an impossible task to determine what ideas are free and what are monopolised. In a great number of cases the invention is so imperfectly developed that the patent remains inoperative and dormant, and simply blocks the way of other inventors, for no one will labour to give value to an invention when a patentee is lying in wait ready to reap the advantage when the practical difficulties are surmounted. As to the alleged analogy between copyright and patent right, there is none whatever in regard to obstructive effect. Copyright involves no monopoly of ideas, but patent right does. The field of authorship is not narrowed by copyright, but the field of invention is, and to a most serious extent, by patent right. I have thus briefly glanced at the impolicy of protection, whether applied to commerce, to labour, or to invention. In every case the principle is the same, and amounts to a restriction upon human power and energy for the benefit of a section of the community. I deprecate all interference with liberty of action, except in restraint of offences; and I maintain the greatest good to the greatest number will only be attained by leaving the social world as much as possible to the governance of natural laws."

EDUCATIONAL NOTES.

Reports of meetings in various localities show that the Education Act has, as might have been anticipated, had the effect of stirring up local action, and in many districts successful efforts will, no doubt, be made so far to increase and improve existing educational organisations as to render it unnecessary to appeal to the powers given by the Act.

As as instance may be mentioned an important meeting, held under the presidency of the Archbishop of Canterbury, at St. George's Hall, Canterbury, to consider the provisions of the Act. The Archbishop said that, now that the Education Act was the law of the land, it was their duty to make the best of the circumstances in which they found themselves. The first great object for which that meeting had assembled was to build Church of England schools where they do not exist; and the second was to see that where schools do exist they shall be thoroughly efficient, and therefore able to place themselves under the new Act. The voice of the country had demanded that the education given in our schools should be based upon religion, and he felt there would always be great difficulty in this matter unless each school were recognised as belonging to some distinct church. The rate-supported schools were not the beau-ideal of the schools contemplated by the Act, though they might come in provided others were not established. The object of that meeting was, among other things, to save them from the introduction of rates. Its promoters believed that under the Act Church of England schools may continue to flourish, and that the people may be saved from a great deal of the trouble of the new system, which is as yet untried. Mr. Gathorne Hardy also fully accepted the Act, and urged the desirability of preventing as much as possible the introduction of rate-supported schools. If they once allowed school boards to be established there would be great danger of subscriptions falling off, for people would not pay both rates and subscriptions. Resolutions were passed commending the Canterbury Diocesan Education Society to increased support, and urging the importance of seizing the short period during which building grants will continue to be made by the Committee of Council, in order to provide increased school accommodation.

A meeting has also been held in the Town-hall, Chester, when the Chester and Manchester Education Board, founded 30 years ago by Bishop Sumner, Bishop Powys, the late Lord Derby, and others, was divided into two boards, corresponding with the divisions of the dioceses. The Lord Lieutenant of Cheshire, Lord Egerton of Tatton, was in the chair. The first resolution was moved by the Bishop of Chester, the second by the Bishop of Manchester, and the other speakers were Sir James Kay-Shuttleworth, Colonel Wilson Patten, M.P., Mr. Hugh Birley, M.P., Mr. A. C. Raikes, M.P., Mr. R. A. Cross, M.P., the Rev. Chancellor Thurlow, Mr. Gilbert Greenall, Canon Hopwood, with the Mayor and the Dean of Chester. Resolutions were adopted in support of the training colleges for schoolmasters and mistresses, which are to be managed by a joint committee of the two boards, and also for an immediate effort to establish voluntary schools where they are wanted. It was stated that for this latter purpose about £25,000 would be required for each of the two dioceses. Subscriptions of £1,000 from Lord Egerton, £200 from Mr. Gilbert Greenall, £200 from Colonel Wilson Patten, and £100 from the Bishop of Chester, were announced at the meeting.

In the diocese of Gloucester and Bristol, steps were taken last March by the Bishop and the Diocesan Association for investigating the educational wants of the diocese. At their request, Canon Tinling and the Rev. H. W. Maddy collected complete and exhaustive returns of all the schools, and presented the report to a special meeting of the committee, on the 27th ult., in Gloucester, when a large and influential body of clergy and laity were present. A resolution was passed, "That a special fund be forthwith raised for the purpose of supplying the educational deficiencies of the diocese in respect of school buildings." The Bishop has called a general meeting of the clergy and laity of the diocese, for the purpose of carrying out their object.

A short digest of the Act, so far as it affects the metropolis, has been prepared by the City solicitor, and laid before the Court of Common Council. It may be interesting to give its substance. For the purposes of the Act, the metropolis is is to signify the places within the jurisdiction of the Board of Works. One school board is to be elected for the entire metropolis, and ten divisions—viz., Marylebone, Finsbury, Lambeth, Tower Hamlets, Hackney, Westminster, Southwark, the City, Chelsea, and Greenwich—are to return members to it. The name of the Board is to be "The School Board for London." The date of the first election will be fixed by the Education Department, but afterwards they will be held in November in every third year. The members representing the City are to be elected by the same persons and in like manner as Common Councilmen. The Chairman of the Board will be elected by the members, either from among their body or not, and he may be paid a salary to be fixed by the Board and the Department. The Board will then at once proceed to supply the several districts with sufficient public elementary school accommodation, available for all the resident children. The expenses of the Board are to be paid out of the school fund, to which all monies received as fees from scholars or provided by Parliament are to be carried. The deficiency, if any, will, in the case of he City, have to be raised by the Commissioners of Sewers from the Consolidated Rate. The Board will have authority to enforce the attendance of children at their schools, and, in some cases, to remit the fees of scholars.

Previously to the election of the Board, distinct regulations will be issued by the Education Department, stating the measures to be adopted with regard to the extra-parliamentary portions of the metropolitan area, together with the number of the Board, and the proportion of members allotted to each division, and also defining precisely the mode of election. It appears to be desirable, for many reasons, that the jurisdiction of the Board should be co-extensive with the present metropolitan area, as arranged for administrative purposes.

THE EDUCATION QUESTION AT THE SOCIAL SCIENCE CONGRESS, NEWCASTLE.

The Duke of Northumberland, in his opening address to the National Association for the Promotion of Social Science, at Newcastle-on-Tyne, spoke of primary education "as a means, and not an end, a preparation for a higher course of self-education to be worked out hereafter by the scholar himself." On the general question of the effects of education, the following are the remarks of the Duke:—"To encourage the efforts of voluntary schools is the best and most certain way to raise the tone of those hereafter to be supported by rates. But knowledge is power for evil as well as for good. Man is ever prone to convert the power bestowed on him for evil purposes, and that which was given for his protection and safeguard into a source of danger to himself. We often hear the dangerous classes spoken of. The dangerous classes, in my eyes, are not only the idle and vicious, which can be kept under control by the common energy of a decently-administered executive, and from which little but occasional outbreaks are to be apprehended; still less that of the industrious labourer, artisan, or mechanic; it is rather that of a highly-instructed class, raised in its own estimation above mechanical labour by its superior acquirements, finding every avenue to advancement thronged and impeded by its own daily increasing numbers, and without any outlet to its powers and its energies, whilst its sufferings are rendered more acute by its sharpened intelligence. This is, as far as I have been able to observe, the class whose discontent is most perilous to the commonwealth."

The subject was also referred to by the chairman of the council, Mr. G. W. Hastings, in his address to the congress. Referring to the Education Act, he said that, although not all that the advocates of extreme views in any direction had desired, it was at least a practical measure, and afforded the broad outlines of a national system of primary education. After advocating the appointment of a Minister of Education, Mr. Hastings urged that the quality of the instruction given should be improved, and that we ought not to be content with teaching the "three R's" badly in six years, when we might get through the same amount of work, and get through it better, in half the time. He thought that at the bottom of the whole matter of improved teaching lay the question of the amalgamation of schools. It was better to have one school of 300 children than six schools of 50 each. The number of classes in the larger school need scarcely be greater than in the small; but, while the master in the small school would only be a superintendent of inefficient pupil-teachers, the large school would support an efficient master and a well-paid staff of assistants. The large school system would be cheaper for all concerned; and, moreover, it would improve the social condition of the teacher, which he considered was half the battle; for as the schoolmaster so would be the school. The large school system would necessitate gradations of rank, with progressive salaries, and do much to lift the profession of teaching from the dead, dreary level which it at present unhappily occupies, so as to give the country the services of a body of teachers made doubly efficient by the prospect of promotion. With regard to the best method of harmonising education throughout schools of various grades, Mr. Hastings stated the object to be to enable any boy or girl, with the requisite ability and perseverance, to work his or her way from the parish school, or even the workhouse school, to the grammar school and the Universities. Nothing short of this could make our education truly national, and nothing would so much weld together the interests of all classes. Such a system, moreover, had been established wherever the English tongue is spoken except in England, and he thought that in this, and not in the mistaken policy of "free" education, would be the true boon to our weekly wage class. Let them not

be encouraged to shirk the duty of providing for the education of their children, but give them scholarships and exhibitions in the national schools, to carry the deserving boy into the secondary schools, and to let him start in the upward race with the self-respect of independence.

A very interesting address was given, on the 24th September, by Dr. Lyon Playfair, M.P., President of the Educational Department of the Congress. He said that for thirty years past efforts had been made to bring the State into relation with the education of the people, but these efforts had been rendered unsuccessful by the conflicting interests and the jealousies of religious bodies. At last, however, Parliament had passed a measure of national education, which, whatever might be its shortcomings, had the great merit that the State had at last been brought into national relations with education. Three leading principles in the Act had given it a national character—first, that it is the duty of localities to bring education within the reach of every child in England; secondly, that it is the duty of parents to make their children attend the schools thus provided; and thirdly, that it is the duty of the Government to see that the objects of the legislature are fulfilled. The Act was an enormous stride in advance of the old system of mere contributory help, under which schools indeed multiplied, but education slipped backward. The Revised Code rather accelerated the decadence, since it led to mechanical teaching in the lower standards only, and to results that were not worth paying for. Under its influence the schools became mere mechanical manufactories, turning out no end of yards of the three R's, in the standards one, two, and three, but very few in standards four, five, and six, because the latter do not pay. The original idea of the Church, if it could have given a fair amount of consideration to the temporal condition of man as compared with his eternal state, was to educate him in correlation to his work and condition in life. The same idea was manifested wherever the State in ancient times interested itself in education, and in the observance of such a relation might be found the secret of the prosperity of Prussia, which had lately so remarkably shown what education can achieve in the union and advancement of a people. The educational principle of continental nations was to link on primary schools to secondary improvement schools. Elementary science, and even some of its applications were encouraged or enforced; but our primary schools do not teach higher instruction than a child of eight years of age may learn, and so, under our present system, no knowledge bearing on the work in life of the people reaches them as a result of State education. A thousand men perish yearly in our coal mines, but no schoolmaster tells the poor miner the nature of the gas which scorches him, or of the after-damp which chokes him. Boilers of steam-engines blow up constantly—the stokers were never instructed in the nature and properties of the steam. In Great Britain alone more than 100,000 people perish annually, and at least five times as many sicken grievously, out of pure ignorance of the laws of health, which are never imparted to them. He wished it to be understood that, in advocating the teaching of science, he meant that the subjects taught should be of immediate interest and applicability to the working classes. It appeared to him that six months spent in teaching future labourers the wanderings of the children of Israel was sheer waste of time, as regards either their temporal or their eternal interests. If you bring up a ploughman in utter ignorance of everything relating to the food of plants, of every mechanical principle, of farm implements, of the weather to which he is exposed, of the sun that makes the plants to grow, and of the rain which refreshes the crops, is that ignorance conducive to his functions as an intelligent being? In all the operations of the field, which of the two men would feel he had the most noble occupation—the ignorant clodhopper, knowing nothing that he is doing, or the worker, intelligent, and understanding his work, aiding nature to fulfil her wise laws, and by doing so, feeling himself like Saint Paul, to be "a fellow-worker with God?" He had selected for illustration the occupation in which the working man is now the least cultured and intelligent, but there was not a single craft which could not be dignified in a similar way. He would mention a significant instance given in Mr. Carleton Tufnell's "Report on the Employment of Men and Women in Agriculture," where he speaks of the present improved condition of the Scilly Islands, formerly in such a state of misery and poverty that the inhabitants were only preserved from starvation during the winter months by constant contributions from the mainland:—"Now we never hear cries of distress from these islands, and for what reason? In 1834, Mr. Smith, who became their proprietor, undertook their improvement. He abolished the cottar system, consolidated holdings, founded good schools under a compulsory system of his own, and kept them up to the mark by constant inspection. He did not content himself with the three R's, but directed the instruction towards the occupations of an insular people. History, geography, the rudiments of mathematics, and navigation were taught to the children. And with what result? So much esteemed are the youths of the Scilly Islands as sailors, that vessels sometimes stop there to procure them, and very frequently they rise to be mates and masters. Pauperism has vanished from these islands, so that it is difficult to find any of the population poor enough to accept the alms offered in the Communion Service." These were some of the advantages of directing the subject-matter of education to the occupations of the people, which, while it elevates the individual, at the same time, gives security for the future prosperity of the nation. "In the industrial battles of peoples we are content to leave our working classes armed with the old Brown Bess of warfare, while men of other countries are arming themselves with modern weapons of precision." The speaker then proceeded to draw an elaborate contrast between Spain and Holland, and afterwards to enlarge upon the benefits of physical training and bodily exercises. Alluding to the subject of compulsory education, he said that the logic of circumstances drove Parliament into the recognition of compulsion, and the same logic would oblige the legislature to make it sufficient. You cannot give political power to a people and allow them to remain ignorant. But it would be an unredeemed hardship to compel children to remain at schools unless these were made suitable to their wants in life. The address then referred at some length to the methods of compulsion, whether direct, as by the operation of law on the parent, or indirect, by the prohibition of industrial occupation to an untaught child, and leaned rather towards the latter method. The subject of Scotch universities, and their connection with the grades of education below them, was next taken up, and the necessity for some means of gradual ascent from the English primary schools was pointed out. The speaker then referred to the existing provision for the supply of teachers, and described it as being over costly and excessive for the present kind of instruction, and altogether inadequate for the higher teaching that would in future be required. He said that no more important object lies before the Education Department in the future than the efficient organisation of the scholastic profession as a whole, so that it may become an object of ambition to the best youth of the country, and may afford to them adequate remuneration in their days of working vigour, with the power of providing for their old age. This would be a true economy to the nation, for a country which has sufficiently large resources in schools and teachers possesses the elements of continued prosperity, and has little to fear in the advancing competition of the world. In conclusion, the speaker pointed out the "chaotic confusion" of the present organisation for developing the intellect of the country. "There is the Committee of Council, with two departments running side by side on parallel rails, yet never

touching each other, lest disagreeable collisions might result. The elementary school department will have no aid from the Science and Art Department; and yet both are under the same masters—the President and Vice-President of the Council. Again, you have a third body, the Endowed Schools Commissioners, tacked on to the same committee by a loose sort of thread, but not bound to co-operate with either department. Then you have all sorts of government schools outside the education department altogether. Union and workhouse schools under the Poor-law Board; military and regimental schools under the War-office; naval and ship schools under the Admiralty; factory and industrial schools under the Home-office. Some of the Universities receive large sums from Parliament, but are responsible to no public department for their proper use. In fact, we have educational materials in abundance, but no architect to make a national edifice out of them. In this confusion the public call for a Minister of Education, in the hope that he may be a nucleus round which the various materials may crystallize in a definite form. In the competition of nations, both in war and in peace, their position for the future will depend upon the education of their peoples. Local advantages or practical aptitudes may give them pre-eminence to-day, but, unless supported by knowledge, these will vanish to-morrow. The competition of the future will be one of public intellect. The Act which I have criticised is our first effort to elicit order from disorder. But it is the mere beginning of a mighty work, which this country must perform if she is to escape the sentence passed on the Church of Sardis—'Thou hast a name that thou livest and art dead.'"

In the education department of the congress, one of the principal questions treated in Dr. Playfair's address, viz., "By what means can a direct connection be established between the elementary and secondary schools and the universities," was discussed at considerable length. A paper upon it was read by the Rev. Brooke Lambert, who, after alluding to the pressure of the labour market, that makes it hard for the parents to sacrifice the earnings of their children, proposed that the difficulty should be met by the establishment of scholarships which would lead the child on, step by step, to the university, paying for his board, and so relieving the parent of the cost of maintenance. He advocated a tax on all young persons employed, from which any employer might be relieved on producing, in lieu of a receipt, a certificate that the child had passed a certain examination, thus substituting interest in place of compulsion as an inducement to attendance.

A paper on the subject was also contributed by the Rev. John Percival, and in the discussion Sir Alexander Grant referred to the Scotch and Indian systems, and regretted that at Oxford and Cambridge the colleges were too strong for the universities, and opened their doors, without preliminary examination, to students who were little qualified to profit by a University training.

Mr. Edwin Pears, general secretary of the association, contrasted the relation of the primary and the higher schools, as it appeared in Scotland, with the defects of the English system, and instanced the little colony of Tasmania, which, in a population of 80,000, gave two scholarships to any British university which the winners might choose to select, the value of each scholarship being £200 a year, for four years. He quoted from the report of the Endowed Schools Commission, and showed that, for all practical purposes, the money required for establishing a direct connection between the primary and secondary schools, also between the secondary schools and universities, was already in existence, and he protested against the application of that money in simply providing education either for the middle or for the higher classes. What he would suggest was the continuation of the fee paid in the primary schools, but that every boy on reaching a certain standard—say the seventh—should have the opportunity of passing, for the same fee, to the secondary school, or endowed school. After passing the necessary examination there, he should have the privilege of being admitted into the university free.

At the close of the discussion, Mr. R. S. Watson read a paper on the "Best Method of Providing Higher Education in Boroughs." He urged that in all large towns professors should be supplied with sufficient salaries to admit of the class fees being very low, and classes for both sexes should be held in the evening, where those engaged throughout the day might carry on their studies in a systematic manner. Every large town should have an institution like Owens College, at Manchester. To the old universities, as the heads of education in England, he looked for help in this matter. College fellowships might be converted into country lectureships, thus diffusing a learned element throughout society in the country, or the universities might contribute an annual sum towards the salaries of the professors, the borough to be benefited contributing an equal amount.

In the same department, a paper on the "Education of Miners" was read by the Rev. W. A. Scott, vicar of New Seaham, in the county of Durham. He recommended that infant schools should be established, with a view to make the most of the few years the pit-boy had for education. They were generally popular, largely attended, and could be made nearly if not quite self-supporting. The night schools were certainly useful, but the long hours of labour made it impossible for the boys generally to avail themselves of them. The Mines Inspection Acts had done good as regards the age at which boys begin work in the coal mines. Twelve seemed likely to be adopted as the minimum age, and, considering the pressing demand for boys' labour, the wishes and necessities of the parents, and the desires of the boys themselves, he was not prepared to object to this age, provided means were adopted for carrying on their education.

Mr. John Glover said that for many years he had refused to employ in his mines any children who could neither read fluently nor write legibly; and the result was that the parents, instead of acknowledging their obligation to their children by sending them to school, removed to a locality where no such restrictions were enforced. It was a fact that the parents themselves were not sufficiently educated to know the value of education. He advocated the compulsory system, as all influence failed to induce the parents to give them necessary education.

EDUCATION OF CHILDREN IN FACTORIES.

The report of the Inspectors of Factories, addressed to Her Majesty's principal Secretary of State for the Home Department, contains, amongst other important matter, some striking remarks upon the necessity for education that prevails amongst the children employed under the supervision of the Act. Both Messrs. Redgrave and Baker concur in the experience gained by attentive consideration of the half-time system, that it does not fulfil the simple requisite that education and labour should go hand-in-hand. Inquiries have led to the conviction that the custom of not sending the children to school until they are at work in the factories prevails very generally; the necessity therefore exists, as an adjunct to the half-time system, that school attendance should be enforced as a condition of employment. Some of the owners of factories have themselves endeavoured to maintain rules to this effect, and amongst the employers of labour are to be found the most strenuous advocates for the adoption of such a course.

The inspectors further propose that, before being permitted to work upon full time, a child should be able to pass a certain educational standard. By such means a certain reality would be given to the objects obtained by attendance at the school; both parents and children would be stimulated, whilst the work of the schoolmaster would be lightened by the interest and energy with which his pupils would be inspired. At present, there

exists a gross and systematic neglect of early training before the half-time, and a persistent anxiety to evade the law, by getting the children passed for full time before the proper age. Upon an investigation made in seven of our large cities, visited by the inspectors, out of 100 young persons, principally about 13 years of age, the following educational results were ascertained, namely, that 53 per cent. could read and write, 14 per eent. could read only, and 33 per cent. could neither read nor write.

The mode in which this question of primary education has been treated in foreign countries appears by an analysis of the regulations in force where education is made a condition of employment. In Prussia, young people under 16 cannot be admitted to work in factories until their father or guardian presents a certificate stating that they can read and write, and this certificate must be produced by the manufacturer when required by the authorities. Under the age of 12, no children are allowed to be employed in the factories. In Saxony, the principle of primary instruction has been established so early as the year 1573, its application having been since regulated by a law which requires attendance at school of both sexes between the ages of 6 and 14; the expenses are defrayed in part by fees and grants. Children under 12 cannot be employed, and above that age the employers are bound to allow them time to attend the primary school, or else to provide a school on the premises. In Austria, primary education is compulsory, and schools, wherever needed, must likewise be established. In this respect a very large portion of the empire is already provided, and in other parts they are to be found in sufficient number, so that the law upon compulsory education can be strictly enforced.

In Bavaria, the same restrictions exist, subject to circumstances, and in certain localities its enforcement is strictly kept. In republican Switzerland, primary instruction is compulsory. Every canton has its own laws and administration, and therefore the mode of instruction may vary from one to another. For example, in the canton of Zurich the attendance of children is compulsory from the age of 6 to 16; the inhabitants who have their children taught at home are bound to satisfy the authorities that the education is as good as that gained in the schools, and they are not exempted from the ordinary fees until the prescribed age.

Throughout the countries visited by the commission formed in 1863 by the French government for this special purpose, it was found that whatever the form of government or religion, both law and custom made primary education compulsory. Notwithstanding the natural obstacles, or the indifference of some populations, remote from centres of intellectual activity, the principle subsists everywhere. The exeeption, therefore, astonishes when it does not present itself as the consequence of evident circumstances. An instance of this kind is related where the colonel of a regiment in one of the minor states of Germany having ascertained that, out of a contingent of 800 men recently sent him, four could not read, the fact appeared so extraordinary that an inquiry was held in order to ascertain the cause.

The inspectors, who have had ample opportunities of ascertaining the opinions of persons connected with factories, urge very strongly that education should be made a condition of employment, and they do so in the full conviction that such a measure would be held as a great boon by all classes alike throughout the manufacturing districts.

CORRESPONDENCE.

INDIA NOT FOR THE WORKING CLASSES.

Sir,—The Labour Aid Society, the trades unions, the Emigration Aid Society, and others interested in promoting the employment of our working men, may very usefully occupy themselves with a measure which, as it concerns India, is really of very great importance to them, as it is to England in general.

The government of India has this year taken measures to educate native foremen, so that they may not have to employ English foremen. There are several reasons which are discussed, and not unnaturally that of economy, but those which really influenee these proceedings are a desire to favour the natives, or a particular wish to exclude the English working man from India. It is alleged that, by drunkenness and disorderliness, he is corrupting the morals of the people of India, though the English friends of the working man might be afraid of his morals being corrupted. The working man is being effectively excluded from the railways created by our capital and enterprise, and new native foremen are to be trained by government to compete with him.

It is certainly very desirable to patronise the working classes of India, but, in the case of India, there are more reasons than one for patronising and not excluding our own working classes. In the first place, they have largely shared in the conquests and defeats of India, where the bones of many thousands of Englishmen rest. Next, it is exceedingly desirable for the working men of India that they shall have a large infusion among them of English working men for their practical instruction. The Indian working man will get the lion's share of employment, and there is no need to push them on by government help. Thirdly, it is very desirable there should be India for the English, as well as for the Hindoos and miscellaneous populations of India, and it is very undesirable the English working man should be dealt with under the old practices against interlopers.

Some of the railway men get drunk, and misconduct themselves; but our government in India must be very strangely constituted if, on account of them and the foreign loafers it so weakly allows to disturb India, it is compelled to go out of its way, and systematically exclude (for this is practically the fact) the English working man from that great field of enterprise, India, instead of giving him every encouragement. He is now left to get to the hill settlements or the plains by his own unassisted efforts, at a great expense, and then the government provides so far as possible for his non-employment. In many other countries where the people are not more moral than they are in India (in South America, for example), you find the English working man who has got on, who has his factory, his store, or is working a mine, and we know the same thing can be done in India.

Before it is too late, it is worth while to think of India for the English, and that will be the best way of governing it for the Hindoos.—I am, &c.,

Hyde Clarke.

32, St. George's-square, S.W.

NO NEUTRALITY.—NO NEUTRALS.

Sir,—The Society for the Encouragement of Arts, Manufactures, and Commerce has already experienced sufficient discouragement for its objects from the events of the war, with the political aspects of which the Society, as such, has nothing to do. The Society has, however, something to do, as the oldest and only constituted society for discussing commercial science, with the commercial considerations.

The point I want to call attention to is one not made sufficiently prominent, that England and the rest of the world, engaged in peaceful and commercial pursuits, have a right to be considered in such capacity before the belligerents in all cases.

As the matter now stands, when two nations, or two fractions of a nation, go to war, they assume the right of disturbing the whole commerce and peaceful relations of the rest of the world. By war, justly or unjustly provoked, and aggravated by one party or both, a great injury is inflicted on everyone else. Not content with

this, one or both of the aggressors calls upon the other nations still further to impede their commerce for purposes connected with the war.

The parties so ill-treated have, of late years, been unwise enough to accept these requisitions, and to discharge what are called the obligations of "neutrals." Thus, the coal trade is a trade of peace, and by the consequence of war it is crippled, to the great injury of this country. This country is then called upon to arrest and alter its whole legislation, police administration, and commercial dealings, in order that no coals may be supplied for war purposes to one of the combatants; whereas though we have made every exertion of late years for free trade and free administration, we are expected to take a contrary course, and to be held responsible for the consequences of any failure.

Such are the results of accepting the title of "neutrals" as against belligerents, whereas we must put the saddle on the right horse, and require that our commercial and peaceful relations shall be first considered, and that the requirements and exigencies of belligerents shall be secondarily and subsequently considered, and for our interests rather than theirs. The sooner our statesmen take this ground, and obtain the accession of other peaceful States, the better. Then there will be fewer apologies to be made, and less compensation to be exacted. As affairs are now going we are always in danger, at the close of each war, of being amerced by an ambitious victor.—I am &c., Hyde Clarke.

32, St. George's-square, W.C.

THE MAINTENANCE OF MACADAMISED ROADS.

Sir,—In an excellent notice in last week's *Journal*, on the enormous expenditure upon the making and repairing the roads and street thoroughfares in this country, some important causes of their rapid destruction seem to have been omitted. Contrary to the system laid down by McAdam, which is, that the stone shall be reduced to a uniform size before being laid down, in almost every case the material is imperfectly broken upon the road, and the consequence is that all the larger inevitably crop up and form lumps or hills, with which our roads are all infested when somewhat worn. What is worse still, the loose, yielding mass of rubble is left to be consolidated by passing horses and vehicles, a state that does not take place until the materials are worn down into dust and mud, which has to be carted away, and the road requires fresh repair. This grinding process may be plainly seen by anyone who will take the trouble to follow the vehicles crushing through the rubble of the new metal, the larger sizes being ploughed up and the smaller ground to powder. Indeed, it does not seem to be a very correct proceeding to charge the ratepayers with the cost of the roads, and then to compel those ratepayers to make the road themselves, at a ruinous cost of horseflesh, and wear and tear of harness and vehicles.

It is in vain to talk of granite sets, or asphalt, or other expedient. Macadam is the best material for resisting heavy traffic, when properly laid down and duly rolled. The granite sets settle down into holes, and it is absurd to suppose that asphalt can ever be produced as hard as granite. The only other material would be vulcanised india-rubber, the best of all, but for the cost and difficulty of procuring.

The rolling must be, of course, by steam-traction, for a team of horses required to draw a 20-ton roller would destroy its work. Excellent engines have already been constructed with three rolls, so arranged that the whole of the space passed over shall be universally crushed solid, the rolls themselves being of sufficient weight not to require a cart body full of stones, a wretched expedient too frequently adopted.

The mismanagement of the turnpike and other roads of this country is only paralleled by the mediæval absurdity of attempting to improve the navigation of our rivers by erecting bars across them at short intervals, instead of endeavouring to assist nature to deepen their bed, an operation that, at any cost, would be a very economical proceeding with reference to the ruinous losses by annual inundations and the difficulties of drainage, which would have been so much lessened by the entire removal of all the dams and weirs upon our rivers, from their source to their embouchure at the coast.—I am, &c., Henry Reveley.

Reading, September, 1870.

OBITUARY.

John Braithwaite, C.E., one of our oldest engineers, and whose name is identified with the construction and early history of the Eastern Counties—now the Great Eastern—Railway, died at midnight on Saturday last, the cause being apoplexy. From the earliest period in railway history, Mr. Braithwaite had been engaged in the promotion and construction of lines, both in England and on the Continent. In laying out the Eastern Counties Railway—of which he was engineer-in-chief—Mr. Braithwaite adopted a gauge of 5 feet, which, however, was afterwards altered to the ordinary 4 ft. 8½ in. gauge. Mr. Braithwaite took an active part in the battle of the gauges, which was fought some twenty years since. He was a supporter of the narrow gauge, and has of late years expressed himself in favour of the adoption of still narrower gauges than are now generally employed. As a mechanical engineer, Mr. Braithwaite will perhaps be better remembered than as a civil engineer in connection with the development of the railway system. It was he who, in 1829, in conjunction with Mr. Ericsson, designed the "Novelty" locomotive engine, which was tried on October 10th in that year, against the "Rocket" engine of Mr. R. Stephenson, and the "Sans Pareil" of Mr. T. Hackworth. The three engines competed for a premium of £500, offered by the directors of the Liverpool and Manchester Railway for the best locomotive engine, and it is matter of history that the premium was awarded to the "Rocket." To Mr. Braithwaite belongs the credit of having made the first steam fire-engine, so far back as the year 1829, in London, in conjunction also with Mr. Ericsson. Four more of these engines were subsequently constructed by these gentlemen, all being eminently successful; yet, so strong was the prejudice which was brought to bear against them, that, from 1832 until 1852, no more were made in this country. Mr. Braithwaite was also well known in connection with most of our large breweries, and for various improvements which he effected in their mechanical arrangements. He was especially engaged in sinking wells in connection with these establishments, having sunk a large number, some of very great depth, for numerous breweries. Mr. Braithwaite was elected a member of the Institution of Civil Engineers on February 13, 1838, and was elected a member of the Society of Arts in 1819.

Professor Miller.—William Allen Miller, M.D., F.R.S., Professor of Chemistry in King's College, London, died of apoplexy on the 30th ult., at Liverpool, whither he had gone to take part in the proceedings of the British Association. Dr. Miller was born at Ipswich on the 17th of December, 1817, and in his twenty-fourth year he became assistant to the late Mr. Daniell, professor of chemistry in King's College, London. In 1844, he cooperated with his master in the publication of a paper on the "Electrolysis of Secondary Compounds." In the following year he was elected a Fellow of the Royal Society, and succeeded Mr. Daniell in the chair of chemistry in King's College. His chief work at this time was his paper on the "Spectra of certain Vapours," published in 1845. In 1849, he again came before the

scientific world with a paper on the "Atomic Volumes of Organic Liquids." From this date his time appears to have been chiefly absorbed by other than purely scientific subjects. He held the posts of treasurer of the Royal Society, president and afterwards vice-president of the Chemical Society, and assayer to the Royal Mint, besides being member of the Science Commission. His later contributions to the scientific periodicals were, a paper on "Transparency," in the *Journal of the Chemical Society*, some "Analyses of Gutta Percha," and "A Treatise on Potable Water." In conjunction with Mr. Huggins he investigated the spectra of the fixed stars. He is known to the educational world by his voluminous and widely-popular "Treatise on Chemistry," in three parts, which originally appeared from 1855 to 1857, and which has already gone through several editions. Although Professor Miller was not a member of the Society, he took an active interest in its operations, and served on several of its committees.

GENERAL NOTES.

Iodine.—Professor Wagner, in his reports, says that the manufacture of iodine from Chili saltpetre already amounts to 30,000 lbs. per annum. The method invented by Thiercelin for its reclamation from the crude material is as follows:—The mother liquors resulting from the manufacture of saltpetre are treated with a mixture of sulphurous acid and sulphite of soda, in proper proportion, and the iodine will be precipitated as a black powder. The precipitated iodine is put into earthen jars, on the bottom of which are layers of quartz sand, fine at the top and coarse at the bottom; from this it is removed by earthen spoons into boxes lined with gypsum, and a greater part of the water thus removed. It is sometimes sold in this impure state, or further purified by sublimation.

Agricultural Statistics of Great Britain.—The Agricultural returns for the year 1870, issued by the Statistical Department of the Board of Trade, give the following results:—The acreage, on the 25th June, under wheat was 3,493,131; barley, 2,368,626; oats, 2,761,707; potatoes, 587,304; hops, 60,138. Compared with 1869, there is a decrease in the acreage under wheat of 195,226; an increase in barley of 117,146; a decrease in oats of 21,013; an increase in potatoes of 2,093; a decrease in hops of 1,654 acres. Under the same collection there was as follows:—Cattle, 5,394,756; sheep, 28,350,417; pigs, 2,168,387. Compared with 1869, there is an increase in cattle of 81,283; a decrease in sheep of 1,187,724; an increase in pigs of 237,935.

Pictures and other Art Works at the New British Institution.—This exhibition is open to the public at the gallery of the New British Institution, in aid to the charitable efforts making on behalf of the bereaved families of German soldiers. One academician is a contributor—Mr. J. H. Foley, the sculptor. The water-colour painters are more numerous. There are the productions of amateurs also, her Royal Highness the Crown Princess of Prussia taking a high place in art, and an honourable one as patroness of the undertaking, and trustee for the direct application of the funds. There are several good works in sculpture, especially an ideal bust called "Ophelia," by Mrs. N. Ellis, and a life-size bust of the King of Prussia, by L. Castan. A contribution which attracted interest was a portfolio of fine impressions of unpublished prints, chiefly portraits of the Royal family, several being from pictures by Landseer, with many drawings and photographs; and a collection of beautiful dried leaves from American trees, all preserved in brilliant colours, and grouped with taste.

Cordova Exhibition.—In order to give foreign exhibitors more time to complete their arrangements, the opening of this exhibition has now been deferred until March 1st, 1871. The season of the year, however, necessitates that the trials of agricultural machinery should be made previously, and the 15th December has been named for this purpose. Further applications for space from intending British exhibitors should be addressed immediately to Messrs. J. M. Johnson and Sons, of Castle-street, Holborn.

Industrial Statistics.—In accordance with an intimation in the House of Commons by Mr. Bruce, the Home Secretary, the various local authorities in the country have been invited to co-operate with the inspectors of factories in the collection of statistics relating to the employment of the people in factories and workshops. Hitherto these statistics have been obtained only from the textile manufacturers, but now they will be sought from every trade and handicraft in the kingdom. If prepared with care and accuracy, these returns will contain an amount of information which will be most valuable; and as we understand it is the intention of the Home Secretary to publish them in future at stated intervals, they will, without doubt, prove an efficient register of the industrial progress of the nation.

The Fungus Show at the Royal Horticultural Society on Wednesday, proved very attractive. Notwithstanding the drought, a great many fine and curious specimens were exhibited; and as there was no collection in the first class, which was confined to edible fungi, the prizes were awarded to Mr. G. Worthington Smith and Mr. James English, whose collections were considered of equal merit, while the second prize was given to Mr. Hoyle. Lord Londesborough exhibited a fine form of *Dendrobium chrysotis* in great perfection, and there were many other objects of interest. W. Wilson Saunders, Esq., F.R.S., presided at a general meeting held at three o'clock, and the following candidates were elected Fellows of the society, viz.:—Arnold de B. Baruchson, Rev. Arthur R. Cole, M.A., Major J. Grant Crosse, Mrs. Darbishire, Edward W. Green, Thomas Laurence Read, &c.

Telegraphs in Australia.—The *Times* correspondent dates from Sydney, July 15:—It is pleasant to feel that the electricians are bringing together the mother country and her colonies. England is always spoken of here as "home," and all British hearts like the notion of being near London. Black and dingy as it is in comparison with this bright place, its vital forces and associations hold us by a spell. The notion of disassociation is by no means relished by the largest section of the population, and every indication of the shortening of the mail and telegraphic routes that at present connect us is hailed with delight. The improvement of all these means of communication will have a far better effect in maintaining the harmony of the relationship subsisting between us than the appointment of envoys empowered to treat plenarily with the Imperial Government. The formation of the Falmouth, Malta, and Red Sea and Indian Ocean line, the Turkish line, *viâ* Constantinople, and the Prusso-Russian line, both of which gave their telegrams to the Persian Gulf cable, are all strong links in the chain of our good understanding. Already we were informed on the 2nd of July of what transpired in England and Europe up to the 11th of June, which is an interval of three weeks exactly. This period may be further lessened by lines now in progress. When the Falmouth and Malta Company can connect Australia with Singapore, or the Eastern Oceanic Company, leaving Singapore to the left, carry their line from Ceylon to Java Head, and so on to Western Australia, the connection will be virtually as complete as it is now between India and England. We, too, are much interested in the battle of the postal routes, and feel confident that two will in future be open to us, one *viâ* America, and one or two *viâ* such means as shall be provided.

Journal of the Society of Arts.

FRIDAY, OCTOBER 14, 1870.

PROCEEDINGS OF INSTITUTIONS.

The Union of Lancashire and Cheshire Institutes.—The annual meeting of this Union was held on Thursday last. Sir T. Bazley, Bart., M.P., presided at a meeting for business, which was held in the afternoon, in the lecture-hall of the Mechanics' Institution, David-street. There was a large attendance of gentlemen representing Institutions in various parts of Lancashire and Cheshire. The Council, in their annual report, which was read by the honorary secretary (Dr. Pankhurst), said that the operations of the Union had been attended with gratifying success. The past and impending changes in the position of the cause of education had only tended to consolidate the forces of the organisation, and deepen its hold upon the sympathy of its friends and supporters. The number of Institutes now in Union was 126, of which three had been admitted during the past year. The Council had given a prominent place to class instruction, which, wherever it had been adopted, had produced good results. The importance of technical instruction had been constantly kept in view. The efforts of the Council in this direction had been attended with gratifying success. Science-teaching had always occupied a high place in the policy and action of the Union. The result, however, of unwarrantable changes made by the Department of Science and Art, had been greatly to lessen the number of successful candidates at the examinations. Representations made by the Council had caused a modification in the action of the Department, so that, in regard to geometrical drawing, all papers equal to a second grade in art were "passed," and a payment of ten shillings each was made on them. The Council were decidedly of opinion that if science-teaching were to be put upon a sound and durable basis, the essential condition of a reasonable permanency of policy must not be wanting. Institutions, teachers, and students might then adopt such arrangements as would enable them to take the fullest advantage of the provisions made. The institution of the Rumney Science and Art Exhibition had a most salutary effect. Mr. Alderman Rumney's example had been followed by Mr. J. A. Bremner, and the Council were pleased to announce the foundation of a Bremner Science and Art Exhibition. The teachers' science classes had, during the past year, been attended with success. Students had been contributed by thirty-nine schools. In May, forty-five candidates passed the examination of the Department of Science and Art. The visiting agent, Mr. Lawton, had continued during the year to inspect and examine the classes of the Institute, and had been able to render valuable services in the provision of educational machinery and teaching power. The Council, in the present position of the Union, felt that much of its future usefulness depended upon the extent to which the organisation acquired a real permanency of constitution. One source of such permanency was the existence of adequate pecuniary resources. In acknowledging heartily the contributions and subscriptions of the friends of education, the Council hoped that all that was wanted of money aid would not fail to arise to those charged with the conduct of the affairs of the Union.—The Chairman said he was sure that only one desire pervaded the meeting, namely, to extend sound and useful information. The report was exceedingly satisfactory. The progress which had been made would, in all probability, have been greater than that reported in the previous year, if an unfortunate change had not been made by the Privy Council, which diminished the fair reward to which schoolmasters were entitled. He rejoiced in the hope that there was a brighter future in store for the people as regarded education. Happily, a scheme had been adopted by Parliament which was likely to work satisfactorily. It was a scheme not absolutely in accordance with his wishes, or those of many of his friends; but, having regard to the opinions prevailing, both in and out of Parliament, he believed that the Education Act was a reflex of the existing public opinion of the country. Increased intelligence on the part of the people, which might now be hoped for, would bring about the blessings of increased sobriety, with all the comforts that resulted from higher and mental acquirements. There was on every hand in our manufacturing industry increased competition, and a consequent necessity, not only as a matter of self-interest, but for the interest of the nation, for improved intellectual culture on the part of the people. Ignorance was the prime cause of much physical suffering. How many deaths resulted from boiler explosions caused by the ignorance or carelessness of employés? There were positively more deaths from such accidents than arose from accidents on railways. In every direction they saw the necessity for a better educational system than that which the country now possessed.—Dr. John Watts moved, "That in order to secure increased efficiency in the work of science-teaching, it is desirable that greater permanency of character should be given to the scheme of the Department, and especially that the remuneration of science-teachers should not be decreased.—In the evening a public meeting was held in the Town-hall, under the presidency of the Earl of Ellesmere. The Chairman, in addressing the meeting, said that so soon as the new Education Act came into operation, the Lancashire and Cheshire Union of Institutes, and all kindred Institutions, should bestir themselves. Elementary education being then assured, their energies should be directed to promoting the higher branches of technical and scientific instruction, so that every artisan might become skilled in his trade, and every miner might have a theoretical, as he had, unhappily in many cases a too practical, knowledge of the gases which he met with. He wished success to the Union, which he felt sure was doing a good work.—The prizes awarded to the successful candidates in the recent Examinations were distributed by the Bishop of Manchester. At the conclusion of his work, the Bishop said the Union of Lancashire and Cheshire Institutes, in its promotion of education, was likely to be of great benefit to the community. Unhappily, amongst the class from which the competitors for honours were mostly taken, education terminated at far too early an age. The great danger was that when young people left school, say, at fourteen, they were unable to realise the value that learning would be to them in after life. They had not sufficiently taken the measure of the opportunities that would be either open to them or denied to them, according to their proficiency in education; and he was afraid few English boys possessed that direct literary or industrious turn of mind which would induce them to continue their studies at home. Therefore, Mechanics' Institutes and evening classes, which had for their object the sustaining of a desire for learning, and the placing before those who had that desire opportunities through which they might gratify it, were likely to form a piece of machinery very beneficial to the community. No doubt there were difficulties in the way of a prize scheme such as theirs was, but its advantages far outweighed any disadvantages that it might be supposed to have; and the stimulus they all needed to cultivate their faculties was a thing that they could not afford to despise. The Union, he considered, acted upon

a principle which would commend itself to the judgment of all sensible persons, when it encouraged a desire for secondary education among young men and women through the medium of prizes. He observed in the journal of the Union the statement that the country had gone back educationally, and the reason of the retrogression was said to be because classical education had for two centuries overridden modern languages, and the teaching of the grammar of dead languages had crippled the teaching of modern languages. This was a statement which he could hardly endorse. In his opinion, grammar was much more soundly and accurately acquired through a dead language than it was through a living one. He did not think that any retrogression educationally—if such there was—was to be traced to any influence that the study of the ancient languages might have exercised over the system of instruction. It might rather be traced to the uncertainty now prevailing in the public mind as to which, after all, was the best of the two methods. For his part, he was contented with the method that was pursued in his own case, namely, the classical. At the same time, he lamented that in the public schools too close attention was paid to the classical languages, to the neglect of that which would be useful in the practical business of life. The mischief was that pupils spent an inordinate amount of time over the work which they professed to do, and, further, that there was an inordinate amount of time spent by them in idleness. The ambition of many parents was that their children should acquire all manner of useful knowledge. The business of education, however, was not to cram young people with information on a multiplicity of subjects; it was rather to teach the mind what faculties it possessed—to put an edge on them, by educating them to their legitimate strength; and by those means to turn out a young man, at the age of 18 or 20, prepared to grapple with the difficulties and phenomena of life, with the confidence of a man who knew what he was about and who had the faculty of self-reliance. His advice to the recipients of prizes was that they should concentrate their energies upon a few subjects, rather than dissipate them upon many.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The exhibition buildings are making rapid and satisfactory progress. The painters and decorators are already at work; indeed, in the fine art galleries they are completing their labours, and it is contemplated by the Commission to invite artists and proposed exhibitors of fine art works to pay a visit of inspection to this portion of the building, in which they are more immediately interested.

The exhibition of machinery in 1871 promises to be an exceedingly fine one, especially in such as are employed in the manufacture of woollen and worsted goods; with the brick and tile-making machines, these will all be in motion, so that their most interesting features will be freely shown.

The Commissioners, by a recent circular, have given notice that, being desirous of affording the manufacturers of steam-engines an opportunity of bringing their latest improvements before the notice of the public, they are prepared to receive applications from those manufacturers whose steam-engines possess features of novelty, and who are willing to allow the gratuitous use of them in supplying the motive power required for the purposes of the exhibition. Any manufacturer being disposed to exhibit on these conditions should send a short description of the engine they propose to exhibit to Lieut.-Col. Scott, R.E. Only a limited number of engines will, of course, be required.

The French supplementary gallery, notwithstanding the war, is being rapidly proceeded with by the French Commission. These supplementary galleries are to be erected solely with the object of giving additional space to the exhibitors selected for admission into the Annual International Exhibitions, and are only to be used for the display of objects corresponding with those prescribed for each particular year.

The Commissioners request that manufacturers of brick and tile-making machines intended to be shown in motion at the ensuing Exhibition of 1871, will, in forwarding their applications for admission, specify the weight, dimensions, and requisite horse-power of each machine to be exhibited.

The authorities of schools, &c., desirous of taking part in the first Exhibition of the series, which will be held in 1871, are requested to fill up a form of preliminary application, and to forward it without delay to Lieut.-Col. Scott, R.E., secretary, offices of Her Majesty's Commissioners, 5, Upper Kensington-gore, London, W. The information required is the name and address of the applicant and of the institution which he represents; the number of scholars attending the school; the nature of the specimens proposed to be submitted, distinguishing the sub-sections to which they belong. The following are the sub-sections:—*(a.)* Writing, plain and ornamental. Examination papers and other works showing the results of general, scientific, and artistic instruction. *(b.)* Drawing and design. *(c.)* Modelling in clay, plaster, cement, wax, and for terra-cotta; carving in wood, &c. *(d.)* Models of machinery, building construction, &c. *(e.)* Needlework, plain and ornamental, lace, knitting, plaiting, &c. *(f).* Miscellaneous work by pupils in schools for the blind, reformatories, &c.

AN INTRODUCTORY LECTURE TO THE DEPARTMENT OF THE EVENING CLASSES AT KING'S COLLEGE, LONDON.

By Leone Levi, Esq., F.S.A., F.S.S.,

Of Lincoln's-inn, Barrister-at-Law; Professor of the Principles and Practice of Commerce and Commercial Law in King's College; Doctor of Political Economy; Dean of the Department.

Delivered on Friday, October 7th, 1870.

After a few introductory remarks, Professor Levi said:—It is not my intention this evening to dwell at any length on any specific branch of science taught in these classes. The purpose of my address is rather to encourage you in the task on which you are about to enter. Would, indeed, that I could bestrew your path with flowers, and that I could help you to gather out the stones which lie in the way to the acquisition of knowledge. But, if I cannot do this, permit me at least to remind you that, if it be troublesome and deep digging for pure waters, once you come to the spring, they rise up and meet you. Happy, indeed, that with a mind as yet almost free from distracting thoughts you are able to give yourselves to so useful a labour. How often do I throw a longing glance back to the days when I occupied your place in a school far away in beautiful Italy, and when, little thinking of difficulties, I was building castles in the air of future triumphs and glories. But there is deep philosophy in cultivating a cheerful and expectant mind. With Carlisle I am disposed to say, "Give us, O give us, the man who sings at his work. Wondrous is the strength of cheerfulness—altogether past calculation its power of endurance Efforts to be permanently usefu

must be uniformly joyous, a spirit all sunshine, graceful from very gladness, beautiful because bright."

A great work is before us. All around us we have an immense amount of productive power. It is ready for labour; it has all the stimulus necessary, much honour to gain, great prizes to win. But the mind, like steel, requires furbishing; like an engine, it is only available when in the highes state of efficiency. How much power is laying waste, how much is misapplied, how much is rendered abortive of result, from ignorance and unpreparedness, we may well imagine, if we cannot absolutely calculate. Now, the purpose of these evening classes is to aid you in developing those powers which you possess —to impart to you the mode of discovering many secrets of nature which lie hidden to an uncultivated mind; to put you in possession of the means by which you may, in its true economic sense, become productive labourers, honoured and honourable workers in the great field of human industry. For I imagine that most if not all the students of the evening classes are intent upon pursuing a life of activity and usefulness, and in making their studies prove not only ornamental to their existence, but useful in their occupations of life.

To a commercial nation like this, a knowledge of the principles which regulate commerce and banking is of primary necessity, and most interesting it is to examine the many perplexing phenomena of the foreign exchanges, and to think of the probable effects of such new channels of commerce as the Isthmus of Suez Canal and oceanic telegraphs may have on the commerce of the world. The study of commercial law, also, is one most valuable as a preservative for the safety of commercial transactions carried on all over the world, whilst attention to the principles of the law of nations may be of immense advantage, now that the sad spectacle is beforo us of a keen and exterminating war between two of the foremost nations in Europe. Political economy is becoming daily more important, and we must consult it for the interpretation of history and social progress, and English law commends itself to every one of us as a preparation for the efficient discharge of the many offices to which we are liable. Last, but not least, however, is the important section of our labours dedicated to the physical and natural sciences, including drawing and mechanics, chemistry and physics, mineralogy and geology, physiology, botany, and zoology. It speaks well for the discriminating skill of our students, that they profit so largely by the opportunities offered them of studying these sciences under such guidance as our able professors can afford. Alas! we have just been reminded that, professors or students, here we have no continuing city. Professor Miller, one of our brightest luminaries, in the midst of his days, in the plenitude of his powers, has just gone from us.

There is a great completeness and variety, certainly in our scheme of studies for the session we are now commencing; and I can well imagine that it may be a source of grave deliberation with many students ere they can decide which of these attractive studies is entitled to their special preference. To learn them all is impossible. To have a smattering of many sciences is of but little use. But you need have no such difficulty of selection if you have some definite idea of the occupation or profession you wish to follow. Do you nourish a silent desire to be a great merchant—to become a millionaire some day, sooner or later? Do you wish to have a seat as a governor of the Bank of England? Or to reach the position of scientific producer, like Whitworth, Armstrong, or Fairbairn? Or to to possess the skill and calculating power of a Watt, or the engineering grasp of a Stephenson? Or do you, *bona-fide*, anticipate the day when you may be the Lord High Chancellor? Are these the fancies that run in your mind whilst you are quietly pursuing the studies before you? My friends, I congratulate you for nourishing in your hearts the ambition of rising to great altitudes. It is well to have an honourable ambition. But you must not lose time. Begin at once to learn those branches of science which you will absolutely require. Suffer nothing else to distract your mind, or to dissipate your powers. The great difficulty you have to contend with is a disposition to frivolity, restlessness, inconstancy. Have, then, a stern, unsubduable will to conquer, and you will conquer everything. When Alfieri was asked how did he succeed to become a poet, he answered—

"Volli, semque volli, e fortissimamente volli."

"I willed it, I always willed it, and intensely willed it." Depend upon it, it is not so much to any natural gift that we owe our success as to the firmness, and even obstinacy, with which we set ourselves to master the difficulties before us. And dismiss any idea, I pray you, that you will get on quite as well without any hard study, for it is not so. It is now universally admitted that scientific knowledge is absolutely necessary for every industry, and employers will not employ persons who do not possess it. We may fancy that a mechanic or artisan, a clerk or an officer, may become, by practice and observation, insensibly disciplined to perform works by the hands with wonderful dexterity, but I doubt whether the clear head and the sound judgment necessary for any profession can be acquired by merely inspecting what others are doing. Let the transactions of a counting-house be ever so important and diversified, let them be ever so judiciously conducted and methodically adjusted, yet if a youth is not furnished with the requisite knowledge to obtain the best advantage from what he sees there transacted, he will not be much the wiser for it. All that is done will seem to him confused and perplexing, and, after years of labour, he may remain utterly unprepared to take a wide and firm grasp of the various operations which are necessary in the prosecution of business. A combination of study and practice is the best preparation for the professional or mercantile career. "The time is past," said Dr. Lyon Playfair, "when practice can go on in the blind and vain confidence of a shallow empiricism, severed from science like a tree from its root. The rudest sailor may steer his ship in the direction of a landmark, but without compass and sextant he dares not traverse the expanse of ocean. Ignorance may walk in the path, dimly lighted, of advancing knowledge, but she stands in dismay when science passes her, and she is unable to follow, like the foolish virgin, having no oil in her lamp. Depend upon it, an empiric knowledge of practice is not the way now to succeed in the struggle of individuals, or in the struggle of nations. Intellect is on the stretch to get forward, and that nation which holds not by it will soon be left behind. For a long time, practice, standing in the pride of empiricism, and in the ungrateful forgetfulness of what science has done in its development, reared upon its portal the old and vulgar adage, 'an ounce of practice is worth a ton of theory.' This wretched inscription acted like a Gorgon's head, and turned to stone the ascription of science. Believe it not; for a grain of theory, if that be an expression for science, will, when planted, like the mustard seed of Scripture, grow and wax into the greatest of trees."

But, gentlemen, it is no longer at your option whether you should trouble yourselves with much study or not. The day is gone when favour or position will enable you to obtain any promotion. See what is being done in almost every profession. A few years ago, the Civil Service was entirely reserved for persons in the enjoyment of patronage. Now it is open to public competition. By an Order in Council, dated 4th June, 1870, "all appointments are henceforth to be made by means of competitive examinations, open to all persons who may be desirous of attending the same." We might, indeed, have wished that a certain number of nominations should be put in the hands of the leading schools and colleges, to be awarded to students, who, besides obtain-

ing the highest number of marks in the ordinary examinations, should give also evidence of high character and morals; but, as it is, we thank Mr. Gladstone most heartily for the great boon he has conferred on the nation. And it is not a light reform to have taken from the hands of official patrons the entire service of the Crown, and to have made it the prize of ability, industry, and good education.

In the law, you cannot become a solicitor until you pass several examinations, and have served a clerkship with some practising attorney for five years. Before you can bind yourself by articles of clerkship you must pass an examination on general subjects. About the middle of your service, there is an intermediate examination on legal subjects, and before you are admitted you must again go before the examiners. In the higher branch of the legal profession (the bar) equal advance has also been made. You cannot now become a barrister by simply eating so many excellent dinners. To be admitted as a student at any of the Inns of Court you must pass a preliminary examination, and afterwards no student is eligible to be called to the bar unless he has attended one whole year the lectures and private classes of two of the readers, or has been a pupil during one whole year in the chambers of some barrister, or have satisfactorily passed a general examination. If you turn your attention to medicine, you will find that no one is allowed to practise as physician unless he has passed an examination on the subject of general education recognised by the college, unless he has been actually engaged in professional studies, and attended the surgical practice of a recognised hospital. For the profession of architect or engineer, no such conditions are imposed, but the Royal Institute of British Architects is giving earnest attention to the better education of members of that profession, and has instituted a voluntary examination, and the Institutes of Civil and Mechanical Engineers are offering many inducements for the general advancement of mechanical science, and the promotion of that species of knowledge which constitutes the profession of a civil engineer. In the army, you cannot have the command until you pass an examination. In the church, you cannot obtain a license without years of preparation. You cannot exercise the profession of an actuary unless you pass the examination instituted by the Society of Actuaries. You cannot be master or mate of a merchant ship unless you pass the examination of the Board of Trade. And if, in some professions, as the mercantile, no such examination has as yet been instituted, though an attempt has already been made in that direction, do not trust, I pray you, upon such exemption for your progress, for unless you are at least equal in knowledge to your competitors, you can have no hope of success. Nor is it otherwise in manufactures. Whence this movement for technical education? It arose from the fact that we now see that in industrial art other nations have been making greater progress than ourselves. It is now, indeed, universally recognised that if we wish to succeed in any branch of our industry, to sturdy will and strong hands we must add some knowledge of science, a cultivated mind, and a refined taste. Education and science can no longer remain the ornament and luxury of the few, they must become the necessary endowment of the many, if we will take a high place in the great arena of international competition. To what but to science does England owe her great achievements? Mechanical and chemical sciences have revolutionised the productive power of the country. It was but yesterday that in the coal beneath our feet we found a primary source of colour, which is fast rendering England independent of the most costly dyewoods, hitherto consumed in the ornamentation of textile fabrics. If you will see what science does for industry, visit the chemical works on the Tyne, and examine how, by a wonderful interchange of elements, they not only transform one article into another, but produce new articles altogether. Yet with all our discoveries and all our advantages here we are but little in advance of other countries, and our only hope of maintaining our position depends on the success which we may yet have in fathoming the inexhaustible secrets of nature, in the increase of the number of patient yet ardent votaries of science, and still more in the diffusion of education and scientific knowledge among the great body of labourers. On every ground, therefore, personal as well as national, be you diligent in getting a very good stock of knowledge, to fit you for whatever occupation or profession you prefer to follow.

But will you permit me to add that even knowledge is of little account unless accompanied by true wisdom. Remember that "knowledge and wisdom, far from being one, have ofttime no connection. Knowledge dwells in heads replete with the thoughts of other men; wisdom in minds attentive to their own. Knowledge descries alone; wisdom applies. That makes some fools, this makes none but wise." In truth, I scarcely know which of the two is, after all, most required. Most desirable it is to know a good deal, but unless you have the faculty of deciding wisely and fairly, unless you are able to act judiciously and wisely at the right moment, your knowledge is of but little use. As has been well said, it is the possession of this great faculty, wisdom, that makes the statesman, the judge, and the general. It was a judicious investment that founded the golden house of Rothschild. It was a series of judicious movements, well-planned campaigns, and masterstrokes at critical moments, that created the military renown of Julius Cæsar, Marlborough, and Wellington. It was a succession of judicious deliverances, emphatically called judgments, the enunciation of the lawful and the right amidst perplexing elements, that created the imperishable fame of l'Hôpital and D'Agaisseau, of Marshal and Story, of Mansfield and Stowell.

In pursuing your studies, guard yourself from the temptation of cramming your mind, or stuffing in as much as possible of intellectual food in the briefest possible time. It is as true of a mental as of a mechanical effort, to produce any effect at all a certain time is necessary. The mind must be saturated with a subject before it can be said to make it its own. There are two evils connected with the system of cramming. First, you attempt to do in a month that which requires a year, a most mischievous course for your digestive powers; and, secondly, you are tempted to try too many subjects at a time, by which probably you succeed in none. The true principle is to take up one subject, to work it, to leaven the whole understanding with it, and then to go to another. I do not mean to say that you should take to learning so leisurely as to study only one subject at a time. The experience of our evening class students is that they can, without inconvenience, take at least two classes each. But you must proceed *pari passu* with them. The cramming that is to be deprecated arises when, after a lengthened idleness, you give yourselves all of a sudden to acquire just what is required to pass the dreaded examination. What good would it be to you were you carefully to listen to the first and second lectures, then discontinue your attendance for a long time, and begin again to come very near the examination? The distinction between the work in these classes and the attendance at the public lectures in any literary institution is just this, that whilst there the chief object is to render the lecture interesting, here our aim is to render it instructive; and, whilst there you may hear some single point well treated and illustrated, here you begin at the beginning, and end with the end, each branch of study being pursued systematically throughout.

And don't be afraid to work lest your health should be impaired. It is a common saying, "It is better to die of wear than of rust."

"Eschew the idle life!
Flee, flee from doing nought
For never was there idle brain,
But bred an idle thought."

The medical officer who examines the candidates who passed the open competition for the Indian Civil Service reported, that of 469 candidates examined up to last year, as many as 295, or 63 per cent., had an unexceptional development of the frame; 121, or 25 per cent., had only a moderate or mean strength; and only 52, or 12 per cent., were inclined to be weak. Two lessons may be drawn from these facts, one of comfort, and one of warning. The lesson of comfort is, that after all the anxiety and labour of preparing for such examination, after all the studies required—and they are heavy, for the examination is very hard, and in a great number of subjects—a very large proportion of the candidates presented themselves with unimpaired health. As a matter of fact, we find that studious men live quite as long as persons of any other profession. The lesson of warning is, that only 12 per cent. of those inclined to be weak did come forward or passed. A person constitutionally feeble must find it hard to overcome the wear and tear of body and mind consequent on the long-sustained effort necessary for the purpose of such examinations. There is another fact which I will refer to from such statistics—for, as you know, I delight in statistics, I like to reason upon facts—and it is this, that, from 1855 to 1869, as many as 661 certificates in the home Civil Service, and 45 in the Indian Civil Service, were refused on account of character, the proportion being more than 2 per cent. of the whole number who passed. It has been well said, "Every man has in himself a continent of undiscovered character. Happy is he who acts as the Columbus to his own soul." But to what purpose do I dwell on matters of this nature, except to urge you to consider well the whole bearings of the task you are about to undertake, and to exhort you to buckle on your armour against all the difficulties—intellectual, physical, and moral—which beset you and all of us in our endeavours to advance.

For the pursuit of study you possess great advantages. True, many of you are engaged the whole day long in occupations seemingly incongruous. True, you have not much time at your command, nor the opportunity of consulting large quartos. True, you do not move, perhaps, among the learned, nor do you live under an atmosphere of sober and quiet retreat. Such of you as depend upon your own exertions must needs provide for your daily wants, and all honour to you for that, for in performing your task you are really the best benefactors of the community you belong to. All other pursuits must give way to this, and the hours which you devote to learning must be after you have done your work. But you are young and vigorous. And all the while you are working you are able to see how science acts and manifests its wonders. You have the advantage of combining the best possible museum—the illustrations of real life in the day time with the line upon line lectures in the evening. In the midst of your active life, cultivate, I pray you, habits of observation. It was from the simple observation of a body falling to the ground that Newton discovered the law of gravitation. It was from observing the steam rising from the tea-kettle that Watt discovered the steam engine. Observe and record, let that be your effort, whilst you are pursuing your daily work.

But I will end as I have begun. Enter into your studies cheerfully, with the intent to succeed, and enjoying beforehand the pleasure of success. There is pleasure in study, pleasure in contemplating new and extraordinary truths, pleasure in unfolding the laws of the universe, pleasure in fathoming the glorious works of creation, pleasure in perceiving everywhere traces of the great Creator. And do not neglect another source of pleasure always near at hand—the pleasure of friendship towards your fellow students. Enjoy this to the full. Recognising this college as your *alma mater*, nourish in your very hearts thoughts of affection, regard, and sympathy, not only for the place where you are studying, but for your fellow-workers in such studies. Wherever Providence may bring you together in your riper years, let the recollection of happy evenings passed together in King's College prove an abiding bond of recognition, spurring you to regard one another as friends and as brothers; and remember that the eye of this institution will follow you with the earnest desire that the blessing of God, that maketh rich, may be your constant and enduring reward.

THE POSTAL AND TELEGRAPHIC DEPARTMENTS IN SWITZERLAND.

Office of Committee of Privy Council for Trade,
26th August, 1870.

Sir,—With reference to the letter from this Department of the 12th ult., I am directed by the Lords of the Committee of Privy Council for Trade to transmit herewith, for the information of the Society for the Encouragement of Arts, Manufactures, and Commerce, a copy of the answers which have been received from her Majesty's minister at Berne, respecting postal and telegraphic departments in Switzerland.

I am, Sir,
Your obedient servant,
W. R. Malcolm.

P. Le Neve Foster, Esq., M.A.,
Secretary Society of Arts, &c.

Questions Sent from the English Post-office, with their Answers.

1. *What is the unit of weight?*

The unit of weight for inland letters is 10 grammes (about one-third of an ounce).

2. *The prevailing unit of charge?*

The prevailing unit of charge for prepaid letters is 10 centimes (one penny); for unpaid, 15 centimes, excepting for letters in the local districts (two leagues in a right line from the office where they are posted to the office of destination), which are only charged 5 centimes, prepaid or unpaid.

3. *The rate of increase for greater weights?*

Letters weighing more than 10 grammes, up to 250 grammes, are charged 10 centimes in the local districts, prepaid or unpaid; 20 centimes for distances beyond for prepaid letters; 30 centimes when not prepaid. Articles sent by letter-post which exceed the weight of 250 grammes are charged as parcels.

4. *The exceptions to the above, if any?*

The only exceptions made are letters which go free from charge, on Post-office business, letters of the members of the Federal Assembly, during their sitting; of the federal and cantonal authorities, charitable institutions, parochial administration for the poor, and letters from soldiers on actual service.

5. *Does the Post-office undertake house to house delivery, and that free of charge?*

The Swiss post delivers at houses in towns and in the country everything which passes through the post, and this without extra charge. This delivery does not extend to isolated and distant dwellings, such as are situated on high mountains difficult of access.

Inland and other Newspapers and Printed Matter.

6. *What is the unit of weight or of size?*

Printed matter has no limit of size.

7. *The prevailing unit of charge?*

The charge for printed matter, excepting journals subscribed for (see further answer 8), is 15 grammes, 2 centimes; from 16 to 250 grammes, 5 centimes; 250 to 500 grammes, 10 centimes. Their prepayment is compulsory. Printed matter not prepaid is charged at letter rate.

8. *The rate of increase for greater weights or sizes?*

Printed matter above 500 grammes in weight is charged at parcel rate (see article 14 below).

9. *The exception to the above—if any?*

There is no exception, save in those cases where the privilege of franking exists (see No. 4 as above).

Journal Subscriptions.

(6, 7, 8, 9, *as above*).

Swiss journals subscribed for pay a charge of $\frac{3}{4}$ of a centime up to 30 grammes, and $\frac{3}{4}$ of a centime for each additional 30 grammes; their prepayment is compulsory. Besides the above charge, they have to pay a duty of 20 centimes where the subscription is made through the post-office. Foreign journals subscribed for pay a charge of $1\frac{1}{2}$ centime under and up to 30 grammes in weight, and the same charge for every succeeding 30 grammes; their prepayment is compulsory. Besides the above postage, there is still the charge of a duty of 50 centimes by subscription on behalf of the post-office which undertakes the subscription.

10. *Is there any stamp duty or other charge in addition to the postage rates?*

Swiss or foreign journals have no stamp duty to pay in Switzerland. There are no other charges or duty to pay to the Federal government but those above-named.

11. *Are there any restrictions as to weight? Or as to writing and other marks? Or as to time and place of posting?*

There is no restriction in regard to the limit of weight. Printed matter or journals ought not to have anything written on them. A mark on the margin to attract the attention of the reader is not considered by the postal authorities as an evasion of this rule. Journals subscribed for must be posted at the post-office in the place of publication. As regards other printed matter, it may be posted at any office. The hour of posting depends on the hour of the mails leaving.

12. *Does the post-office undertake house to house delivery, and that free of charge? If any charge is made, what is its amount?*

The delivery of printed matter from house to house and journals subscribed for is gratuitous, that is to say, without additional payment, in like manner as letters (see No. 5).

13. *Is the conveyance and distribution of printed matter open to anyone, or has the post-office a monopoly?*

The delivery of printed matter, especially journals in the locality where they are edited, is generally performed by the publisher or editor. The post-office has only the monopoly of carrying closed parcels under 10 lbs. in weight. Printed matter, open in covers, does not really come into the monopoly; nevertheless, its conveyance is generally confided to the post, which undertakes the delivery from house to house without extra charge. Articles sent by letter post, as also by parcel post, may be forwarded by express if they be urgent and the sender requests it, immediately after their arrival at the office, on payment of a special fee. Letters addressed to several persons done up in one packet are considered an infringement of the post-office monopoly. In case of doubt, the post-office authorities have a right to have the packet opened by the person to whom it is addressed in their presence. It is forbidden to address, under cover, to the post-office letters for several persons; if it be done, each letter will be charged as if it had been sent separately, according to the laws regulating the post-office (see Article 4, Postal Regulations).

Parcel Post.

14. *Does the post-office undertake the conveyance and distribution of parcels? If so, what are the regulations as to contents, rate of charge, &c.?*

The Swiss Post-office undertakes the transmission of goods and merchandise of various kinds, and things of value done up in closed parcels; also the payment of money orders. The latter are issued at the larger post-offices for any sum not exceeding 500 francs (£20 sterling); at the smaller post-offices, the limit is 200 francs (£8 sterling). The post-office does not undertake the transmission of articles which will readily become putrid, or anything explosive or liable to sudden combustion, &c., such as gunpowder, gun-cotton, fire-works, ether, photogene, nitro-glycerine, &c. The post-office does not undertake, excepting under special restrictions, the conveyance of very fragile things, things difficult of transmission, or of too great a weight, or too bulky, live animals, or liquids. If posted, the sender is responsible for any damage caused. The terms for sending the parcels is determined by the nature of their contents, the distance they have to go, their bulk, weight, &c.

Additional Parcel Tariff.

To this is appended a copy of the parcel tariff, which applies to parcels of no value as well as to parcels of declared value.* The sender may forward a parcel with or without declaring its value. In case of loss or damage, the post-office allows compensation on the declared value, or, in default of that, on the weight of the parcel. A parcel may be accompanied by a letter to the receiver of the parcel. Printed periodicals may also be added to a parcel. Parcels of value should be securely fastened by means of seals, &c. The address of a parcel may consist of a trade-mark or number, with the place of destination indicated, or in an open letter accompanying it, or in a written address affixed to it. Parcels may be addressed to the residence, or *poste-restante*. Parcels addressed to persons' residences are delivered free of charge, excepting when they exceed the weight of 10 lbs. or the value of 1,000 francs; in this case they pay a uniform charge of 15 centimes for the delivery. They must be handed in direct at the post-office, and may not be put in the letter-box. They can be prepaid or not paid; they are registered; the sender receives a receipt if he wishes it; he may request it to be sent by express to the residence at any hour of the day or night (on condition that the parcel does not weigh more than 5 lbs. or exceed the value of 200 francs). Parcels sent by express are charged an additional rate, according to the distance they have to be taken, and varying according to whether they are delivered by day or night. It must be added that the Federal post makes a regular exchange of dispatches with the German States, Austria, and Hungary, as well as with the French and Italian railways which join the Swiss frontier.

15. *Is the conveyance and distribution of parcels (such as the above) open to anyone, or has the post-office a monopoly?*

The post-office has the monopoly of the conveyance of closed parcels without value, or of declared value, and of money not exceeding the weight of 10 lbs. (5 kilogrammes) inclusively. The post-office, nevertheless, also enters into competition with the private conveyance companies, and conveys parcels of a greater weight, up to the limit of 120 lbs. Above that weight, it does not take them, only conditionally and exceptionally. It effects their conveyance either by the medium of railways, or, on other routes not served by them, by means of their own special conveyances; these conveyances also take passengers. The number of passengers taken by them in 1869 were 1,126,127. It is prohibited to do up in the same wrapper several closed parcels which, separately, would not exceed the weight of 10 lbs., and which are addressed to several persons, and to forward them any other way than by post (see Art 21 of the law on postal taxes).

16. *To what extent is it now, and for what description of parcels, is it brought into use?*

We give below the figures for the transmission of parcels in the interior and internationally in 1860:—

* This tariff is too bulky for insertion here, but these charges vary from 15 centimes for 2 lbs. to 210 cent. for 10 lbs., according to distance.

For the interior	4,774,171
„ Germany	180,179
„ Italy	16,277
„ France	75,307
„ Germany	179,936
„ Italy	12,434
„ France	92,995
	5,331,299

The rough estimate was about 2,751,722·66.

17. *What have been the effects hitherto observed on the retail and wholesale trade of the country?*

The monopoly of the post to closed parcels of the weight of 10 lbs. has not caused any unfavourable effect on the interest of commerce or freedom of industry in Switzerland. On the contrary, it has been acknowledged that the Swiss post, from its low rates, its clearness and simplicity, the extension given to the postal service so as to benefit all localities; and the gratuitous distribution of parcels to the residences of the persons to whom they are directed, affords to the public much greater advantages than could ever be obtained by private means of conveyance.

18. *Does the Post-office enjoy any privilege in the use of the railways for the conveyance of mails?*

Below is given a copy of the Article 8 of the Federal law of July 28th, 1852, concerning the establishment of railways. The Article specifies the obligations of railways to the Swiss Post administration:—

"Art. 8.—The railway authorities must take letters and parcels, without charge, for the post-office, according to the Federal law of June 2, 1849.

"The services of the conductor in charge is also gratuitous.

"If travelling post-offices are established, the expense of their establishment and maintenance is charged to the Federal post administration, but railways are obliged to convey them and the post-office officials gratuitously."

19. *Is the Post-office self-supporting? If so, what is the annual amount of profit or net revenue? If not self-supporting, what is the amount of loss?*

Below is given an account of the receipts and expenditure of the last ten years:—

	Receipts.		Expenses.		Surplus Receipts.	
	fr.	c.	fr.	c.	fr.	c.
1860	6,916,911	56	5,750,488	58	1,166,422	98
1861	7,112,951	55	5,808,661	46	1,364,290	09
1862	7,426,353	70	5,935,730	68	1,490,623	02
1863	7,744,082	52	6,135,174	82	1,608,907	70
1864	7,950,131	52	6,466,829	07	1,503,302	45
1865	8,348,173	07	6,857,306	35	1,490,866	72
1866	8,617,815	66	7,414,054	70	1,203,760	96
1867	8,770,428	37	7,653,584	54	1,116,843	83
1868	8,814,715	57	7,885,615	34	929,100	23
1869	9,447,717	45	8,140,816		306,901	23

The Swiss Confederation having, in 1849, purchased the posts, which till then were the property of the cantons, is obliged to pay them an annual indemnity, and to deduct from the net income of the postal service, a sum not exceeding 1,486,560 francs.

Telegraphs.

I. *What changes have been introduced into the charges for telegram messages, and from what date?*

a. From 25th November, 1852, the message from 1 to 20 words the charge was 1 franc; 21 to 50 words, 2 francs; 51 to 100 words, 3 francs.

b. 22nd January, 1859. The message from 1 to 20 words, 1 franc, with a further charge of 25 centimes for every additional 10 words.

c. 1st January, 1868. The message from 1 to 20 words, 50 centimes, with a further charge of 25 centimes for every additional 10 words.

In the home service the number of dispatches has increased 101 per cent. in the years 1867 and 1868. The following table shows the progress made from 1852 to 1869:—

	Home.	Foreign.	Total.
1852	2,876	..	2,876
1853	74,095	8,491	82,586
1854	109,599	19,568	129,167
1855	133,936	28,915	162,851
1856	169,376	57,696	227,072
1857	192,664	67,500	260,164
1858	180,489	66,613	247,102
1859	196,425	90,451	286,876
1860	208,311	95,619	303,930
1861	217,700	114,233	331,933
1862	241,814	140,638	382,452
1863	298,778	158,093	456,871
1864	325,165	189,787	514,952
1865	364,118	227,096	591,214
1866	383,159	285,758	668,917
1867	397,333	310,687	708,020
1868	798,186	354,906	1,153,092
1869	951,337	418,087	1,369,424

THE NEW POSTAGE ACT.

After thirty years' experience of the penny postage, says the *Times*, we passed, on the 1st of October, to halfpenny postage stamps on post-cards, on newspapers, and on book packets, or pattern, or sample packets, not exceeding two ounces in weight. The "post-card" is a novelty; time will show what can be made of it. In 1840, it was expected that stamped covers or envelopes for letters would be used almost exclusively, and a large supply was provided by the Post-office; but it soon appeared that adhesive stamps would have the preference. The number of stamped envelopes used, however, is not inconsiderable. The public are now at liberty to send their own paper to the stamp-office to be impressed with postage-stamps, and in the financial year 1868-69, upwards of 11,000,000 stamps were impressed on envelopes provided by the public. If all the envelopes stamped in a single day were, when closed, to be laid end to end, their united length would not be less than six miles. We shall see whether the post-cards will not beat them. Before newspaper stamps pass from recollection, one remarkable period of their history should be recorded. It was found desirable to allow some of the principal newspaper proprietors to stamp their own newspapers while printing them, by means of a die supplied by the Inland Revenue Department, and attached to their machines, together with a "tell-tale" to register its movements. This plan was first adopted by the *Times*. There were great difficulties in making this arrangement, but they were all overcome. The Halfpenny Postage Act has been already noticed in our columns, but it is of so much interest, that it may be acceptable if we give a fuller statement now that its day has come. The Act provides that, from and after the 30th of September, 1870, there may be sent by post between places in the United Kingdom, at the rate of one halfpenny—1, a post-card; 2, a book packet, or pattern, or sample packet, not exceeding 2 oz. in weight, or, if exceeding 2 oz., then one halfpenny for every 2 oz., or fractional part of 2 oz.; 3, a registered newspaper (with or without a supplement or supplements), and one halfpenny is to be also the postage on each registered newspaper (with or without supple-

ment or supplements), in a packet of two or more, but the packet is not to be liable to a higher rate of postage than the rate chargeable on a book packet of the same weight. The Postmaster-General, with the approval of the Treasury, is authorised to make regulations as to the pre-payment, dimensions, and maximum weight of packets, the nature of covers, &c., and such other regulations as from time to time seem expedient for the better execution of this Act. The new Act repeals, from and after the 30th September, five other Acts, or parts of them, passed in 1836, 1840, 1848, 1853, and 1855, but the repeal is not to affect (among other things) "any right, title, obligation, or liability accrued before that repeal take effect,"—words which appear to secure, for the usual limited period, the free transmission by post of newspapers with impressed stamp published on or before the 30th of September. In case of need, ordinary letters are to have a preference even over post cards, for the Act provides that where the despatch or delivery from a post-office of letters would be delayed by the despatch or delivery therefrom at the same time of book packets, pattern or sample packets, or post cards, they may, subject and according to Post-office regulations, be detained in the post-office until the next despatch or delivery. The Inland Revenue Commissioners are to provide proper dies and other implements for denoting, by adhesive, or embossed, or impressed stamps, or otherwise, the postage duties payable under this Act; it will not be lawful to use for a letter, &c., sent by post, an embossed or impressed stamp removed from the paper or card on which it was embossed or impressed, although such stamp has not been before sent by post or used. Newspaper stamps in hand, rendered useless by this Act, will be allowed for as spoilt stamps. Any publication coming within the following description is, for the purposes of this Act, to be deemed a newspaper—that is to say, any publication consisting wholly or in great part of political or other news, or of articles relating thereto, or to other current topics, with or without advertisements; but it must be printed and published in the United Kingdom, at intervals of not more than seven days, and printed on a sheet or sheets unstitched, and it must have the full title and date of publication printed at the top of the first page, and the whole or part of the title and the date of publication printed at the top of every subsequent page. The following is, for the purposes of this Act, to be deemed a supplement to a newspaper—that is to say, a publication consisting, wholly or in great part, of matter like that of a newspaper, or of advertisements, printed on a sheet or sheets, or a piece or pieces of paper, unstitched, or consisting, wholly or in part, of engravings, prints, or lithographs illustrative of articles in the newspaper; such publication in every case being published with the newspaper, and having the title and date of publication of the newspaper printed at the top of every page, or at the top of every sheet or side on which any such engraving, print, or lithograph appears. The proprietor or printer of any newspaper within the above description, or of any publication which, regard being had to the proportion of advertisements to the other matter therein, is not within the above description, but which was stamped as a newspaper before the passing of the Act 18 and 19 Victoria, cap. 27, may register it at the General Post-office every year in such form as the Postmaster-General directs, paying a registration fee not exceeding 5s.; the Postmaster-General may, from time to time, revise the register, and remove therefrom any publication not being a newspaper, and his decision (or that of the Treasury in case of appeal) on the admission to or removal from the register of a publication shall be final. Every publication for the time being on the register will be deemed a registered newspaper for the purposes of this Act, and will be deemed a newspaper for the purposes of any postal arrangement or convention with a colonial or foreign government. Existing Treasury warrants and Post-office regulations relating to the postage on newspapers, book-packets, and pattern or sample packets, passing between the United Kingdom and places out of it, are continued until altered. On any question whether a publication not being a registered newspaper is a newspaper or a supplement, or whether a packet is a book-packet, or pattern, or sample packet within this Act, or any Treasury warrant, or Post-office regulations, the decision of the Postmaster-General, or of the Treasury (in case of appeal) shall be final. If any registered or other newspaper, supplement, publication, packet, or post-card, is sent by post otherwise than in conformity with this Act or any Treasury warrant or Post-office regulations, it is to be either returned to the sender or forwarded to its destination, charged with postage not exceeding letter postage, or without any additional charge, as the Postmaster-General, with the approval of the Treasury, directs.

The Pattern Post.—The *Field*, of the 8th inst., says:—"With the present month the public have come into the enjoyment of certain additional postal facilities—newspapers are transmitted more cheaply than before, book packets of two ounces are carried for a halfpenny, and for the same modest sum a post-card is sold, which dispenses alike with paper, envelope, stamp, and secrecy. But, while the chiefs of the Post-office thus give with one hand, they take with another. For some time past, the privilege of sending little parcels by means of the 'pattern and sample post' has been allowed, although the articles may not have actually been patterns or samples. For instance, an angler in a remote part of Scotland, Ireland, or Wales, could write to London or elsewhere for lines or baits, and, in the course of a post or two, receive a little packet costing only a few pence for postage; whereas the charge would have been prohibitory as a letter, and conveyance by any other means would be out of the question. But all such things are now to be stopped; the new postal regulation declares that henceforth 'the pattern and sample post is restricted to *boná-fide* trade patterns or samples of merchandise. Goods sent for sale, or in execution of an order (however small the quantity may be), or any articles sent by one private individual to another, which may not actually be patterns or samples, are not admissible.' But we really cannot understand why one man who wants to sow a hundred acres of land should have four ounces of seed sent to him for a penny stamp, while another who wishes to purchase a shilling's worth of vegetable seeds for his garden can only have it forwarded at the rate of twopence an ounce, or eight times as much as the other. Nor can we see why two gardeners, living far apart, should be precluded from making a gift or interchange of seeds without being mulcted to the same extent. And similar circumstances arise in other trades, where a manufacturer can send a specimen to obtain an order of £50 or £500, but a retail dealer may not send the same article in exchange for a dozen postage stamps, nor a parent send it as a present to a child at school. Moreover, we fail to see, when a seedsman sends out a number of packets, how the Post-office authorities are to know which are *boná-fide* samples and which are sent in execution of small orders. It seems to us that the new regulation offers a premium to dishonesty, and that if it could be carried out strictly it would not only place a very undesirable check on intercommunication between widely-separated districts, but would have a tendency adverse to the revenues of the Post-office. All these packets require the despatch of one letter; very frequently a reply is necessary; and often there is further correspondence—all of which would be cut off with the stoppage of the cause for writing. The alteration we think a mistake, and the sooner it is rescinded the better."

Unused Postage Stamps.—The *Standard* has a letter to the following effect from a correspondent:—"In my business I use entirely the penny embossed envelopes, and I have at the present moment a very large quantity of embossed stamps torn from damaged envelopes on

hand; surely they must retain their value. I sincerely hope that the Post-office authorities will, if they forbid the use of embossed stamps, issue immediate instructions to postmasters to exchange them for the ordinary adhesive labels, and unless this is done it will be a vast injustice to the British public."

Halfpenny Postage.—The Secretary of the Post-office has intimated to a City firm that invoices, out of envelopes, may be sent at the halfpenny rate of postage.

An Ocean Penny Postage.—The *English Mechanic* says:—"We have an inland penny postage; why not an ocean penny postage? If a letter can be taken from London to Liverpool for a penny, why can it not be taken from Liverpool to New York for another penny, and from New York to Philadelphia say for an additional penny? It can be done, and done with advantage to all concerned; and we venture to say that it will be done—and perhaps soon. The government now takes a letter from London to Liverpool and delivers it for a penny, and makes a gain out of the transaction. It can even with still greater gain take a letter from Liverpool to New York for a similar sum. Let us suppose that an ordinary letter weighs half an ounce. There are 71,680 half-ounces in a ton; 71,680 pennies are nearly £300. The cost of carrying a ton from Liverpool to New York is less than £10. There is, therefore, no reason why the British government, having in their hands the necessary mail facilities, should not take a letter across the Atlantic for a penny. There is, in fact, every reason why it should. It would be hailed as a boon by ten thousand emigrants in America and the friends of emigrants here."—In connection with this subject, it may be interesting to the members if the following is reprinted from the "Weekly Notes of Proceedings of the Society," published May 8th, 1852. The association referred to was the Postage Association, established at the Society of Arts, which effected among other things the reduction of the Australian postage to 6d. "A deputation from the association formed to promote the establishment of a low uniform rate of international postage had an interview on Monday with the American Minister, at his residence in Piccadilly. The deputation consisted of Sir John Boileau, Sir John Burgoyne, Mr. W. Brown, M.P., Don Manuel de Ysasi, Mr. Elihu Burritt, Mr. Henry Cole, C.B., and Mr. J. C. Macdonald. Sir J. Boileau introduced the subject as one possessing the greatest claims to the favourable notice of the governments both of the United States and of Great Britain, since nothing would tend to unite more firmly the two countries than easy and cheap communication between this country and those who were constantly emigrating in such large numbers. These emigrants were of the poorest classes, to whom the proposed reduction would be peculiarly beneficial.—Mr. Burritt spoke to the very general feeling in favour of cheap postage amongst the people not only of the United States, but of the colonies of Canada, Nova Scotia, and New Brunswick, in proof of which he exhibited petitions, largely signed by the chief official and private persons of those colonies.—Sir John Burgoyne expressed his astonishment that this change had not been made before. We are daily witnessing the good effect of reduction in prices, and are continually discovering, what the Chancellor of the Exchequer had so lately expressed, that the return after reduction is larger than was expected; nor could there be any reason to believe that the reduction now sought would be attended with other results. He hoped that America would set the example to England, if this country did not very soon take the first step.—His Excellency, in his replies to the observations of the deputation, said that he had already expressed his opinion in favour of the greatest possible reduction of ocean postage, both officially and private, to his own government and to ours. Looking to the vast emigration annually taking place to the United States, from out of the poorest classes of Great Britain, it was most important to both countries that epistolary correspondence should be rendered as cheap as possible. He found that nearly one-half of the postage between the United Kingdom and America is paid by the poorest classes of Irish, whilst the large number who emigrate thither from Germany are all very poor, and, on this ground, he thought it both the duty and the interest of the various governments to make the change even at their own cost. But his opinion was that, even at one penny, in five years it would be self-paying. He deprecated the adoption of half-measures; a reduction to sixpence was sure to end in failure. Without committing himself so far as to say that his government would take the initiative, he believed that any advances made here would be at once fully responded to by the United States."

EDUCATIONAL NOTES.

The Committee of Council on Education, to whom power was specially given by the Act to fix the boundaries of the metropolitan districts, specified in the fifth schedule, and the number of members to be elected by each division, and also to nominate the deputy returning officers, have issued the following order:—

"1 Each of the following divisions—viz., Tower Hamlets, Hackney, Southwark, Westminster, Chelsea—shall have the same boundaries as the parliamentary borough of the same name, excluding such parts as are outside the said metropolis.

"2. The division of Finsbury shall include such parts of the parliamentary borough of Finsbury as are within the said metropolis, and the parts of Furnival's-inn and Staple-inn respectively which are outside the said borough of Finsbury.

"3. The City division shall include the area comprised within the parliamentary borough of London, except those parts of Furnival's-inn and Staple-inn which are within such borough.

"4. The division of Marylebone shall include the parliamentary borough of Marylebone and the parish of St. John, Hampstead.

"5. The division of Lambeth shall include the parliamentary borough of Lambeth, all those parts of the parishes of Lambeth and Camberwell outside the boundary of the said borough, and the Wandsworth district, as described in Schedule B, part 1, of the Metropolis Local Management Act, 1855.

"6. The division of Greenwich shall include the parliamentary borough of Greenwich, and all those parts of the parishes of Greenwich and Woolwich, and of the districts of Plumstead and Lewisham as described in Schedule B, part 2, of the Metropolis Local Management Act, 1855, which are outside the said borough of Greenwich.

"7. The returning officer for the first election of the School Board for London shall be the Right Hon. Russell Gurney, one of her Majesty's counsel, Recorder of London.

"8. The School Board for London shall consist of 49 members elected as aforesaid; and the number of such members to be elected, and the deputy returning officer in each division shall be the numbers and the persons respectively mentioned in the second and third columns of the Schedule annexed.

"9. 'Parliamentary Borough' in this order shall mean a borough as defined by the Boundary Act, 1868."

The number of members to be elected in each division is as follows:—Chelsea, 4; City, 4; Finsbury, 6; Greenwich, 4; Hackney, 5; Lambeth, 5; Marylebone, 7; Southwark, 4; Tower Hamlets, 5; Westminster, 5.

Mr. G. W. K. Potter, secondary, is nominated as deputy-returning officer for the City. In the other divisions the name of a vestry clerk is given.

On the 5th inst. a meeting of the London Branch of the League was held in Freemasons'-hall. The report

stated that from its commencement in July, 1869, down to the present time, 1,016 members had been enrolled, 31 public meetings held, and 15 district committees formed in the metropolis and its suburbs. As upon the composition of School Boards would greatly depend the successful working of the Act, the committee would hold it to be one of its most important duties to co-operate with the various district committees in selecting the names of members for the Metropolitan School Board, and to promote the election of the most suitable persons. Some difference of opinion appeared to exist, and one of the speakers especially protested against the League proposing to employ agents to interfere in elections for the local school boards, which, he thought, would be a great evil, and would multiply the divisions which nearly always existed in elections.

On the 7th instant, however, a meeting, specially called by the London branch of the League, was held in the same hall, for conferring as to the best course to be taken to secure united action, so as to return the best and most liberal men at the Metropolitan School Board. It was then stated that preliminary meetings had been held in the various boroughs, and that the following persons had been nominated as representatives—Finsbury, Messrs. Galbraith and Lucraft; Chelsea, not decided; Tower Hamlets, Messrs. Mathias, C. Colin, Dr. Bowkett, Le Lubea, Repton, and Retts; Marylebone, Professor Huxley, Mr. R. Cremer, Miss Garrett, F. Pennington, and J. Guedalla; Lambeth, Messrs. Howell, Stainsby, and Mottershead; Hackney, Mr. J. Hales; Southwark, Mr. G. Odger and Mr. Stafford. Many of the speakers complained that they had not received the assistance from the League they had a right to expect, and Mr. Odger said that so far as the working classes were concerned, he was for independent action. It may be mentioned that Professor Huxley has consented to be put in nomination.

The executive committee of the Education Union have passed a resolution urging the friends of religious education to bestir themselves in every district of the metropolis, so as to secure the return, as members of the School Board, of "those who are favourable to religious liberty in national elementary education, and the just treatment of existing voluntary schools."

On the 6th inst., the Bishop of Manchester presided at a meeting of churchmen at the Manchester Town-hall, in order to form a board of education, and to take steps to supply school accommodation in districts of the diocese at present inadequately served, so as to forestall, as far as possible, the operation of the Education Act as to school boards and rate-aided schools.

With reference to technical education, a deputation, consisting of members of a committee of a proposed national university for industrial and technical education, has had two interviews with the Lord Mayor. Among those present were Mr. Alderman Gould, of Kingston, Dr. John Mill, Colonel J. M. Carter, Captain Mercier, Mr. John Dale, Mr. Thomas Braithwaite, Mr. F. Rhys Thomas, and Dr. Carter Blake. On the first occasion, Dr. Mill read a report, with the view of showing the advance that had been made over England in recent times by continental nations in reference to arts and manufactures, but the Lord Mayor expressed an opinion that the publication of such a report would hinder the spread of technical education, as its statements were greatly exaggerated, and he recommended that the document should be modified. This having been agreed to, a second interview took place, when the amended report was presented. From this it appeared that the committee, having received the adhesion of 50 mayors and provosts of most important industrial cities and towns in the United Kingdom, believed that the time had now arrived for the establishment of a great national institution for supplying the technical instruction so greatly needed in all branches of our trade and commerce. They submitted that the proposed university should meet the existing want by training professors and teachers of industrial technology to supply the new colleges and schools which must shortly be called into existence. It should contain not only a museum, library, laboratory, and workshops, but the following professorial chairs:—The fine arts applied to industrial productions, chemistry, geology and mineralogy, mathematics, physical and mechanical technology, nautical astronomy, navigation, meteorology, political economy, trade, commerce, architecture, shipbuilding, steam, telegraphy, magnetism, modern languages and literature, natural history and botany, history, agriculture, health, ethics, music, and gymnastics. In conclusion, the committee recommended that a public meeting should be held in the Egyptian-hall, that auxiliary meetings should be held throughout the United Kingdom, that meetings and lectures should be held in industrial districts, and information on the subject diffused. After some conversation, the Lord Mayor consented to be nominated vice-president and chairman of the executive, as he went cheerfully with the committee in their work.

NEW BOOKS.

A Digest of Facts Relating to the Treatment and Utilisation of Sewage. By W. H. Corfield, M.A., M.B., Professor of Hygiene and Public Health at University College, London. 8vo. 7s. 6d. (Macmillan and Co.)

Elementary Lessons in Logic; Deductive and Inductive. With copious questions and examples and a vocabulary of logical terms. By W. Stanley Jevons, M.A., Professor of Logic in Owens College, Manchester. 18mo. 3s. 6d. (Macmillan and Co.)

Advanced Text-book of Zoology. By H. Alleyne Nicholson, M.D. Price 6s. (Blackwood and Sons.)

The Origin of Civilisation and the Primitive Condition of Man; Mental and Social Condition of Savages. By Sir John Lubbock, Bart., M.P., F.R.S., Author of "Prehistoric Times," &c. Pp. 396; with twenty-five illustrations engraved on wood. 8vo. Price 16s. cloth. (Longman and Co.)

Select Methods in Chemical Analysis and Laboratory Manipulation. By William Crookes, F.R.S., &c., Editor of the *Chemical News.* (Longman and Co.)

On the Scientific Use of the Imagination; a discourse delivered before the British Association at Liverpool, September 16, 1870. By John Tyndall, LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution of Great Britain. 8vo., pp. 42. Price 1s. 6d. sewed. (Longman and Co.)

Spectrum Analysis in its Application to Terrestrial Substances and the Physical Constitution of the Heavenly Bodies, familiarly explained, by Dr. H. Schellen, Director der Realschule I. O. Cologne. Translated from the German by Jane and Caroline Lassell; edited, with notes, by William Huggins, LL.D., D.C.L., F.R.S. 1 vol., crown 8vo., with coloured plates and other illustrations. (Longman and Co.)

In the Press.

Gems of Modern French Art. A series of 16 carbon photographs from the pictures of eminent modern artists, with remarks on the works selected, and an essay on the French school. By William B. Scott. In large quarto, cloth, gilt edges. Price 21s. (Routledge and Co.)

The Natural History of Commerce. By J. Yeats, LL.D. Price 5s. (Cassell, Petter, and Galpin.)

The Elements of Practical Perspective. By E. A. Davidson. Containing perspective, projection of simple points, lines, planes, and rectangular solids, polygons and prisms, pyramids, circles, cylinders, arches, &c. With 36 full-page illustrations, drawn on wood by the author. Cloth limp, 2s.

Drawing for Carpenters and Joiners. By the same Author. Containing a description of the construction of the subject of each study, and the method of drawing it, with elementary lessons in freehand and object drawing. With 250 illustrations and drawing copies. Double vol., cloth limp, 3s. 6d.

An Introduction to the Osteology of the Mammalia. Being the substance of the course of lectures delivered at the Royal College of Surgeons of England in 1870. By W. H. Flower, F.R.S., F.R.C.S., Hunterian Professor of Comparative Anatomy and Physiology. (Macmillan and Co.)

A History of the Gothic Revival. An attempt to show how far the taste for Mediæval architecture was retained in England during the last two centuries, and has been re-developed in the present. By Charles L. Eastlake, F.R.I.B.A. Architect; author of "Hints on Household Taste." In one volume, with numerous illustrations. (Longman and Co.)

The Sun; Ruler, Light, Fire, and Life of the Planetary System. By Richard A. Proctor, B.A., F.R.A.S., author of "Other Worlds than Ours," "Saturn and its System," &c. In one volume, crown 8vo., with many drawings and coloured plates. (Longman and Co.)

A Handbook of Dyeing and Calico Printing. By the same Author. Illustrated with numerous specimens of textile fabrics. 8vo. (Longman and Co.)

Introductory Text-book of Meteorology. By A. Buchan, M.A. (Blackwood and Sons.)

GENERAL NOTES.

Trade Marks and Designs.—By a law, approved July 8th, 1870, foreign trade marks and designs are protected in the United States.

Hill Settlements in India.—There are complaints that the government has not provided the requisite sanitarial accommodation for the English troops in the Bengal presidency. It appears that Mount Aboo has been neglected, and it is urged the sanitarium should be formed there for Decca and Nusseerabad. The *Times of India* observes that, with the daily increasing facilities of communication, it would not be impossible to have all, or nearly all, our English soldiers, during the hot season, in cool and comfortable quarters, instead of being grilled in the burning plains.

South Australia.—Dr. Schomburgh, in directing attention to the agricultural capabilities of South Australia, makes mention of two branches of industry for the development of which he thinks the climate of the colony especially adapted. Of these the more important is sericulture, which starts under peculiar favourable auspices, inasmuch as the silkworm disease, which has for some years been prevalent in Europe, is wholly unknown in Australia. The mulberry trees introduced by the government are in a most thriving condition; China and Japan are near at hand, and can supply any number of eggs, and experiments have already established the fact that the quality of South Australian silk is excellent. In fact, with due attention, the silk of the colony might hold the same place in the markets which its wool already occupies. The other culture which Dr. Schomburgh particularly recommends is that of Zante currants and Sultana raisins. There are numerous vineyards in South Australia, but the wine produced from them cannot compete with European vintages, and the doctor thinks it would be more profitable if the worthless vines were to be grafted with the Ionian and other raisin grapes. He himself distributed more than a thousand grafts of the Sultana grape last year, and has reason to believe that this fruit, which commands the highest prices in the European markets, is permanently established in the colony.

Statistics of the Italian Railways.—Throughout the kingdom of Italy there were, on the 31st December, 1868, 3,580 miles of railway in operation, 790 miles in course of construction, and 865 miles sanctioned, making in all, when completed, 5,235 miles. Of the length opened, the lines of the company of Upper Italy numbered 1,410 miles; the Roman States, 900; the South, 890; Calabria and Sicily, 130; the Papal States, 210; whilst others had 40, making the total of 3,580 miles. The cost of construction had amounted to £59,000,000 sterling. The total receipts from all sources were, in 1868, £3,520,515; in 1867, £3,215,551; the expenditure, in 1868, £1,991,918; in 1867, £1,979,525. The number of persons of all classes who travelled, in 1868, were 43,896,960; in 1867, 40,664,952. The company of Upper Italy carried, in 1868, 25,256,100 persons; the South, 6,093,785; the Roman States, 11,469,644. The stations which furnished the largest receipts were at Bologna, Genoa, Milan, Pistoia, Torino, and Venice. The government guarantees and subventions amounted, in 1868, to £2,164,271 sterling, from which certain advantages were derived that reduced the amount to £1,432,754, the total cost chargeable to the State for the furtherance and encouragement of the railway system. During the year 1869, another 175 miles had been opened, making 3,755 miles in operation on the 1st of January, 1870. Compared with other principal European countries, the Italian railways hold the position of tenth as regards population and ninth as regards superficies.

Belgian Rails.—Belgium exported in the first six months of this year 19,566 tons of rails to Russia; to the Zollverein, 18,318 tons; to Turkey, 12,356 tons; to France, 4,109 tons; to Italy, 3,832 tons; to the United States, 2,999 tons; to Sweden, 1,700 tons; and to Spain, 1,657 tons.

The Simla Fine Arts Exhibition has secured a house in which to exhibit the pictures of the year. Innesown has been secured for the present year's display—a house said to be fairly adapted to the purpose, as the rooms, if not very large, are light and lofty; whilst the spacious pleasure-grounds attached to it will afford ample space for the promenade. It is believed there will be hardly less than 300 drawings in water-colour and 100 oil paintings sent in for exhibition. Besides this, there is sure to be a fine collection of photographs, giving promise of a display worthy of Anglo-India and the occasion.

Rogers' Life-Saving Apparatus.—Experiments were made on Friday, September 30th, at the mouth of the Mersey, with Rogers' life-saving apparatus. When thrown to a vessel in distress, the projectile used is a cone projected from a mortar; when thrown for the purpose of getting a purchase to haul a boat out from the beach, the projectile has a folding anchor at the head, the arms of which expand and bite the ground directly there is a pull upon their centre by the line through the hollow of the projectile carried by the latter when shot from the projecting mortar. The experiments were quite successful, and, as the apparatus is simple and inexpensive, it will no doubt be taken up by shipowners, and its greater range and accuracy will possibly cause it in time to supersede the rocket apparatus at the coastguard stations.

National Prosperity and Social Security.—At the meeting of the Social Science Congress, on the 26th instant, Mr. Francis Fuller read a paper on this subject. He stated, as an anomaly, that whilst by the adequate application of labour to the cultivation of waste lands in the United Kingdom such lands could be made to produce, with commercial profit, an annual value of at least £100,000,000 sterling in ordinary articles of food, we pay foreigners, in some years, nearly £50,000,000 sterling for the very things which could be profitably produced at home. At the same time, hundreds of thousands of people were in distress from want of work, hovering precariously about the narrow lanes which separate indigence, pauperism, and crime; and notwithstanding our large imports from abroad, the greater portion even of the employed population were under-fed, and suffering from an insufficiency of the nutritive food which, if the measures advocated by the "Industrial Employment Association" were adopted, would be superabundantly supplied from our own soil. In this plan, Mr. Fuller maintained, would be found a satisfactory solution of the ominously increasing difficulties of the labour question. As connected with that question, he dwelt upon the urgent and imperial necessity of rescuing from ruin of soul and body the multitudes of the young of both sexes who are now growing up in the ways of all evil, to become hereafter the curses and the cankers of the body politic. Some improvements had been made in the arrangements for educating and training pauper children, but it was above all things essential to deal with the "street Arabs," not merely the boys, but emphatically the girls. An exemplification of the value of such training was afforded by the success of the boys who had emigrated from the Philanthropic Society's farm at Redhill, many of whom were now thriving farmers, employers of labour, and even proprietors, and had remitted money to pay the passage of relatives, in order to save them from falling into crime and misery. But it was lamentable that the commission of some offence against the law constituted the qualification for the benefits received by these boys. Prevention should be considered at least as important as cure. This was the principle enunciated by the Industrial Employment Association, the facts and statistics collected by which contained a great mass of valuable information.

Waste of Fuel.—Mr. T. W. Lewis, president of the South Wales Institute of Engineers, in his address at a recent meeting, said :—It appears to me that a very great saving is to be effected by a little more attention to the construction of our boilers, the amount of boiler power, provision for heating the water, preventing the radiation and loss of heat, the general arrangements in the every-day practice of our mechanical engineers. The quantity of fuel that has been wasted in the South Wales district is perfectly astounding; and I am sure, if I were to give figures, they would not be credited. It no doubt arose to a very great extent from the abundance and cheapness of the coal, for while large coal was being consumed here regardless of quantity, and without any effort made to preserve and utilise the heat obtained, other manufacturing districts, not blessed with fuel under their feet, were (in consequence of its comparatively high price) obliged to devise means for obtaining two and three times the work out of every ton of coal that we did here, and also to consume their small coal and utilise gases for heating. Keen competition and the low price of iron, however, forced our ironmasters to the use of their waste gases, hot blast, and small coal in the manufacture of iron, and thus effect a very great saving in fuel; but there is still very much to be done in reducing the quantity of fuel wasted in the getting up of steam, and in preserving the power when once obtained. Great economy might be realised, even with our present system, by increased boiler power, improved draught, so as to consume small coal and refuse, the heating of the feed water by the exhaust steam and the waste heat on its way to the stack, the effectual covering of all the boilers, steam pipes, cylinders, &c.; but we should not rest satisfied until we have a much more perfect form of boiler, whereby only about 1½ to 2 lb. of coal per horse power per hour would be consumed. Even the arrangements common in this district may, by a comparatively small cost, be improved so as to reduce the consumption of coal one-half. There are several places within my own knowledge where, by improvements such as I have sketched out, the consumption of fuel is now 50 per cent. less than formerly, and small coal is used instead of large. The matter is one of national importance, inasmuch as we are wasting 50 per cent. of the very material which has really been the means of making this country the seat of manufacture for the greater portion of the world, and of now holding its own with the manufacturing centres on the Continent; but to us engaged in the getting, using, and disposing of the coal, it must present itself most forcibly, with the constantly increasing tendency to run up the cost of getting coal in this district. Even if a saving of 25 per cent. could be effected in the coal consumed for steam purposes in the South Wales mineral basin alone, the value of it per annum would represent above £105,000. The consumption, per horse-power per hour even then would be far in excess of some of the improved engines and boilers now used in districts where fuel costs twice or thrice what it does here. In fact, there are some engine and boiler makers that now guarantee their engines and boilers not to consume more than 1½ lb. per horse-power per hour, while a great many of our engines in this district consume 8 lbs. to 10 lbs. per horse-power per hour. With these facts before us, although the contrast may to some extent be modified according to circumstances, I hardly need dwell upon the desirability of the Institute again taking into consideration and thoroughly investigating this important question of the most economical mode of using our fuel. Another subject, closely allied to the use of fuel, is that of the large proportion of coal lost in working, and left underground, upon which a paper was read before this Institute in the year 1861. Although very great improvement has taken place in a portion of the South Wales mineral basin in this respect since the introduction of the long-wall system (which I may here mention owes its general adoption in this district to the papers and discussions of this Institute, and for which all interested in the minerals, both as landlords and tenants, are much indebted), still a very large proportion of coal is left underground, amounting to an average of at least 18 per cent. This is again a very serious loss, and deserves most careful attention.

Keighley Schools of Trade, Science, and Art.—The inaugural ceremony of opening the new buildings at Keighley (Yorkshire) for educational purposes took place on the 30th ult., under the presidency of his Grace the Duke of Devonshire, K.G. In the new buildings, which have cost £12,000, two distinct institutions will be maintained—the club, and the education department. The arrangements for the club will completely supply the wants of the town and district; and a lecture-hall has been constructed to accommodate 1,000 persons. The trade school will be a component and indispensable part of the system of technical education. The school of art has for some time been successfully worked under the direct supervision of Mr. Stephenson. Its removal into the new buildings will increase materially its efficiency. The rooms appropriated to it are of the usual character, and care has been taken to secure to the teachers the advantages of modern improvements. The school of science will bear the same relation to the scientific work of the institution as the school of art. It will consist of laboratories, a lecture theatre, and sundry class-rooms. It will also derive the same advantages from its connection with the trade school.

Shipping Trade with India.—Our shipping trade, says the *Produce Markets Review*, has wonderfuly developed during the last decade, but calculations as to the rate of its increase are somewhat disturbed by the impetus given to the cotton trade during the American war. It is clear, however, from the abstract, that although the number of ships sent to India from England is rapidly increasing, the same can hardly be said for any other country excepting Ceylon. The shipments to India from Australia, China, France, and America, are not increasing, but the trade with these countries has never been very large, most of the products of the two latter being transported from England. From the parliamentary returns, which are only completed up to 1868, it appears that altogether India received at her ports, during that year, 4,937 ships, but this is exclusive of the coastwise trade, which shows an additional number of 6,588 ships. The shipping trade of India with England and foreign countries, however, reached its highest point in 1865, after the commencement of the American struggle, when no less than 26,823 boats and ships were employed by her foreign and coasting trade. But although the receipts of merchandise from countries other than England and Ceylon have not increased, we find that her exports to almost all nations, excepting China and Australia, have largely developed. It is interesting to observe the enormous increase in the exports of India during the American difficulties, but the excess, beyond a natural extension of business, was of course wholly atributable to the stoppage of the supply of cotton from the States. From the following summary of the trade with the United Kingdom, an approximate idea of the state of our commercial transactions with India may be formed :—

	Imports From United Kingdom.		Exports To United Kingdom.	
	Vessels.	Tons.	Vessels.	Tons.
1860 ..	708	549,390	844	664,665
1861 ..	798	636,236	870	675,996
1862 ..	847	733,434	1,045	857,210
1863 ..	724	651,095	934	806,279
1864 ..	906	828,238	1,032	928,309
1865 ..	819	771,196	988	921,241
1866 ..	731	714,050	1,175	1,051,492
1867 ..	781	765,733	685	680,076
1868 ..	958	948,397	673	669,706

Journal of the Society of Arts.

FRIDAY, OCTOBER 21, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

CANDIDATES FOR SCHOOL BOARDS.

The Society of Arts has felt called upon to make exertions for an improved national system of primary elementary education, as an indispensible basis for an improved system of secondary and art and science education, to which, for several years, it has applied its funds, and conducted examinations throughout the country The Council could not but observe in the public controversies on the recent Elementary Education Bill, which has now become law, that the best interests of the children, the future of the nation, were much overlooked and exposed to sacrifice in the narrow interests of political parties and religious sects. The Council, therefore, invited a meeting, which was held at their House, with the view to the reconcilement of differences, and the conciliation of mutual exertions for the attainment of the common object. This course appeared to be attended with a fair share of success. The Council regret, however, to perceive, in proceedings for the election of school boards, the reappearance of the like spirit of party, and that persons are put forward who have hitherto given no heed to the need of educational improvement, who display a want of a clear perception of the ends to be especially attained, and of the qualifications needful for the attainment of the object of the legislation—a sound general system of national education which shall be fully up to the best models established by years of experience in this country.

It is to be observed that in the recent proceedings and speeches at public meetings, elementary education is spoken of as if it were generally all sufficiently well known—as if all that is, or that could be, now in question is the extension of the common methods of instruction, about which, it is assumed, there can nowhere be any reasonable doubt or material difficulty—all that is needed to be done being the extension of these common methods of elementary instruction to the neglected classes — the utterly uneducated. Now, this common conception of the sole ends to be attained, displays a most dangerous state of error, of which it is necessary to give forewarning.

The Bishop of Manchester, who, as a distinguished school inspector, is of the largest experience in the inspection of schools, abroad as well as at home, has declared of the existing schools and the common methods of instruction, that about one-third are tolerably good, about one-third indifferent, and one-third positively worthless. The reports of other clerical inspectors also show that this comprehensive general description is applicable to the religious as well as the secular instruction given in a very large proportion of the common elementary schools. The inquiries directed by the Society into the educational condition of some districts in the metropolis, tend to confirm this view. On an examination of the outcome of the school teaching given in existing schools, for the classes of children chiefly in question, it appears that the results vary from full sixty per cent. of failures to get places and keep them—to not more than two or three per cent.

Moreover, a large proportion of the common schools, from defects of sanitary conditions, in modes and times of school teaching, are productive of mortal injury and bodily disablement. From bad ventilation and overcrowding, they are declared to be the chief sources of children's epidemics. The medical officers of health of the metropolis have from time to time called attention to these bad sanitary conditions, to which, in a representation made to the Privy Council office, they attributed a great part of an excess of deaths in the school of life of upwards of nine thousand annually in the metropolis alone.

The Council would urge upon electors, as well as upon candidates, the consideration of the questions, whether they are all aware of these widely prevalent conditions? whether they have really so studied the means of efficient training and instruction as to be enabled to decide confidently on them, and that they can effectually remove the evils extensively attached to the existing schools, or confidently administer with efficiency as well as with economy of results the educational funds that may be placed at their disposal?

Even the conditions of the existing schools, which the Bishop of Manchester classes as comparatively "tolerably good," may, nevertheless, be challenged as conditions greatly wasteful of time as well as of money. There are very few of these schools in which good instruction in reading, writing, and arithmetic, is imparted before the thirteenth or the fourteenth year. This excludes the greater proportion of the children of the wage classes from complete elementary instruction, as the parents of those classes must have their children into whatsoever productive service may be got for them by about the eleventh year. It is an extensive general complaint that the children of those classes are taken away from school long before they are half taught. This common condition of exclusive occupation

with the long time elementary school teaching also excludes from secondary and art and science instruction the greater proportion of the children of the middle classes, who cannot afford to allow them to remain out of productive service beyond their thirteenth or fourteenth year. But it is demonstrated that, under conditions investigated at the instance of the Council, and explained in reports to them, which have been published, that by an improved administrative organisation of educational funds, and by a division of educational labour for class teaching, the common elementary education, which is now imparted in about seven years, at a total cost of twelve or fourteen pounds per head, may be better imparted in three or four years, and that, too, on the half-time principle, by trained teachers, at a total expense of not more than three or four pounds per head, together with physical exercises, by which aptitudes for manual labour are imparted or improved. In other words, it is proved on practical evidence, published by the Council in its *Journal*, that by improved methods, three or four children may be taught well at the expense now commonly incurred for teaching one comparatively ill. It is requisite to make known that, within certain limits, the power of teaching and training children is, in time, in efficiency, and in economy, very much as the numbers that can be brought together for simultaneous class-teaching under trained teachers, and that all separation for party or sectarian purposes, all separation of children into small schools, or schools below the numbers required for efficient class teaching, is detrimental to the objects of education and wasteful.

As an instance of the economy obtainable by union, the Council has always presented as a model example Faversham School Union, of eleven small parishes, by which the total expenses of elementary school teaching are reduced to one-half, or to little more than five pounds per head, including the infant school, as against a total cost of thirteen or fourteen pounds per head in the common schools. As regards the means of obviating the religious difficulties, the Council beg leave to repeat their statement of this example :—"In respect to instruction in religion, the only desire must be that it may be improved beyond that now given, as described by the clerical inspectors in the last report of the Committee of Privy Council on Education (which *vide*). Merely for industrial purposes, what is needed is the displacement of habitual liars, cheats, and drunkards, requiring perpetual, painful, and expensive supervision, by a commandment-keeping, truthful, sober, law-abiding, contract-performing, conscientious, trustworthy class, thoroughly imbued with practical Christianity, for which the clergymen of all denominations ought to be made really responsible. The Faversham School Union, approved by the late Archbishop of Canterbury (Sumner) and the Protestant Dissenters living there, is an admitted example of how the anticipations of the late Dr. Chalmers may be realised, and religious differences set aside, and education be placed on the basis of a common Christianity."

The local inquiries made for the Council show that the number of children who are totally uneducated, who are neglected and who live on the streets, and must be provided for under the Act, are much larger than is commonly supposed. In one sub-district of the metropolis, for example, that of Battersea, where it was publicly stated that the numbers of destitute children might be about six hundred, it appears, upon the examination for the Council, that the numbers are nearer three thousand.

One of the first duties to be performed by the new school board will be to obtain information, and to make returns to the Education Department, to enable it to determine the sufficiency or insufficiency of the education given within the school district.

If anyone will examine the instructions for local inquiries of this sort given by the Council, and the reports on the examinations made on those instructions, he will see that very special qualifications are needed for the direction of such examinations as shall be thought complete and trustworthy. The examinations referred to were cited in Parliament as of first-rate importance. They revealed a state of things of which even schoolmasters and school managers living within the districts and the local administrators were totally unaware, and had at first difficulty in believing, and were not at all likely of themselves to have elicited.

To remove from the streets the utterly deserted children—to uproot, as it were, the great seed-plots of juvenile delinquency and of the adult habitual criminal population—to gather the filthy and squalid castaways, to engage the co-operation of the police in that work, and to get the provision of appropriate places for their reception by the poor-law authorities, to provide for these objects such appropriate treatment as to make them good Christians and good citizens, and ensure to them a career of self-supporting, honest industry, and that they shall be mendicants and criminals no longer—is in itself a large and difficult task, but not beyond means of tried efficiency, known to those who have given special attention to the subject. To bring into competent schools and under proper training the children whose parents, of the wage-classes, neglect their education entirely, and in respect to them, to reduce the need of compulsion to the minimum by conciliating the business of the school with the place of work, and by letting as

much as possible of earning go on with learning on the half school time principle—will require very special means and skilful adaptations, which are little known out of the northern manufacturing districts. To bring up the quality of the teaching in the State-aided and rate-aided schools, the indifferent and the bad to the quality of teaching, and economy in money as well as time in obtaining results to that of the best leading model schools, will be a necessary task, which can only be expected to be competently performed by a Board already conversant with those models, and which appreciates them.

It will be dangerously easy for a school board, consisting of members without any special qualifications, and without any competent and responsible official instructional aid and information, to forego these great ends, and occupy itself with party objects, or with the conflicts of sinister interests, for appointments and salaries, and especially to give way to brick-and-mortar interests, in the construction of expensive new buildings beyond all real necessity for them, and thus aggravate instead of reduce the existing burdens of the ratepayers. The Council would therefore, in the great interests of the measure, urge upon electors the necessity of seeking for gentlemen who are not merely conversant with methods of elementary education as it commonly is, but who are conversant with the best long-tried and practically proved methods of elementary education as it ought to be, and as it must be unless the object of the movement be widely frustrated.

One great educational axiom is, that "as is the teacher, so is the school," and under this head additional force will be required for the training colleges. Another great axiom is, that to improve the morals and manners, and stimulate the intelligence of children, especially those of the depressed and long neglected classes, the best efforts must be given in the earliest stages, for the power of altering the disposition and the character of the child diminishes in an increasing ratio as age advances. Under this head it is felt that the foremost effort should be given to the improvement and extension of infant schools. The care and training of infancy, and especially of female children of all ages, is a female duty and prerogative. The Council would submit that it is befitting and desirable to obtain, as members of the school board, the services of ladies who have paid distinguished attention to the education of the poorer classes.

The Council has submitted in full in the *Journal*, for impartial and independent judgment, the important examinations and facts on which its conclusions are founded. It does not assume that competency for the school boards is confined to persons of public position; but it urgently suggests the need of the more careful examination of the competency of others in whom the qualifications have not yet been manifested.*

Metropolitan School Board.

To the Electors of the Metropolitan Boroughs.

Gentlemen,—The Council of the Society of Arts presume to address you on the choice of gentlemen to be elected on school boards, in order to give effect to the great measure of national education, whereby, happily for the future prosperity of our country, the children of all classes must receive the elements of instruction.

The Society of Arts for years has devoted large funds to promote education, especially among artisans, without reference to political or religious controversies. It sees with regret that even now there remains a tendency to confuse such controversies with the simple question how a child under eleven years of age should be taught reading, writing, drawing, cyphering, singing, and drill.

The Council respectfully venture to advise you to elect on the Metropolitan School Board men and women who have given proofs that they understand the means by which the efficiency of teaching may be increased, the expense diminished, and the time of learning reduced so as to admit of secondary art and science instruction where practicable; and to reject persons who offer themselves merely with political and sectarian aims and much self-assertion, and who have given no such proofs.

The Council, therefore, earnestly recommend that you apply to well-known friends of education to allow themselves to be elected, and thus set to the United Kingdom an example worthy of imitation.

(By order) P. Le Neve Foster,
Secretary.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts' Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

---

* Those who, being new to the subject of educational organisation and administration, would inform themselves upon it to enable them to take part in the proceedings under the new Act, may be referred to the Council's instructions to their delegates to the meetings in Manchester and Birmingham, held for the consideration of an improved system of national education, and also to the *Journal* of the Society for December 17, 1869; March 25, 1870; April 8th, and August 12th.

The following are the old and new rules of the Inland Pattern and Sample Post contrasted:—

Old Rules.	New Rules.
1st. The postage is 1d. for every weight of four ounces or fraction of that weight.	The postage is now one halfpenny for every weight of 2 oz. or fraction of that weight; but the pattern and sample post is restricted to *boná fide trade patterns or samples of merchandise.* Goods sent for sale, or in execution of an order (however small the quantity may be), or any articles sent by one private individual to another which may not actually be patterns or samples, are not admissible.
2nd. No packet of patterns or samples must exceed 12 oz. in weight, or 2 feet in length by 1 foot in width or depth. Any packet exceeding these limits is sent to the Returned Letter Branch.	6th. No packet must exceed 12 oz. in weight, or two feet in length by one foot in width or depth.
3rd. The postage must be prepaid by means of postage stamps, except in London at the chief and district post-offices and the branch offices at Lombard-street and Charing-cross, where, from 10 a.m. to 4 p.m., patterns may be prepaid in money, provided the amount be not less than £1 in any one case, and that the patterns be tied in bundles representing postage to the amount of 5s. each.	1st. The postage must be prepaid, either by adhesive stamps or by means of a stamped wrapper, or by a combination of both; except at the chief and district offices, and the branch offices at Lombard-street and Charing-cross, in London, and at the chief offices in Edinburgh and Dublin, where, from 10 a.m. to 4 p.m., it may be prepaid in money, provided the postage amount to not less than £1 in any one case, and provided the packets are posted in bundles, each representing a postage of 5s.
4th. There must be no writing or printing on the packet in addition to the address of the person for whom the packet is intended, except the address of the sender, a trade mark and numbers, and the prices of the articles; these particulars may be given on small labels attached to the samples or the bags containing them. If this rule be infringed the packet is treated as a letter.	4th. There must be no writing or printing upon any packet except the address of the person for whom it is intended, the address of the sender, a trade mark or number, and the price of the articles; nor may there be any writing or printing or other thing enclosed except such address, mark, number, and price, and a written or printed description of the articles; and these particulars may be on labels attached to the samples. If this rule be infringed, the packet will be treated as a letter.
5th. It is permitted to enclose in a sample packet a printed or written description of the samples. Any unauthorised enclosure will be forwarded to the address on the packet, charged with the full postage as an unpaid letter, together with an additional rate of one penny.	5th. Any prohibited enclosure will be taken out and forwarded to the address on the packet, charged with full postage as an unpaid letter.*
6th. The patterns or samples must be sent in covers open at the ends, so as to be easy of examination. Samples, however, of seeds, drugs, and such like, which cannot be sent in open covers, may be enclosed in boxes, or in bags of linen or other material, fastened in such a manner that they may be readily opened; or in bags entirely closed, provided that they are transparent, so that the officers of the department may be able to satisfy themselves as to the nature of the contents. If this rule be infringed the packet is treated as a letter.	3rd. Patterns or samples, when practicable, must be sent in covers open at the ends, and so as to be easy of examination.† But samples of seeds, drugs, and such like articles, which cannot be sent in covers of this kind—but such articles only—may be posted enclosed in boxes or in bags of linen or other material, fastened in such a manner that they may be readily opened; or in bags entirely closed, provided such closed bags are transparent, so as to enable the officers of the Post-office readily to satisfy themselves as to the nature of the contents. If this rule be infringed, the packet will be treated as a letter.
7th. If a packet of patterns or samples be posted altogether unpaid, it is charged with double the postage which should have been prepaid. If a portion of the postage be prepaid, the packet is charged with the amount of the deficiency, together with an additional rate of one penny.	2nd. If a packet be not sufficiently prepaid, but bear a stamp of the value of one rate, it will be forwarded charged with double the deficient postage; a packet posted wholly unpaid will be charged with double the pattern postage.
8th. When, owing to a great and unusual influx of letters, books, samples, &c., the transmission or delivery of the letters would be delayed if the whole mail were dealt with without distinction, a postmaster may keep back sample packets until the next despatch or delivery; but he must on no account detain them, except in the case specified, or beyond the time named.	

* It is the duty of postmasters, whenever they have ground for suspecting an infringement of any of the above conditions, and occasionally, even when there is no ground for suspicion, to open and examine pattern packets posted at, or passing through, their offices.

† In order to secure the return of pattern packets which cannot be delivered, the names and addresses of the senders should be printed or written *outside*; thus:—
"From ——— of ———."

9th. The rule which forbids the transmission through the post of any article which may injure the contents of the mail bags or the officers of the post-office, is so far relaxed as to permit the transmission of scissors, knives, razors, forks, steel pens, nails, keys, watch machinery, metal tubing, pieces of metal or ore, and such like, as samples, provided that they be packed and guarded in so secure a manner as to afford complete protection to the contents of the mail bags and the officers of the post-office, while at the same time the samples may be easily examined. If any packet containing such articles as these be posted which is found not to be sufficiently guarded, it is stopped, and a notice of its detention is sent to the person to whom it is addressed or to the sender, who may then obtain it upon personal application; but the packet is charged with a fine equal in amount to the postage to which it was liable as a packet of patterns.

A correspondent in the *Times* suggests that the railways should inaugurate a penny parcels delivery. "A great trouble is caused many industrious bands in the country by their not being able now to receive by post their small packages. Let our different railways have a parcels room at each station, charging one penny. Let each package be forwarded to the nearest station, to be called for."

Miss Emily Faithful, in a letter to the *Times*, shows that a very largo number of ladies will suffer by the

postal change. The work societies will now be even less effective than before, and the one chance hitherto accorded of earning a few pounds by fancy-work will thus be taken away from educated women before more suitable occupations are opened to them.

A correspondent of the *English Mechanic* complains that the new rules will put a stop to the interchange of prepared objects for the microscope between members of microsopical societies, and prevent the sale of small articles by tradesmen, who now advertise them carriage-free for one or two stamps in excess of the price of the article, for which stamps can be sent from John-o'-Groat's-house to the Land's-end.

THE UNION OF SCIENCE AND INDUSTRY.

Dr. Lyon Playfair, C.B., M.P., delivered the address at the opening of the session, at the Birmingham and Midland Institute, on September 29th. After paying a tribute to the memory of Charles Dickens, the president of the Institution last year, he proceeded to the subject of his address—the intimate union between science and labour. "This union," he said, "is far from being simple. It is not science which creates labour, or the industries flowing from it. On the contrary, science is the progeny of the industrial arts on the one side, and on the other of the experiences and perceptions which gradually attach themselves to these arts. So that the evolution of science from the arts is the first circumstance of human progress, which, however, quickly receives development and impulse from the science thus evolved. Industrial labour, then, is one of the parents, and science is the child; but, as often happens in the world, the son becomes richer than the father, and raises his position. It may not be the waste of an hour if we consider these relations more closely. Had I not been frightened with the length of of the word, I would have entitled my discourse inosculation of the arts and sciences. In one sense that means their embrace, but in another it means junction with open mouths, as when two arteries join and mutually pour their contents into each other. Well, this word has found a practical expression in the minds of the Birmingham people when they founded this Institute; and though it is long and pedantic, I will take it, after all. The industrial arts spring clearly out of the necessities of man. Man is peculiarly helpless as regards his own personal and physical belongings. With an intellect which, when developed, approaches that of an angel, he has a naked unprotected body like that of an earthworm. Covered neither with chitine, nor thick hide, nor with fur, nor feathers, he looks as helpless at his birth as the unfledged gosling; but, unlike it, never gets a better protection from wind or weather as he grows older. Neither has he any natural tools with which he can labour. The earthworm can mine and tunnel so as to seek protection under ground; but even this is denied to man. Every lower animal has within itself admirable tools for work; but man has neither in hands nor feet tools sufficient for his protection or sustenance. We know of no race of savages so absolutely wild as to possess no arts. Man has sometimes been described as a fire-making animal, because none other than he has learnt how to use it. Fire is the essential condition for industrial development, and without it man would be a miserably helpless creature. It is his first substitute for want of fur and feathers as a protection against the inclemency of the weather. It is the origin of all his arts. He throws stones into the fire, and then casts them, when heated, into water, and thus boils his food. Soon he finds out that the water will boil in vessels placed upon the fire; but the vessels, being made of wood, burn, so he plasters them over with clay; the clay is baked by the heat, and he thus discovers pottery. Thus, step by step, arise the arts—so slowly, indeed, that an acute writer like Archbishop Whately believed that no savage tribe improved the arts, unless by introduction from another tribe of higher civilisation and culture. This is certainly a mistake. The growth of arts is indeed very slow; but few savage tribes lose a step in progress when it has been made. No science or art is developed in uncultured minds, or even in cultured ones, except as the result of very long experience and observation. Nakedness and want of tools form the stimulant to man's industry, and the arts grow slowly, and at first almost imperceptibly, from his necessities. The experience which he thus acquires becomes an inheritance of common knowledge. Science is the evolution of that knowledge, and the mode of it is worthy of your consideration. The facts accumulated are necessary for science, but do not create it, for that arises only when man's reason acquires dominion over his senses, and teaches him to verify the impressions conveyed by them. In savage life, science is not developed, because the gratification of the senses, and subordination of everything to them, are incompatible with the evolution of science from any number of facts. Even in civilised life, it is long before men learn how to subdue their senses to their reason. Science does not depend upon facts alone, but upon the increase of mental conceptions which can be brought to bear upon them. These conceptions increase as slowly as the common knowledge derived from experience. They both descend by inheritance from one generation to another, until science, in its progress, becomes a prevision of new knowledge by light reflected from the accumulated common knowledge of the past." Having illustrated his argument that experience is the foundation of science, and that with material prosperity arises philosophy, Dr. Playfair went on to show how seldom it is, though leisure and wealth exist among the aristocracy of a country, that science is promoted by them. "Poverty in the individual is the stimulant to exertion, while wealth is not unfrequently the narcotic producing intellectual torpor. No doubt there are men in all classes who do not succumb to the benumbing influences of wealth. Formerly, the aristocracy furnished a large proportion of our statesmen, though latterly, they have also come from the productive classes, as instanced in the Cobdens, Brights, and Gladstones. But still there are eminent statesmen from the upper classes, showing that personal and hereditary talents among them are of a high order. Why is it, then, that they advance science so little? Precisely because, like the schoolmen of the middle ages, their education separates them from the fund of common knowledge accumulating among an industrious people. Referring to the printing-press, and the consequent necessity for the use of the vernacular by the learned, he said it was not till the close of the eighteenth century that the vernacular was generally used in our schools. This knocked down the great barrier to progress, for the learned class and the industrial class became again united, and could travel on the same road, as they had done when Greece and Rome accumulated their intellectual treasures for posterity. Yet to this day, the upper classes do not realise this fact, and they continue to cut off one-third of the lives of their children by forcing them to sleep in antique Greek and Roman beds, actually as left by their original occupants, without ever being made anew; and when the youth of the upper classes awake to the realities of life, they find themselves unprepared to profit by them. Like Rip Van Winkle, they wake from their long sleep only to find that they are twenty centuries behind their generation, and can do it little good. They rarely advance the science or philosophy of the present; though they make good statesmen, because they have had noble studies of human mind and human actions in the glorious records of antiquity; for these have the same springs now as when Greece had its greatest prosperity and intellectual vigour. So far as regards politics, ethics, sculpture, painting, and architecture, the world has advanced little beyond, if it has reached the position of Greece and Rome. But these, though they grace, do not

now form the foundation of a nation's prosperity. That is formed upon the applications of science to industry. It is through the industrial classes that new experiences and perceptions accumulate; it is through them that a superfluity of wealth is directed to the support of a separate learned class; and it is from them mainly that this learned class takes its origin. Hitherto, we have been looking at the evolutions of science from the arts. Now let us see how the latter receive their great impulse from the former. In early ages, the raw material at hand led to its industrial application; and, in later ages, it impressed the character of industries upon the country possessing it. When any tribe or nation can take from another the raw material, which the last either does not use or uses with less intelligence, the first nation must be under the guidance of science. The science may be undeveloped, dealing with qualities only and not with quantities, but science it must be; for it is impressing upon the material the conception derived from a cultured intelligence, and making these of a higher relative value than the mere local possession of the material itself. This is the great element of industrial competition in the world at the present time. Take the case of Great Britain in modern days. We have, in large quantities, and in fortunate proximity, coal, iron-stone, and lime. We have copper, and tin, and zinc, in smaller proportions. As intelligence rose in this country, and initiatory science became evolved from industrial pursuits, the inhabitants no longer sold their mineral wealth to distant nations, but manufactured it for themselves. As long as the growing intelligence of our inhabitants equalled or exceeded that possessed by any neighbouring nation, our prosperity was secured; because, in addition to the science of the time, the raw material of industry was in our possession, and competition with us was an impossibility. And so it is with all nations. But the moment that any nation allows the intellectual element of production to fall below that of its neighbours, the local advantage no longer suffices for superiority. When commerce and science open up paths of rapid intercommunication throughout the world, the cost of transit of raw material is diminished, and the intellectual superiority of another nation far more than balances the possession of raw material. Roads, railways, ships, and steamboats, arising in the march of science, can spread raw material everywhere, and enable nations to test their relative intellectual powers applied to it. Let us take a case:—Cotton, being indigenous to Hindostan, calico was made at Calicut. Soon the intellectual culture of the Arabians exceeded that of the Hindoos. Calico was manufactured by them, and introduced into Spain, where it flourished. Then came the great national crime of Spain, in the beginning of the 17th century, when a million of the Moriscoes, who still possessed the experience in manufacturing industry, were suddenly expelled on account of their doubtful Christianity. With them, cotton, woollen, and silk manufactures were also ejected from Spain. The 15,000 looms of Seville were thus reduced to 300, and the 40,000 silk-weavers of Toledo lost their subsistence as soon as the intelligence and skill of the Moors passed to Tunis. In precess of time this country took up the cotton trade which Spain flung away, and made it our own by great mechanical inventions. Not, be it observed, by manual labour, but by the result of intelligence applied to machinery and locomotion. And look how much intellect now exceeds the value of the raw material as a factor in production. Cotton is grown in America, crosses the broad Atlantic as a bulky and expensive freight, is seized hold of by our mechanical science and manufacturing enterprise, crosses the Atlantic again as calico, pays a heavy import duty, and yet undersells the products of the mills at Lowell. When the great American people, through their rising colleges, and by a better understanding of the effects of restrictive tariffs, apply their intellectual powers in this direction, such relative superiority of manufacturing science will be impossible in the presence of the raw material at the door of their mills. More strange still to see Switzerland, with no seaboard and no coal, bringing cotton from America, transporting it through the defiles of the mountains, then back again over land and sea, in the form of high-priced cotton goods, underselling America in her own markets. What enables such a country to do this? It is not cheapness of labour; it is intellectual or scientific superiority in relation to the manufacture which competes successfully against local advantages. Take another instance. Sweden has excellent iron, and we send for it to Birmingham, where you convert it into tools, axes, chisels, and hoes. You send these to America, though good iron ore exists in that country. Well, some day the Americans find that by giving a different edge and temper to their axes, or a different form to their hoes, they can do their own work better; so they send to Sweden for the iron, and fashion it into their peculiar forms, and Birmingham does not send so many axes and hoes as formerly, but America actually sends over some to this country, to see whether we like their new forms better than our own. You see that the mere possession of the raw material confers but a small advantage on the country, and that the changes which are continually taking place are not regulated by it. The intellect, which has such a predominant value, receives its expression, at least to a large extent, by incessant efforts to convert the brute labour of man into an intellectual superintendence of labour performed by a machine. This may be illustrated by any branch of industry taken at random. I see opposite my study window, as I write, a house in course of erection, and the labour of the builder will serve my purpose as well as any other. An Irish hodman is carrying a quantity of bricks up a ladder, in order to supply material to the builder. The sight is familiar to us still, though not so much so as it was a few years since, because a change is passing over this form of labour. Let us study the reasons for the change. The Irish hodman is a human machine, unskilfully and expensively put into operation. He felt that himself, in his fine, confused way, when he wrote to his friend in Ireland, "Dear Pat, come over here and earn your money: there is nothing for you to do but to carry the bricks up a ladder, for there is a man at the top who takes them from you and does all the work!" The man at the top is a skilled workman, more nearly fulfilling his human functions, for he is using intellect in his work. The hodman is a worker also, but only a user of his own brute force in a very unintelligent way. Every time that he ascends the ladder with his load of bricks he is carrying his own weight in addition to that of the bricks; his force is thus wastefully expended. After many years, his employer perceives this, and substitutes human labour first by that of a horse, then by that of a steam-engine. Now, when you pass a house in course of erection you will see a horse trotting over a prescribed course. It is pulling up a whole barrowful of bricks by a rope and a pulley. The horse, tended by one man, is doing the work of seven or eight hodmen, and with much economy of money, inasmuch as the cost of the hay and oats, from which its power is derived, scarcely exceeds that of the beef, potatoes, and beer of a single hodman; while increased economy of labour is also attained, because the weight represented by the bodies of seven hodmen is not drawn up along with the bricks. Food, burned within the bodies of the men and the horse, is in both cases the source of power. Again, in large houses, the horse disappears, and a small engine draws up the bricks. Economy is again achieved, for the coal, which is the food of the engine, is less costly than the hay and oats required for evolution of force in the horse. A single man, using scientific knowledge in the guidance of the engine, is now doing the work of several horses or many men. Let us analyse the changes which pass over the forms of labour illustrated in this particular case. The first tendency is to substitute the brute force of a man by an intellectual superintendence of a cheaper form of force, either animal or physical, the aim being

to obtain economy of production, either through economy of time, or by the substitution of a cheaper form of force for human labour. In fact, economy of time generally follows the economical substitution of force. Savages have an utter disregard of time in the performance of labour. They will expend a month in sharpening a single arrow. Some of the rock crystal cylinders worn by chiefs for ornaments are stated to take two men's lives to perforate. The Kamchadals of North-eastern Asia take three years to hollow out a canoe, and one year to scoop out the trough in which they cook food. As soon as a savage tribe employs fire, instead of implements made of stone or bone, to hollow out their canoes, they are using a natural power to economise time and brute human force, and are on the high road to civilisation. In human progress it is always so, for it is a natural law that the sweat of the brow should be lessened by the conception of the brain. The economy produced by the substitution of cheaper for dearer forms of force is remarkable in all cases where it is applied. The Prussians saw this very well when they wanted to make England declare coal as a contrabrand of war in the present campaign, that it was the representative of so many men added to the enemy; for three or four pounds of coal, even in the wasteful way in which it is used, are more than equal to a man's force. I recollect, some years since, reading an interesting address on this subject by Sir William Armstrong. When coal was first an object of commerce, it was transported on the backs of men from the pit's-mouth to the sea-coast. A man in this way might carry a load of half a hundredweight; but after a time a pack-horse was substituted for the man, and carried about three hundredweight. As science progressed, the pack-horse was attached to the wheel-cart, into which its load was put, and it pulled down sixteen hundredweight. Then, as industry progressed, tram-roads were laid down between the pit and the coast, and the same horse pulling a waggon carried forty hundredweight. Finally came the great triumph of science, when coal was employed to pull itself. The smoking, snorting iron horse, fed with coal and water, drags along the railroad 200 tons. The conversion of coal into force which produces this great result is in point of cost scarcely greater than that of the human beast of burden, or the packhorse originally used for a scant result. And yet our engines are so imperfect that they only use one-tenth and waste nine-tenths of the available force in coal. The importance of the transformation may be better understood if you view the force of coal as expressed in men's power, just as we do in speaking of an engine as having so many horse-power. If human force were alone used in this country, the sum of production must be limited by the number of inhabitants. In such a case the United Kingdom could not produce more than the products of the labour of its thirty millions of inhabitants of all ages. But the coal excavated annually in this country represents in actual attainable work almost exactly the sum of the force of the whole population of the globe, viewed as adults. So that the use of a natural force, in substitution for human power, augments vastly the productive resources of our small, insular kingdom, and enables it not only to supply its own want, but also to export to other countries its superfluity of production." In pointing out the depressing effects of slavery upon the practical energies of a people, Dr. Playfair said, "did time not fail me, I should like to have shown how it injured this country through its colonies, even in the lifetime of many of us. But you may think all these things are of the past, and have no application to us now. You are mistaken. There is a slavery in ignorance which is seriously detrimental to a people. Liberty in thought, in expression, and in action is essential to human progress. Science can only prosper when she follows Descartes' maxim, that you are to take nothing as true on the authority of others. "Ne recevoir jamais aucune chose pour vraie qu'on ne la connaisse evidement être telle." If science be not free enough and strong enough to battle against all untrue opinions, whether in religion or politics, she cannot advance; and "la science arrêtée arrête le monde." If industries be hampered by selfish rules of unions, whether they be those of masters or men, by which production is retarded, and intelligence and skill discouraged, the industries must languish and die in those places deprived of a natural liberty. The masters or the labourers may ruin themselves or their children by slavish restrictions on trade, but they are powerless in restraining the advance of scientific applications to industry. It is a law of progress, which neither nations, trades, nor individuals can resist, that as civilisation progresses the brute labour of the man must be lightened by the use of natural forces. The latter can often do in a few hours, under the guidance of intellect, what the unaided labour of a man could not do in a life-time. This is how all men should work, they should use their heads as well as their hands, so as to save the labour of the hands by the well-conceived thoughts of the head.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

The exhibition buildings are making rapid progress towards completion. The painters and decorators have finished their work in the fine arts gallery, and Messrs. Minton, Taylor, and Co., have commenced laying the encaustic tiling on the floors. The walls of the galleries are painted in distemper, a pale green, relieved by a broad band of chocolate under the cornice and by the skirting, which is also chocolate. The ceiling is ordinary distemper. The effect of the whole has been pronounced by those who have seen it to be exceedingly pleasing. In the lower part of the building, which has just been taken possession of by the painters, the same colours will be employed, and, with some exceptions, the same style of decoration will be employed. A dado, five feet high, of chocolate colour, will run round the entire court, and the girders which support the fine arts galleries above will be panelled in the same colours. The colour of the tiles for the flooring is dark red.

The French supplementary gallery, or annexe, forms three sides of a square, and has direct communication with the exhibition buildings. The court-yard, or interior of the square, is to be laid out as a garden, and used for refreshment purposes. It is proposed to open up to the view of persons in this court-yard the gardens of the Horticultural Society.

American artists, residing in the United Kingdom who purpose exhibiting works of painting and sculpture, are requested to communicate their names and addresses as soon as possible to the Secretary.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

MUSICAL PITCH.

It will be recollected that the Society set on foot, some little time since, inquiries in reference to the pitch in use in various countries on the Continent, and, through the courtesy of the Foreign-office, replies were obtained from the principal continental cities. The letters received have been published from time to time in the *Journal*, and two others, lately received, are appended below. The following *resumé* of the correspondence has been made, which it is believed will be of interest to the readers of the *Journal* :—

Questions	Is there any standard musical pitch officially prescribed, and in use; and, if so, what is it, and by what number of vibrations for "C" is it represented?	By what authority is it adopted, and how enforced?	Is it compulsory on any, and what class of musicians, and whether or not in military bands, conservatoires, operas, Royal chapels, &c.? Name these, if any.	Remarks.
*BADEN (Grand Duchy)	No; but Paris pitch commonly adopted.	None.	It is only obligatory when ordered by authority, and only exists in the Grand Duchy at the Court theatres at Carlsruhe and Mannheim, and in the military bands.	The introduction of the normal pitch necessitates purchasing new wind instruments, therefore private persons are glad to avoid the change of pitch.
BERLIN	No; the new Parisian orchestral pitch is only employed at a few theatres and orchestras.	It is not enforced.	It has only been introduced at Berlin in the Royal Opera House, by command of the Intendent General of the Royal Theatres.	It is to be expected by degrees the Parisian pitch will become universal, as it offers special advantages to singers.
BOLOGNA	No musical pitch, officially prescribed, exists in Bologna.	No authority to regulate the pitch.	No.	The pitch adopted by the orchestra of the theatre, and of the Musical Lyceum is represented by 887·77 vibrations for La.
BRUSSELLS	No standard pitch, except for the military bands, and that the old pitch commonly in use, 902 vibrations.	None, except the Minister of War for military bands.	Not generally, only for the military bands.	A Royal Commission reports there would be no advantage in lowering their pitch, which is 902 vibrations, nevertheless the Theatre Royal has adopted the French normal pitch of 870 vibrations; the Conservatoire Royal de Musique and the Orchestra of Popular Classical Music still keep the old pitch of 902 vibrations.
*COLOGNE	No. The Concert Society (*Conzertgesellschaft*) of Cologne adopted the French normal pitch some years since.	None.	Only obligatory for the representations of the Concert Society.	
COPENHAGEN	No.	None.	Not compulsory.	The pitch at the Opera (Theatre Royal) is taken from two old forks nearly agreeing with the normal French pitch. The A of the military bands is at least quarter tone higher than that of the theatre. The School of Music has the pitch of the Royal Theatre.
*DRESDEN	No officially prescribed musical pitch.	None; but the French pitch is adopted in some chapels and orchestras, comprising about one-sixth of all the chapels and orchestras.		The pitch in the Royal Chapel at Dresden, for A is represented by 892 vibrations. In the Roman Catholic Court Church of Dresden the old so-called *chorus-tone* still exists, representing, for A, 855 vibrations.
FLORENCE	There is none.	None.	The musical pitch adopted in Florence is generally that of Vienna.	The pitch is left entirely to the taste of every orchestra director.

* Those places marked with an asterisk have sent tuning-forks.

	Is there any standard musical pitch officially prescribed, and in use; and, if so, what is it, and by what number of vibrations for "C" is it represented?	By what authority is it adopted, and how enforced?	Is it compulsory on any, and what class of musicians, and whether or not in military bands, conservatoires, operas, Royal chapels, &c.? Name these, if any.	Remarks.
*LEIPSIC	None. The pitch in common use is high, 920 to 940 vibrations for A.	None. The authority for its use is merely custom.	The pitch compulsory for military bands at Leipsic is the same as at Dresden.	It has not been considered necessary to alter the pitch, as the alteration would involve a renewal of brass instruments.
MILAN	At Milan there is a pitch officially adopted in the Royal Conservatoire of Music, in the theatres of La Scala and Canobbianna, in the schools of music and theatres connected with them, and in the National Guard. This pitch is the Paris pitch, namely for *La*, 870 vibrations.	The authorities which regulate this pitch are the Academical Council for the Royal Conservatoire, and the Committees of the Town Council for the theatres, the schools connected with them, and their musical bands.	The pitch of 870 vibrations for the note *La* is compulsory on the before-named musical bodies, but without government interference.	
MOSCOW	No answers received.			
*MUNICH	The officially prescribed pitch for music and musical instruments is the French pitch.	It is prescribed by authority of the Royal Musical Intendance (Kœniglich Hofmusik Intendanz), and its general use has been thereby secured; only such tuning-forks are allowed to be used in Bavaria as have been approved and stamped by the above-named Intendance.	The directors of all establishments for instruction and education in Bavaria are made specially responsible for the exact observance of this regulation.	The use of the standard pitch is, therefore, obligatory on all classes of professional musicians, and as no objection has hitherto been raised against the regulation in question, it may be assumed that the French pitch, which is especially calculated to prevent the overtaxing of the human voice, is at the present time in universal use in Bavaria.
NAPLES	None.	None.	None.	The pitch usually adopted is that of Vienna.
ST. PETERSBURG	The same as the French pitch.	It is established by ukase.	It is compulsory for the Imperial Chapel, the Imperial theatres, for the orchestras of regiments, and, in general, at all musical establishments. It is equally compulsory for manufacturers of musical instruments.	
STOCKHOLM	No answers received.			The Academy have taken the subject into their consideration, and propose to petition the King to adopt the French pitch.
*STUTTGART	None; but the French pitch may be regarded as the customary pitch in Wurtemberg.	None.	The French pitch is used in the Conservatorium and Stifts Church, the organ of which has been tuned thereto. Private theatres and concerts, as well as the town and church orchestras in Wurtemberg still continue the old high pitch, either on account of the expense or difficulty of retuning the church organs.	The French pitch is not introduced for military music, as there is no vocal music, and it would not be worth the cost of providing new instruments.
TURIN	None.	None.	None.	

* Those places marked with an asterisk have sent tuning-forks.

	Is there any standard musical pitch officially prescribed, and in use; and, if so, what is it, and by what number of vibrations for "C" is it represented?	By what authority is it adopted, and how enforced?	Is it compulsory on any, and what class of musicians, and whether or not in military bands, conservatoires, operas, Royal chapels, &c.? Name these, if any.	Remarks.
VENICE	No fixed musical pitch. Our orchestras adopt the musical pitch of Vienna because the greater part of their wind instruments are made in that city.	As no officially prescribed musical pitch exists, no authority regulates it, and as our orchestras have no fixed pitch, it varies according to the taste of the directors; it ought, however, to be stated these artists try to keep the pitch as low as possible.	The non-existence of a fixed musical pitch answers this question. However, it may be observed that the organ of the metropolitan chapel of St. Marco was formally tuned on the basis of the old *La*, very low. A few years ago it was directed to be raised, because the bowed instruments lost their fullness of tone, and the wind instruments manufactured in Vienna were not in tune with it; now, this organ is tuned a quarter of a tone lower, but still it is higher than the normal French pitch. The other organs are tuned according to the fancy of the builders. Modern builders generally adopt the Vienna pitch in preference to that of Paris. There is no authority which regulates the pitch in bands of the army and the National Guards.	
VIENNA	No; but the French standard pitch has been introduced in both the Imperial theatres, in the Court band, and in the more important concert societies in Vienna.	None. The Lord High Chamberlain's Office introduced the pitch of the Imperial theatres, and the Grand Master of the Ceremonies' Office that for the Court music. The French standard pitch was introduced in these two establishments in 1862. The Society of Friends of Music in the Austrian Empire followed this example, on their own account, for their "conservatorium," as also did the Society of Philharmonic Concerts.	The French standard pitch is only obligatory for the two Imperial theatres and the Imperial band of music. The remaining theatres in Vienna, and all the theatres in the provinces are not Court or State establishments, neither is the "conservatorium" of the Society of Friends of Music. Therefore a measure of this sort, connected as it is with pecuniary sacrifices, could not be dictated to these. The adoption of the French standard pitch is becoming every year more general. The French standard pitch has not yet been introduced into the Austrian military bands.	

Further Correspondence.

SWEDEN.

The following has been furnished by the Royal Musical Academy of Stockholm:—

(Translation.)

"As far back as May 20th, 1856, the following circular was sent from Paris to various countries:—

"'It is known that all lyric theatres, musical conservatories, and musical societies have a different musical pitch, often varying even in the same orchestra. Thus, the tuning-fork of the Paris opera is said to be, in a scientific publication, half a tone higher than it was in 1823. Owing to this, the works of the older composers lose their character, which fate will soon be shared by more recent ones. Singers also, in changing stage and pitch, are placed in an awkward position, and injure their voices by this tendency to raise the musical pitch. This uncertainty is equally disadvantageous to manufacturers of musical instruments.

"'It is, therefore, highly desirable that a general tuning-fork, with a fixed number of vibrations, be adopted, to serve as a universal rule for the musical pitch in every country.'

"Two years later, a committee was formed in Paris, consisting of eleven persons, amongst whom was Berlioz, Halevy, Meyerbeer, Rossini, &c. The following was stated at some of the meetings of the committee:—That Tavart and Cagniard, as well as Latour, have agreed that a tuning-fork giving the note A makes 440 single or 880 double vibrations in a second.

"If we go back to the 18th century, during the latter years of the reign of Louis XIV., the rule for A in the orchestra was 810 double vibrations per second (fixed from the year 1699 to 1755). Now the A is 890 vibrations, at the Opera in Paris. Thus we see that, from the year 1715 to 1855 an increase of nearly a whole tone has taken place.

"This increase, although progressive, has to a large extent taken place in the present century, and more rapidly during the last twenty years.

"The trial by Scheibler, in 1834, showed the musical pitch at the Opera in Paris to be 867, and at the Conservatoire 870 double vibrations per second. According to Dr. Lissajou's communication, the musical pitch at Berlin, in 1857, was 896; that of San Carlo, at Naples, 889; and that of La Scala, at Milan, 903; that of the Stockholm Opera being 880 double vibrations per second.

"The committee came to the following conclusions:—A so-called normal tuning-fork was prepared, which

tuned in A, should make 870 vibrations in a second, at a temperature of + 15° centrigrade.

"The Parisian authorities agreed to this proposal on Feb. 9, 1859. The normal tuning-fork which is to act as a guide both in Paris and in the departments, is kept at the Conservatoire Imperiale in Paris.

"By the care of Mr. L. Palmstedt, the Musical Academy has received from one of its members, Dr. Lissajous, a handsome copy of the tuning-fork mentioned above. Now that the Academy has received instruments from the celebrated manufactory of Godefroy, in Paris, the orchestra of the 'Kousertoriet' is tuned to the normal tuning-fork.

"As soon as the Academy has had time to find out whether wind instruments made according to older construction can be altered to reach the same musical pitch as the normal tuning-fork, as well as the cost of such alteration, taking for granted that the expense will be less than the purchase of new ones, the Academy will probably send a petition to his Majesty, humbly requesting the adoption of the normal tuning-fork over the whole country."

(Signed) J. S. Cronhammer,
Secretary of the Royal Musical Academy.

Stockholm, November 5, 1869.

St. Petersburg.

(Translation.)

Sir,—By a letter of the 12th February, 1869, your Excellency sought the assistance of the Minister of Foreign Affairs in obtaining information, requested by the Society of Arts of London, in reference to the musical pitch in use in Russia.

The Imperial Government applied to the competent authorities, and I have the honour to inform your Excellency that, in accordance with the terms of a decree sanctioned by his Majesty the Emperor, dated 6th April, 1862, contained in a ukase of the 30th of May of the same year, the French normal pitch has been established throughout the empire of Russia. This pitch is obligatory in the Imperial Chapel, the imperial theatres, regimental bands, and in every establishment, whether under the crown or of a private character, where there are orchestras or choirs, and in which music and singing are taught. It is also obligatory on all makers of instruments.

I have the honour to transmit a tuning-fork in use in Russia, which has been furnished by the Director of the Imperial Theatres.—Accept, &c.,

(Signed) Westmann.

His Excellency Sir Andrew Buchanan.

METEOROLOGICAL SCIENCE.

The Committee of the Royal Society, nominated in 1866, at the request of the Board of Trade, for the conduct of the inquiries which commenced under the direction of the late Admiral Fitzroy, have now published the results of their gratuitous labours for the improvement of meteorological science, during the year ended 31st December, 1869. Their published report informs us of the progress effected by the office in the several departments, the commencement of which was fully described in the former reports for 1867 and 1868. The most important feature of the past year, as compared with its predecessor, has been the organisation of systematic operations, in the discussion and publication of the results furnished by the self-recording instruments at the observatories. The whole of these discussions are conducted at the office in London, under Mr. R. H. Scott, the marine branch being under the charge of Captain H. Toynbee, the Marine Superintendent.

The statement of the results arrived at by the committee are classified under three separate headings, namely, Ocean Telegraphy, Telegraphy and Weather Signals, and Land Meteorology of the British Islands. The officials continue, as in former years, the practice of lending to captains in the mercantile marine instruments which have been tested at Kew, and are generally, except in short voyages, returned for re-comparison with standards as soon as the ship returns to port. The loan is granted on condition of observations being regularly taken and entered in a register, which is issued with the instruments, and is sent to the office when they are returned. Captains of merchant ships are allowed to purchase any of such at cost price, on condition of their keeping a register of observations for the use of the office. The committee undertake, in addition, the entire duty of supplying her Majesty's navy with all the meteorological instruments used in the service. The result of these observations are tested as to their correctness, and, where possible, the Marine Superintendent makes a point of having a personal interview with the captains of all the ships supplied in London, and as many as can be made by journeys to Liverpool. A large mass of data, under the head of "Ocean Telegraphy," has been reduced to a state that will admit of publication.

At the meeting of the British Association at Dublin, in 1857, it was requested that self-recording anemometers should be established on some of the islands in the Atlantic Ocean, in aid of the observations now being carried on on ship-board. It has been determined at once to commence the tabulation, reduction, and discussion of the accumulation of important matter arising therefrom. This work is now in progress, but will require considerable time for its completion. The construction of deep-sea thermometers has been much improved in the course of the year. The dredging expedition made in H.M.S. *Porcupine* adopted a form of thermometer for deep soundings which resembles in principle that formerly employed under Admiral Fitzroy's direction. These have given great satisfaction, one of them having been used throughout the entire cruise without its accuracy being in the slightest degree impaired. A supply of instruments have also been granted by the committee, for educational purposes, to the navigation schools at Aberdeen, Leith, Plymouth, and South Shields; and also a set has been allowed to remain at the Church of Scotland Training Schools, Edinburgh.

Under telegraph and weather warnings, we are informed that no material change has taken place, except in an increase of reporting stations both at home and abroad. They now number 20, and are situated—eight in England, two in Wales, six in Scotland, and four in Ireland. A considerable change, however, is recorded as having taken place in respect of the interchange of weather reports with foreign countries, owing to the establishment of direct communication between Norway and Holland. The Meteorological Office received from the Observatoire Impérial in Paris reports from Paris (twice daily), as well as once a day from Strasbourg, Lyons, Brussels, and Corunna. The Ministère de la Marine forwarded reports from Cape Grisnez, St. Mathieu (Brest), Grognin (L'Orient), Ile d'Aix (Rochefort), (twice daily), Biarritz, and Cape Sicie (Toulon). In return, the office dispatched to the Observatoire, reports from Nairn, Scarborough, Yarmouth, Penzance, Valencia, and Greencastle; and to the Ministère de la Marine a daily *résumé* of the weather, as reported from the stations in these islands and in Norway. Upon the whole, it appears that the office receives 35 reports every morning, and nine every afternoon. Experience has shown that in most instances the office is able to transmit to neighbouring countries information of much greater value than any it can receive from the Continent, owing to the fact that most of our storms come to us from the Atlantic. The committee have continued the practice of lending barometers to small ports and fishing stations, where the inhabitants are too poor to be able to provide such for themselves. Fourteen of these barometers were issued

in loan during the year, and there are now 111 stations around our coasts thus supplied for public use. The stations are situated—48 in England, 2 in Wales, 38 in Scotland, and 22 in Ireland.

The land meteorology of the British Islands has undergone the most active development since the date of the last report. The stations fitted up with self-recording instruments are seven in number, and they were all inspected by Dr. Stewart; and the records of the observatories are examined at Kew. In consequence of the great regularity and comparative freedom from defects, the committee have resolved that their systematic publication of results should commence with the year 1869. They have, therefore, increased the computing staff, so as to keep pace with the progress of the instruments. The continuous records will be capable of being utilised for entirely distinct purposes. On the one hand, it is anticipated, they will furnish mean numerical results of accuracy surpassing anything which could be yielded by eye observations; and on the other hand, they will exhibit the change in atmospherical conditions which pass over our islands with absolute fidelity, and will thereby throw a totally new light on the study of the weather. This weather journal, intended to be published in a form available for weather study, will appear at intervals of three months, and will be entitled "The Quarterly Weather Report of the Meteorological Office." The costs of the department have been—for researches in ocean meteorology, £1,639; telegraph and weather warnings, £2,639; land meteorology of the British Islands, £3,174; expenses of management, &c., £2,966; making a total charge of £10,418. Something additional has been incurred in consequence of the transfer of the office to No. 116, Victoria-street, where the very valuable researches of this department can now be conducted under more suitable arrangements.

NATIONAL EDUCATION IN FRANCE.

A report upon the educational condition of France has been presented by Mr. Sackville West, her Majesty's Secretary of Embassy at Paris, and, considering the advantages possessed by the writer, the information thus afforded may be taken as a fair criterion of the actual existing facts before the war. The statistics, which have been collected from official sources, show that 190,014 persons were employed in public and private education, of which 90,319 were men, and 99,695 women. There were besides 155,865 persons more or less engaged in matters connected with general education.

Public instruction is divided into three classes, viz., "l'enseignement primaire," "l'enseignement secondaire," "l'enseignement superieur." The "primary" involved a total cost to the State of £2,461,560, in 1868, which was derived from the various sources, namely, communal, departmental, fees, donations, and the budgets. In 1846, there were 58,556 schools, with 3,436 923 children; and, in 1869, they had increased to 72,000 schools, with 4,600,000 children. The average increase in the number attending the primary schools, during the period 1848 to 1863, was about 70,000; the births during the same time having remained stationary. Out of a population of 38,200,000 (1866) there were, from tho ages of 7 to 13 years, 3,974,062 children of both sexes; of these, 3,310,702 were attending school, 663,360 not attending, and 393,173 under the category of uneducated. Of the 287,812 boys not attending, about 160,000 were either in tho secondary or professional schools. The State pays for all schools aliko, and claims a general jurisdiction, which the clergy dispute, and consequently the lay and religious elements are very antagonistic. The Church has primary and secondary schools of its own, and in five years, 1861-66, the lay element was gradually losing ground.

The "secondary" consists of the lycées and the communal colleges, and the results show that, in 55 years, the number frequenting the secondary schools have doubled, and at the lycées tripled. The expenditure under this head amounts to £2,578,580, the greater part, £2,342,592, being derived from family payments, and the remainder from the communes, State, and departments. The free secondary instruction, which is apart from the State, is in the hands of the clergy, and also of laymen. This consisted, in 1866, of 909 schools, with 78,413 pupils, to which must be added the nunneries. Altogether, the pupils receiving instruction under every category numbered 155,000 in 1866, being an increase of three per cent. over the same in 1852. The special secondary instruction is provided in the Universities, and prepares students for the agricultural, commercial, and industrial careers. In 1868, it was given, in 77 lycées and 247 colleges, to 5,002 students. It is remarkable that the number of young persons taking advantage of the secondary education was, in proportion, greater under the old monarchy than in 1842. In 1763, there were 562 establishments, with 72,747 pupils, or 2·90 per cent. of the population. In 1842, 1,374 establishments had only 64,341 pupils, and, even taking into account the 7,450 pupils of the Lycée, the proportion is only 2·4 per cent. Classical education was, however, given in former days in many instances gratuitously, now a pupil at a lycée has to pay £120 a year, besides other expenses.

The "higher" consists of three schools and 53 faculties, 408 professorships, and 18,000 students; also, 22 preparatory schools of medicine, and five literary and scientific. There are municipal establishments, but their professors are appointed by the State. The whole charge amounts to £280,000, and in the shape of university fees, £136,000 was received; £152,702 were voted in the budget of 1866. The State expends an annual sum of £40,000 in gratuitous education at the lycées, to the sons of public officers.

Although a decided progress is observable in primary education, not more than 68 per cent. of the children could, in the year 1866, be considered as having profited by school education. The number of recruits who can neither read nor write does not diminish in proportion to the increase of the pupils at the primary schools. They appear to lose between the ages of twelve and twenty what they learnt between eight and twelve; hence the necessity of establishing adult classes and school-libraries on a more extensive scale. Out of 15,870,173 men, and boys over eight years old, there are 3,821,483, or 24 per cent., who cannot read; and out of 15,967,520 women, and girls over eight years old, 5,245,506, or 33 per cent. There are 5,468,999 men, and boys over eight years old, or 15 per cent., who cannot write, and 7,487,314 women, and girls over eight, or 47 per cent. It follows, therefore, that out of twelve Frenchmen three cannot read and four cannot write, and that out of twelve Frenchwomen four cannot read and six cannot write.

The friends of education in France express much discouragement at these results, which contrast, in their opinion, unfavourably with Germany, England, and the United States. Great importance is attached to primary education, since the communal school ought to be the nursery of the lycée and departmental college. The organisation of the latter is very minute, so much so, it is said, that the Minister of Instruction could tell exactly at what hour the students of the colleges, from Nice to Dunkerque, or from Metz to Bayonno, were about to translate or recite an ode of Horace. The sums devoted to national education, they complain, are small in comparison with the enormous expenditure of the war and marine departments; a growing necessity for a more comprehensive and liberal system of national education is expressed, although they fear that any such measures would meet with strenuous opposition from the clerical party.

EDUCATIONAL NOTES.

There is strong reason to fear that the election of school boards, especially that for the metropolitan district, will, in the first instance at least, be to a great extent a mere party contest, and that candidates will be chosen as representatives of political or religious interests, and not, as might have been hoped, because they have shown that they really understand better than their neighbours what are the educational wants of the people, and how they can best be supplied. Some of the addresses already put forth by candidates show this but too clearly, and moreover, promise to "maintain the strictest economy," and to "protect the pockets" of the ratepayers, as if a liberal expenditure in educating the people were not the truest and wisest economy.

It is satisfactory to find, however, that in some quarters the extreme danger of importing party spirit into this question is beginning to be felt. A correspondent of the *Times*, under the signature "H. M. M.," says:—"The formation of the London School Board, under the new Act, is no ordinary occasion. If ever there was a time when sectarian differences should be laid aside, that time has now arrived. What, as an individual, without any right to speak beyond what a deep interest in the Act confers, I should like to say is this—namely, that persons who have a well-known and well-defined sectarian position should magnanimously, in the cause of education and of London, decline to be put in nomination. Everyone would respect the withdrawal of 'advanced' names on the 'non-sectarian' as well as on the 'sectarian' sides. Do not let the rated householders of London allow enthusiastic sectaries of any creed or no creed to get seats on the board. What we want on the board is men about whose fitness neighbours of opposite opinions will agree. Think what a cruel thing—not to enlarge on the various aspects of impolicy—it would be to make this board a battle-field for conflicting opinions which should be fought out in common morality elsewhere."

At a recent meeting at Bradford, Mr. A. Illingworth, M.P., incidentally adverted to the election of a school-board, expressing a hope that, at any rate, in such a matter as that, so simple and yet of such primary importance, the burgesses would not get into the political rut. Let them consider the education question in all its bearings. He held that the election of a school-board should be preceded by discussion among the ratepayers, and an intelligent understanding of the bearing and meaning of the Act. He hoped that the school-board would not be made an arena for sectarian strife. They wanted primary education for the children of the borough. They did not want school-boards to be made use of either by one sect or another for the carrying out of their special pet views.

At Birmingham, an attempt at promoting united action by the League and Union jointly in the nomination of candidates has failed, the answer of the League to the proposal being that they "do not feel justified in entering into any coalition for the purpose of nominating the members of the school board, as such a course would tend to limit the free choice of the ratepayers, and they further consider that the difference of principle between the two bodies is so great as to preclude united action."

With regard to the Metropolitan Board, the main object of the League appears to be to promote the election of working-men candidates, for at a recent meeting it was decided "that no action beyond advice should be taken by the League in the various local elections; that no more working-men candidates should be put up in any borough than there was a reasonable chance of returning; and that wherever, by a compromise, a working man could be returned, such compromise should be acted upon."

At the recent Church Congress at Southampton, a discussion took place on "The Duty of the Church in the Present Phase of the Education Question as affected by the Elementary Education Act." On this, Mr. A. J. Beresford Hope, M.P., the Rev. B. Morgan Cowie, B.D., the Rev. A. R. Ashwell, Principal of the Durham Training College, Mr. Cowper-Temple, and others addressed the congress. Mr. Beresford Hope argued that the first result of the new condition of things, so far as the masters and mistresses are concerned, would be that a code of class feeling would be developed, and that the clergy would not be able to rely on them in virtue of their office as church teachers. The clergy must, therefore, teach religion themselves; and, after exhausting all the expedients of local co-operation, the powerful aid of diocesan inspection must be invited to encourage and to harmonise religious teaching from parish to parish. The abolition of the compulsory inspection of religious teaching by the government inspectors made it incumbent upon the Church to supply tho lack in the most formal and complete manner. Such inspection ought, as far as possible, to be made compulsory on Church schools, and the inspectors ought to be paid, a special fund being raised for the purpose. With regard to the rate-aided schools, he thought the clergyman would often have great difficulty in systematically keeping together a class of children, who had already toiled through the school day, for religious teaching in some other room. But, in proportion as the difficulty was great was the absolute necessity for making the attempt.

An important meeting was held at Exeter, on the 7th inst., to consider the Endowed Schools Act. The High Sheriff of the county presided. After speeches by the Earl of Devon and Lord Portsmouth, the Bishop of Exeter moved:—"That the educational organisation of the county, so far as endowed schools are concerned, should consist of schools of different grades, so connected, by means of exhibitions, that the progress of the deserving scholar from a school of the lower grade to a higher may be provided for and facilitated." As a member of the Commission, he explained the work which the Commissioners had done. Their scheme was that schools should be divided into three grades; the first for those whose parents could afford to send them to school till 18 or 19. These should receive a classical education. The second grade was for those who remained at school till 16 or 17, who would receive a semi-classical education; and the third, of those who left school earlier, who would receive a good English education, and the elements of Latin grammar if thought necessary. Sir J. D. Coleridge supported the motion, which was carried. Sir Stafford Northcote proposed a resolution to the effect that, in dealing with educational endowments, a substantial portion should be applied to the purposes of female education. He observed that, in many instances, foundations intended for both sexes had been monopolised by one. A committee was appointed to co-operate with the Endowed Schools Commissioners.

Last Wednesday afternoon, at the instance of the National Association for the Promotion of Social Science, a meeting was held "to consider whether any steps may be taken to bring before the public the desirability of securing an efficient school board by the election of men without reference to their political or religious opinions, but solely on the ground of their personal fitness and acquaintance with the educational necessities of the metropolis." Dr. Lyon Playfair, M.P., presided. Mr. Hastings, Chairman of the Council of the Association, moved:—"That, in the judgment of this meeting, the opportunity which is now, for the first time, afforded to the ratepayers of London of electing a school board for the entire metropolis, and therefore of making adequate provision for the education of the people, is one which imposes upon the ratepayers, individually and collectively, the duty of bringing forward and supporting candidates who, from their acquaintance with the educational necessities of the metropolis, and the educational systems in this and other countries, as well as from their known

sympathy with the large classes who will be more immediately affected by the provisions of the Education Act, will be likely to make efficient members of the School Board, and to do their duty without regard to sect or party." The men wanted, he said, were those who were practically versed in the work of education. The resolution was supported by Professor Sheldon Amos, Mr. Payne, Mr. Applegarth, Mr. Chadwick, and Canon Cromwell, and was carried unanimously.

The chairman of the Michaelmas Quarter Sessions for Surrey, in charging the grand jury, said he was glad that the Compulsory Education Bill would soon come into operation, and he hoped that would reduce the number of prisoners. The children of the metropolis would then attend the schools, and receive an education. By an Act passed in 1866, entitled the Industrial Schools Act, children found wandering, or whose parents had been convicted, could be taken before a magistrate, and he could commit them to an industrial school instead of a prison, but no one was appointed to carry that Act into operation. By the Compulsory Education Act, however, an officer would be appointed, and he would take children before the magistrates if they did not attend the schools. They would be taught the difference between right and wrong, and he had no doubt that there would be a great decrease in crime.

CORRESPONDENCE.

SPELLING REFORM.

Sir,—Extremes meet on the question of spelling reform. On the one hand there are those who would not change in one "jot or tittle" the orthography which happens to be now current, while, on the other hand, there are those who will be satisfied with nothing short of a radical reconstruction. Is there not a middle course between these two extremes? Mr. Ellis has inadvertently fallen into the error of supposing that the fragment which appeared in a former number of the *Journal* was a complete exposition of a perfect scheme of mine for spelling reform, as though a subject so extensive, important, and difficult could be discussed in all its bearings within the limits of a few pages. It will therefore be unnecessary for me to reply to criticisms based upon an erroneous impression.

It may be presumed that the feasibility of introducing gradual and moderate improvements in the present orthography, as opposed to sweeping and thorough changes, is a question open for discussion.

If it appeared desirable and practicable to bring about the adoption of a perfect and complete system of spelling this year or next year, we should have to consider which of the several systems now proposed is the most eligible—Mr. Pitman's phonetic (which Mr. Ellis has abandoned), Mr. Ellis's glossic, Mr. Bain's diacritic, Mr. Bull's sonotypic, or some combination or adaptation of any one of these.

Seeing, however, the apparently insurmountable obstacles to the introduction of any theoretically perfect system, the question naturally suggests itself—Is no improvement whatever possible?

The greatest difficulties in teaching reading and spelling arise from such words as the following:—*Door, floor; blood, flood; love, dove; move, prove; soup, group; touch, young; soul, four; believe, receive; doubt, debt; plough, rough, though, through, cough.* Very little difficulty is experienced with such words as *mat, mate; met, mete; pin, pine; not, note; tun, tune*, &c. Now it happens that the words of the latter class are counted by thousands, while the irregular and difficult words may be counted on the fingers'-ends, and, in some cases, the anomalies are confined to two or three words. Thus *flood* and *blood* are the only words of their kind. The changing of these few words and others like them would be a very trifling change, but the gain to the learner would be immense. Thus, "door," "floor," = *dore, flore;* "blood," "flood," = *blud, flud;* "love," "dove," = *luv, duv;* "move," "prove," = *moov, proov;* "soup," "group," = *soop, groop;* "touch," "young," = *tuch, yung;* "soul," "four," = *soel, foer;* "believe," "receive," = *beleve, reeeve;* "doubt," "debt," = *dout, det;* "plough," "rough," "though," "cough" = *plow, ruf, tho, throo, cof.*

In support of changes like these, we have the authority of the best old authors before the orthography was stereotyped by modern printers and compilers of dictionaries; these are, in fact, the true historical and analogical spellings of these words.

Here, then, is a principle by which a vast amount of improvement might be effected, without introducing any new letters or combinations, or applying any new principle, by simply selecting from materials before us. How far these changes should be carried, it would be presumption in me, and, I think, in any individual, to dogmatise upon. This question, being a national one, must be determined in some shape or other by government authority.

It is quite beside the mark to say, what we are perfectly aware of, that anomalies would still remain, but, even with those, there may be applied many expedients and aids to diminish the difficulty of reading and spelling. For example, the rule, "A vowel is short before two consonants, or one consonant final," would be of very general application, though not universally applicable. Then, as to the accent, the rule that the accent is on the first syllable, unless otherwise indicated, would be very useful. It is a question whether the limited use of diacritic marks, to indicate the position of the accent, would not be advantageous in exceptions to these rules.

No scheme of spelling reform can be used in government schools without the sanction of the Education Department, and the responsibility of determining whether any or what scheme of reform shall be sanctioned must rest with the government.

It will possibly be said that such a proposal as is here indicated is not logical or complete, but the House of Commons have hitherto acted more on the principle of practical convenience than theoretical consistency. Besides, a logical and symmetrical system of spelling would require single signs for single sounds, and similar signs for similar sounds. The attempt to construct a perfect and consistent system of orthography on the basis of the present incomplete and insymmetrical alphabet is "to put new wine into old bottles" with the certain result.

Then the great difficulty practically is this. Supposing children were taught to read in phonetic, or glossic, or diacritic, they must go over the ground again to learn the present spelling and reading in books and newspapers. If the existence of the present orthography in books and newspapers could be ignored, there are at least a dozen ways in which a consistent system could be constructed; but, with the mass of literature before us in the present spelling, it would seem to be good policy to adhere as closely as possible to the existing arrangements, and to change nothing needlessly. This is the principle upon which all reforms in England have been carried.—I am, &c., E. Jones.

The Hibernian Schools, Liverpool.

NO NEUTRALITY—NO NEUTRALS.

Sir,—In your issue of October 7th, 1870, under the above heading, appears a letter from Mr. Hyde Clarke, which contains a glimmering of that knowledge which is required in order to find out how to appreciate the following motto, viz.,—"Universal free trade the first condition of universal peace." I regret, however, to differ from him when he says, "whereas, though we have made every exertion of late years for free trade, &c." I deny, with all due deference to him, that we, as a nation, have made every exertion for free

trade, or even any exertion since the Corn Laws were repealed in 1846.

But what is free trade? There is room to differ on this point. My definition is this, viz., that so long as a vestige of that fiscal system remains on the statute book which levies taxes on commodities, or the interchange of commodities, so long are we destitute of free trade. I contend that until Britain has swept from her statute book the customs and excise laws, she is violating the principles of free trade, and thereby rendering herself unable to come into the world's court with clean hands to advocate them. Whilst we levy a duty on the produce of any country we are virtually at war with that country, for I contend that commercial wars are the seed of physical wars. Therefore, how can we, whilst thus tainted, expect to hold, in the eyes of civilisation, that truly noble and independent position which ought to characterise all real neutrals. I enclose herewith an extract which appeared in the *Sun* of the 10th inst., copied from an official journal, which I sincerely hope you will insert in the Society's *Journal*, as one of the most important pieces of information yet given on the subject, inasmuch as it shows that the will of the French nation was gradually but spontaneously and unobservedly being formed; a moral power was thus exerting itself, prompted by the influence of that small modicum of free trade which was introduced into the French treaty ten years ago.—I am, &c.,

Thomas Briggs.

The Homestead, Richmond.

The French People and the War.

Extracts of the reports sent to the Minister of the Interior in the Ollivier Administration, prior to the declaration of war, have been published in the *Journal Officiel*, and offer a strange contradiction to the Emperor's statement that he had been forced into war by the French people. The extracts occupy eight pages of the official journal. The Minister had desired the prefects to ascertain the feeling of the country, and their answers were almost unanimous in favour of peace. The prefects were too courtly to oppose the central authority in so many words, but they gave the impression that the people will only support war from patriotism and public duty, not from any love of it for its own sake. Even the most warlike departments speak in these terms, and nowhere is there any manifestation of military enthusiasm. The prefect of the Aube says plainly, "War is not desired, but it is dreaded." "It is to be hoped that the country will not be driven to that extremity," says the prefect of the Creuse. The prefect of the Var says, "I cannot affirm to your Excellency that in the department of the Var, under present circumstances, a war could be popular; but the ruling principle on the public mind is confidence in the Emperor and his government, and a firm resolution to follow them wherever they may lead the country." Many of the prefects make no secret that their people have little attention to spare from their agricultural pursuits. "With respect to the country districts," says the prefect of the Ain, "the occupations and the anxieties of the harvest engross the attention of the population. It is but by slow degrees that the news of this grave incident will reach them. But, whatever may be their desire for peace, and however much it may be needed by them, they will, I am convinced, follow the current of public opinion by a patriotism equal to the occasion." That is hardly a description of enthusiasm. "The only anxiety of the people," says the prefect of the Neireu "is at this moment the continuance of the drought." "War would appear to us," says the prefect of the Ardèche, "as a fresh calamity added to those of the vine disease, the silkworm disease, and the drought." In the replies of the administrators of the Somme, the Orne, and the Oise, we find these admissions—"The country requires peace;" "A hearty peace is hoped for;" "It is hoped that the firmness of the government will contribute to the maintenance of peace." The unhappy department of the Moselle answers that it does not wish for war, but craves for peace. Certainly the experience of the last three months will not have modified that desire. Some of the reports show the individual characters of the prefects. One of them, the prefect of the Doubs, advises immediate action. "Has not experience shown, particularly in the case of the Luxemburg affair, that the national susceptibility is easily excited among us, but that a speedy re-action follows when hesitation and diplomatic discussions are protracted?" Another, the prefect of Vaucluse, boldly says:—"The people are apprehensive of war, and fear that the Emperor may too readily permit himself to be dragged into it." Another reply is outspoken enough:—"The Emperor and his government may do as they please—peace or war. By all its interests the department of the Nord clings to peace, but if honour and safety should demand, it will resign itself to war." "This news," says the prefect of the Ariège, "coming in the midst of profound calm, has caused great excitement. There is a general hope that everything will be attempted to render possible the maintenance of peace."

TRADE MARKS AND DESIGNS.

Sir,—Referring to the note on "Trade Marks and Designs" in the last number of the Society of Arts *Journal*, I beg to enclose the following extracts from the law, to assist your readers in securing the protection now offered in the United States, when required.—I am, &c.,

L. De Fontainemoreau.

4, South-street, Finsbury, October 17th, 1870.

By the new American law—"A patent for a design may be granted to any person, whether citizen or alien, who by his own industry, genius, efforts, and expense has invented or produced any new and original design for a manufacture, bust, statue, alto-relievo, or bas-relief; any new and original design for the printing of woollen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed or worked into any article or manufacture, or any new, useful, and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, or patented, or described in any printed publication, upon payment of the duty required by law and other due proceedings, the same as in cases of inventions or discoveries.

"Any person or firm domiciled in the United States, and any corporation created by the authority of the United States, or of any state or territory thereof, and any person, firm, or corporation resident of, or located in any foreign country which by treaty or convention affords similar privileges to citizens of the United States, and who are entitled to the exclusive use of any trade mark, or who intend to adopt and use any trade-mark for exclusive use within the United States, may obtain protection for such lawful trade-marks."

EXHIBITIONS.

Guiana Exhibition.—In the month of May last, attention was called to the announcement of a local exhibition of natural products, industrial results, and specimens of the fine arts, which was at that time intended to be held in the City of Georgetown, the capital of the colony of British Guiana, during the autumn of the present year. Circumstances, however, have led to the postponement of the date for opening the exhibition to Wednesday, the 8th of February, 1871, and it is desired, in making that change known, to invite the especial attention of the artists of this country to the opportunity which will be thereby afforded to

them, of bringing their productions under observation in a hitherto untried and novel field, with a reasonable prospect of practical results in the shape of sales. The artist contributors will be guaranteed against all risk of loss or expense, and will have the chance of sharing in the distribution of honorary marks, medals of gold, silver, or bronze, with certificates of honourable mention, which it is the intention of the committee of correspondence to award to competitors. The scheme provides for the reception in London, storage, packing, freight, and insurance on the voyage out and home, and whilst in the colony, of all such contributions with a guarantee for the safe return and delivery to the owners of all such as may remain unsold, and the payment of the prices in all cases where sales may have been effected on the terms named by the artist. All articles will be returned after a comparatively brief interval, it being fully intended that such as remain unsold should be shipped from the colony by the Royal Mail steamer leaving Georgetown on the 8th March, so as to be in London on the 29th of that month. Any further particulars desired will be furnished on application to Mr. McLean, of the Haymarket, who has undertaken to assist the committee in London. The committee, Messrs. E. G. Barr and W. Walker, will also be happy to receive and answer any inquiries addressed to their offices, 36, Mark-lane, E.C.

GENERAL NOTES.

South African Silk.—There has lately been exhibited at the offices of the Silk Supply Association a specimen of silk from the Cape, which has been pronounced of high-class quality.

Paris.—The Registrar-General, in his weekly return for the 17th inst., says:—"In Paris alone and its environs more than two millions of people are exposed to the conditions in which spreading, devastating pestilences are generated—defective water-supply, dirt, and want. The quarter of a million children will be the first sufferers."

Steel Rails.—There are in the United States, says the *Philadelphia Ledger*, 46,000 miles of railway which it is necessary to relay with steel rails. It takes 100 tons of rail to lay a mile of road. The estimation of 200,000 tons would only relay 200 miles annually. If steel rails were admitted free, their consumption here would be enormous, and the advantage to railway companies correspondingly great. Dear rails mean dear transportation, with large profits to the manufacturers of the domestic article. The two interests involved are in a great measure sectional. The great West wants cheap railways, that it may, by cheap transportation, put the product of its labour and enterprise into the markets of the world at the smallest possible cost, whilst those capitalists, principally at the East, engaged in making steel rails, desire exclusively to themselves the home market, for a comparatively new article, at paying profits.

Electro-plating with Nickel—Mr. Adams, of Boston, claims to have discovered a process by which the deposit is effected. A paper on the subject was read by M. Gaiffe, the French agent or partner in Paris, before the Academy of Sciences, in which it is stated that the presence of even the smallest quantity of potassa, or soda, or alkaline earths in the bath containing the nickelising preparation, is injurious to the properly adhesive coating for the metal. The use, he said, of perfectly pure double chloride of nickel and ammonium, or of perfectly pure sulphate of nickel and ammonia, and also of perfectly pure nickel, as one of the electrodes, is required. By these means, the nickel is made to adhere regularly and strongly, and only needs polishing after the metal coated over is taken from the bath. At the next meeting of the Academy, M. Becquerel stated that eight years ago he had applied, for the purpose of the electro-deposition of nickel and other metals, the same metal as described by M. Gaiffe and his associates. He had purposely repeated some of his former experiments, with the express view of ascertaining whether the statement made by M. Gaiffe, concerning the injurious action of the presence of potassa, be correct or not. The result is that potassa in no way affects injuriously the deposition of nickel, since the double sulphate of nickel and potassa can be applied as well as the double sulphate of nickel and ammonia; but, if the positive electrode is not made of nickel, it is necessary to add free ammonia, in order to saturate the sulphuric acid which is set free.

The Export Coal Trade.—The exports of coal from the United Kingdom amounted, in August, to 1,132,804 tons, as compared with 1,081,326 tons in August, 1869, and 1,058,952 tons in August 1868. The exports to France, in August, were 228,274 tons, against 164,266 tons and 147,058 tons respectively. The shipments of coal to Russia presented a considerable increase in August, but they almost ceased to Prussia, in consequence of the blockade established in that month by the French as regards the North German ports. In the eight months ending August 31, this year, coal was exported from the United Kingdom to the aggregate extent of 7,713,916 tons, as compared with 6,921,922 tons in the corresponding period of 1869, and 7,302,983 tons in the corresponding period of 1868. The exports to France were 1,626,114 tons, 1,333,063 tons, and 1,281,382 tons respectively. The exports of coal have increased this year to Russia (considerably), Sweden, Holland, France, Spain, Italy, the United States, and Brazil; but they have decreased to Denmark, Prussia, the Hanse Towns, and India. The value of the coal exported in August was £552,950, against £520,590 in August, 1869, and £513,374 in August, 1868; and in the eight months ending August 31 this year, £3,664,495, as compared with £3,306,515 in the corresponding period of 1869, and £3,610,807 in the corresponding period of 1868.

A New Poison.—In a paper addressed to the French Academy of Sciences, MM. Rebuteau and Peyre have given a description of a plant which grows in the vicinity of the French settlement of Gaboon, and which the natives call *m'boondoo.* They have gathered it themselves in a moist soil in the neighbourhood of the River Camo, at thirty leagues from the frontier. It is very difficult to procure, because the sorcerers of the country conceal the plant with great care from the profane, so that its properties are still in a great measure a mystery. The roots vary in thickness between three centimetres and one (a centimetre is four-tenths of an inch); their length varies between 50 and 70. The rind, whether fresh or dry, is reddish outside and a vivid red within; the root itself is mere hard wood. Both this and its bark are exceedingly bitter; their infusions, even when considerably diluted, still retain this taste to a high degree. They yield abundant precipitates, even when treated either by iodide of potassium or phospho-molybdic acid; whence it may be concluded that they contain at least one if not several alkaloids. The effects produced upon animals may be briefly stated as follows:—When a very weak dose is injected under the skin of the frog, the poison only produces constraint in the limbs, a sort of paralysis, which prevents the creature from leaping easily, and makes it crawl like a toad. But, notwithstanding, the substance does not act like woorara, since the power of muscular contraction is not impaired when the operator excites the nerves. With a dose of three millgr., the extract introduced under the skin, after causing the constraint alluded to, brings on tetanic convulsions, when the animal is touched, or the table on which it lies is struck with the hand or otherwise. Nevertheless, the creature does not become rigid, as when poisoned with strychnine; and if it has received a weak dose, it will recover in the course of a few hours when put into water. Hence it may be concluded that the poison is rapidly eliminated from the animal economy.—*Galignani.*

Journal of the Society of Arts.

FRIDAY, OCTOBER 28, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts' Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

THE POSTAL AND TELEGRAPHIC DEPARTMENT IN NORTH GERMANY.

Answers to Questions on Postal Arrangements in the North German Confederation.

Inland Letters.

1. *What is the unit of weight?*

The proximate permanent unit of weight will be 15 grammes, but the present temporary unit is one "loth," equivalent to 16⅔ grammes (a little over half an ounce).

2. *The prevailing unit of charge?*

The prevailing unit of charge is one silber groschen, equivalent to 1⅕d.

3. *The rate of increase for greater weights?*

There is only one higher charge, viz., of two silber groschen, *i.e.*, an increase of cent. per cent. on letters not exceeding two "loth" in weight, but an increase which diminishes in the per-centage of incidence in inverse proportion to the weight of the letter, until, at the extreme limit of half a pound, that per-centage is only 6⅔ per "loth," which represents the fifteenth part of a silber groschen per "loth" beyond the first "loth." The North German postage system recognises thus only two weights and charges, viz., the "loth" at one silber groschen, and beyond a "loth" to half a pound at two silber groschen. This simplication of the charges for letters is specially recommended by the fact that scarcely 8 per cent. of the letters conveyed exceed the weight of two "loth," and by the consequent advantageous economy of the time and labour of the postal officials.

4. *The exceptions to the above, if any?*

There appears to be no exception to the unit of weight. But there is an exception to the unit of charge, viz., a reduced charge of half a silber groschen for letters written and delivered within a town—with the exception of Berlin.

5. *Does the post-office undertake house-to-house delivery, and that free of charge?*

House-to-house delivery is undertaken by the post-office free of charge, except in rural districts lying outside the town or village possessing a post-office.

6. *If any charge is made, what is its amount?*

In such districts the charge for delivery is half a silber groschen per letter. But it is permissible to compound, annually or otherwise, for this additional charge, by subscribing an average sum based upon the aggregate of charges actually occurring in the first fortnight of the subscription period.

Remark.—In case of unpaid letters, one silber groschen is levied in addition to the charge for paid letters. Hence the charge on an unpaid letter of the unity of weight is, as in England, deubled, but on higher weights is only increased by one-half. No unpaid letter can, therefore, cost more than three silber groschen within the limit in weight of half a pound.

Inland Newspapers, &c.

1. *What is the unit of weight or size?*

The unit of weight is now 2½ "loth," equivalent to 41⅔ grammes (over 1¼ ounce).

2. *The prevailing unit of charge?*

The prevailing unit of charge is ⅓ of a silber groschen per 2½ "loth."

3. *The rate of increase for greater weights or size?*

The rate of increase is ⅓ of a silber groschen for each 2½ loth.

4. *The exceptions to the above, if any?*

There are no exceptions.

5. *Is there any stamp duty or other charge in addition to the postage rates?*

There is a stamp duty in the Federal countries, and there is an additional charge for delivery in rural districts, as in the case of letters.

6. *Are there any restrictions as to weight?*

The limit of weight is half a pound. Packages of newspapers of greater weight must be packed and forwarded as parcels at the parcel rate.

7. *Or as to writing and other marks?*

An inner, as well as an outer address is permitted, and lines to direct the reader's attention are also allowed; but no alterations or additions are permissible, in whatever manner they may be made, except the colouring of illustrations and maps.

8. *Or as to time and place of posting?*

They follow, in respect to time and place of posting, the regulations for letters.

9. *Does the post-office undertake house-to-house delivery, and that free of charge?*

Yes; but in rural districts a charge is made, as in the case of letters.

10. *If any charge is made, what is its amount?*

The amount of charge is half a silber groschen.

11. *Is the conveyance and distribution of newspapers open to any one, or has the post-office a monopoly?*

There is no monopoly of the post-office, except in the case of political newspapers. It has, however, the privilege of free conveyance on railways by every train.

The post-office also receives subscriptions for journals. The exception in respect of political newspapers is not maintained as a monopoly, but for facilitating the censorship in times of emergency.

Parcels.

1. *Does the post-office undertake the conveyance and distribution of parcels?*

Yes.

2. *If so, what are the regulations as to contents, rate of charge, &c.?*

The parcel rate is reckoned by distance and weight, beginning at 2 pfennige per lb. for five German miles, and rising at 2 pfennige per lb. for every five German miles, to 30 for every 10 German miles from 30 to 100, and for every 20 German miles from 100 to 160 German miles, making in all 17 progressive charges from 2 pfennige to 2 silber groschen and 10 pfennige per lb. The minimum charges are—

	Silber Groschen.
For 5 German miles	2
From 5 to 15 „	3
From 15 to 25 „	4
From 25 to 50 „	5
Over 50 „	6

All parcels must be accompanied by a separate addressed card or paper, for which no special charge is made. This card should contain the address, the outward description of the parcel, and the declared value (if any), and should be sealed with the same impression as the parcel. The parcels must be sent for by the receiver, to whom the post-office sends a notice, with a receipt for the cost to be paid to the district postman. If the parcel is sent out by the post-office, it is of course charged for in addition. If the value of a parcel be declared, the insurance against loss is—

	To 50 dollars.	From 50 to 100 dollars.	Over 100 dollars.
	Silb. gros.	Silb gros.	Silb. gros.
For 15 German miles	½	1	1
From 15 to 50 „	1	2	2
Over 50 „	2	3	3

Should the declared value exceed 1,000 dollars, then on the excess only one-half of the above insurance premiums is levied. Parcels not securely packed will not be received. All articles likely to damage other postal packages are of course forbidden, but otherwise there is no restriction as to the kind of article which can be forwarded by parcel post, except that in consequence of a live bear having been once sent, all living animals (except oysters) are forbidden. The limit of weight is now 100 lbs.

3. *Is the conveyance and distribution of parcels (such as the above) open to any one, or has the post-office a monopoly?*

There is no monopoly of the post-office for parcels, but the post-office has the privilege of free conveyance on railways by every train for all parcels of less weight than 20 lbs.

4. *To what extent is it now, and for what description of parcels is it brought into use?*

It is largely used for all kinds of articles.

5. *What have been the effects hitherto observed on the retail and wholesale trade of the country?*

This question it is impossible to answer at so short a notice, but it may be remarked that the effects of the abolition of the postal conveyance of parcels would be seriously felt in all districts in which private companies would not be tempted, for there would be no chance of profit, to undertake their conveyance. It is accordingly considered that this branch of the post-office is not only beneficial but is also essential in the interest of the whole kingdom.

6. *Does the post-office enjoy any privilege in the use of the railways for the conveyance of mails?*

The post-office can forward all letters, newspapers, and also all parcels of less than 20 lbs. each in weight, either in separate bags and parcels, or in mail-wagons, by every train free of payment to the railway companies. This privilege arises out of the former monopoly by the State of the conveyance of persons and goods. When the railways were constructed, the State abandoned this monopoly, reserving, however, to the post-office the free conveyance of letters and newspapers, and also of parcels.

7. *Is the post-office self-supporting?*

Yes.

8. *If so, what is the annual amount of profit or net revenue?*

About 400,000 thalers, equivalent to about £60,000.

9. *If not self-supporting, what is the annual amount of loss?*

No loss.

Postal Telegraphy.

There is no system of postal telegraphy; the telegraph system is an entirely distinct part of the administration of the country, but in the hands of the government. This separation of the postal and telegraph services is much regretted by many intelligent persons in the North German Confederation. I may be allowed to mention that any further information respecting the regulations of the North German Post-office can be found in the printed collection of all the laws and regulations of the postal system.

As to railway communication?

With respect to the questions on railway communication, it is impossible, without bestowing a larger amount of time than is now at my disposal, to give answers to such comprehensive queries.

(Signed) J. P. Harriss-Gastrell.

Berlin, June 18th, 1870.

CINCHONA CULTIVATION IN INDIA.

Amongst the services which the Indian government are rendering, not only to the population of India, but to the whole civilised world, is the successful cultivation of the quinqueno tree. The collection of the different varieties from amongst the forests of the Andes, their temporary removal to the Royal gardens at Kew, and subsequent transference to the Neilgherry hills, where a site had been selected by the botanists, forms the earlier stage of the proceedings. The narrative of these interesting operations, which commenced in the year 1859, is given in Mr. Markham's "Travels in Peru," and the blue-books of the India Department. The report just published, extending over the later period down to the present time, puts us in possession of the correspondence between the Secretaries of State and the Governors of Madras and Bombay, the records of the proceedings of the officers and managers, general views of progress at various intervals, combined with other subsidiary matters, all showing the importance attached to this experiment.

The opening dispatch, dated 16th June, 1866, from the India Office, states the object which the authorities had chiefly in view, viz., the maintenance of the gardens at Ootacamund until their produce could be generally diffused and rendered accessible to the greatest possible number of the poorer inhabitants of the country The officers of different ranks were instructed to make known the uses of the bark, and, where practicable, to promote the cultivation of the tree by villagers and small holders of land in suitable situations, even if they should not be able to do more than plant a few trees around their houses; that in all cases, where the cultivation should be undertaken for purposes of trade or profit, a

charge be made for the plants; but amongst the lower classes a supply should be gratuitously furnished, and every other assistance afforded them in the prosecution of the work; that an experienced chemist or analyzer should be appointed to investigate the various points connected with the extraction and the use of alkaloids, and to promote the establishment of a manufactory of quinine and of the inferior products of the cinchona. How far these instructions were carried out, during the time which intervened between the date of this letter and the last account of the gardens, 25th July, 1870, appears from the perusal of the correspondence, and the reports of the botanists and managers of the property.

The total number of plants growing in the gardens 31st March, 1868, was 2,353,370, against 1,926,044 as compared with the previous year. The number distributed to the public made a total, up to that time, of 170,470. The first plants permanently planted out in August and September, 1862, had attained heights varying from 17 to 18 feet, the larger kinds having been cut down for the bark, to be sent to the European market, These plants began to show their tree-like character. and, together with those planted in 1863 and 1864, were then yielding an abundance of excellent seeds, of third, second, and first crops, according to the age of the trees. With regard to the period required to produce bark, Mr. M'Ivir, the manager, had definitely fixed it at four to six years, at which age the trees on the Neilgherries had commenced to yield a small harvest, the quantity being found to equal that of the finest Peruvian bark. The demand for seeds had been very great, and the "Notes on Cinchona Cultivation" had enabled the private planters to raise the seeds successfully. The public sales of bark had realised very satisfactory prices, ranging higher than those obtained for them as a description of American bark. A wide field seemed therefore opened for enterprising capitalists, since the best kinds would, without doubt, be cultivated with certainty over the whole plateau of the Neilgherries, and that, too, on grass-land, where the preparation required but a small outlay of capital. As a private speculation, the cultivation was gaining ground, and several fine estates were progressing rapidly. It was also gratifying to the authorities to observe the readiness with which planters, both European and native, were disposed to undertake the cultivation in connection with coffee plantations. During the year, 198 acres additional had been planted, making a total of 1,093 acres under the management of the government, and the whole executed at a cost from the commencement of 432,367 rupees.

An analysis of the bark sent by Mr. Howard, 1868-9, gave a steady and increasing yield of alkaloid, whilst one variety had been ascertained by Mr. Broughton, the government quinologist, to yield the extraordinary amount of 9·75 per cent. of quinine. The plants had been found to contain the greatest vigour at heights varying from 5,000 to 6,000 feet, and there existed a large demand for the seeds from almost every part of the world. Three parcels, containing 235,000 seeds of the three best varieties, had been forwarded for the use of the Mexican government. Captain Maury, of the state of Virginia, had been supplied with a packet from the gardens, and all the information that had been gained by the botanists there respecting their cultivation. Mr. Cross, the gardner who conveyed portions of the original collection to India, was commissioned to visit New Granada, and make a collection of the most valuable species which grow in that republic. The only drawback to the complete success of the cultivation during the year was the condition of the private estates, which had received a check, and their value had fallen considerably in the market.

Looking around, however, the experiment appeared to be gaining ground in various quarters. Good progress was making at Darjeeling, where the total number of cinchonas was 3,028,110, viz., 2,232,532 in government, and 795,578 in private plantations, whilst the area planted was about 965 acres. The fact of several private companies entering upon this cultivation on a large scale was regarded by the authorities as some guarantee of the ultimate success of the growth of these febrifuge trees on the slopes of the Himalayas. Seeds had been sent to Mysore, where the cultivation did not make such rapid strides as had been anticipated. In British Burmah a carefully-selected site had been planted, and the co-operation of the residents had been gained. It was feared, however, that, as a commercial speculation, an elevation of 2,000 feet would be insufficient, but the naturalisation of the bark could not fail to be a great blessing to the native population. In Travancore, the government had established its garden in 1862, and we find in 1867 that 3,495 plants were raised from cuttings, and planted in a new clearing. Ten acres of forest land had been set aside for the purpose of cultivating the cinchona, and about six acres had been cleared and planted. Dr. Cleghorn, Conservator of Forests at Madras, who subsequently visited Peermade, in company with Mr. Markham, observes that "the Travancore sirkar has well seconded the efforts of the British Government, and that the results of the experiment is more successful here than anywhere else in Southern India, excepting in the Neilgherries."

The latest stage in the experiment is summed up in the dispatch from the India Office, dated 19th May, 1870. The series of careful and judicious analyses made by Mr. Broughton had resulted in practical conclusions upon certain important questions relating to the chinchona cultivation, the best conditions of growth, the time for harvesting, and the mode of gathering the bark. Upwards of a million plants were then permanently planted out, some being 25 feet high and 32 inches in girth. The time, therefore, in the opinion of the government, had arrived for the adoption of some systematic course for utilising the very large quantity of febrifuge alkaloids now stored in the bark of the trees. This would be best obtained by a constant system of annual harvestings. Owing also to the large number of trees in a sufficiently advanced stage of growth to yield bark suitable for the extraction of alkaloids, the question was under consideration, whether this should be used in the manufactory at Ootacamund, in the Neilgherries, for the supply of the hospitals in India, or be sent to the London market, or whether a portion should be sent home and a portion worked up on the spot. Also whether the plantations should remain in the hands of the government for the supply of quinine to the hospitals, and the distribution of seeds and plants throughout India, or be eventually disposed of, as in the case of the Assam tea plantations. Thus far, therefore, the experiment may be regarded as having entered upon that point when the cultivation might be left to the natural course of commerce, and the government could withdraw without detriment to the future prosperity of the undertaking.

Any notice of cinchona cultivation would be incomplete without paying some passing tribute to the Spanish botanists, Ruez, Pavon, and Tafalla, who made an expedition to Peru and Chili, in the end of the last century, and whose efforts resulted in the discovery of numerous cinchonæ, some of which are now growing in India. Their magnificent collection of plants was entrusted to a Royal Commission for arrangement and publication, whilst the results of their labours may be found in the "Flora Peruviana," the "Quinologia" of Ruiz, with its supplement, and the "Nueva Quinologia" of Pavon, recently edited by Mr. Howard. When the commission had completed its labours, the specimens were deposited in the Herbarium at Madrid, where they are kept apart in two large bundles. It may be added that the very interesting and voluminous report of the India-office, extending over nearly three hundred pages of matter of the most varied description, has been greatly facilitated in its perusal by the very admirably arranged index at the commencement of the book.

THE "FISH" TORPEDO.

Various experiments have lately been tried with torpedos. These experiments were made with both moving and fixed torpedoes, the former being tried at Sheerness on the 8th, and the latter at Chatham on the 11th inst., in the presence of the Commander-in-Chief. The history of the fish-torpedo is given as follows by the *Mechanics' Magazine*:—Towards the close of last year the scientific world was startled by the announcement that a torpedo of wonderful construction, and possessing still more wonderful powers of offence, was being tried on behalf of the Austrian Government. The stranger hailed from the little port of Fiume, where it might be seen, under the strictest surveillance of its inventor, disporting itself in the briny waters of the Adriatic. It was in shape like a fish, and could be made to travel in any direction under water, being self-propelled and capable of moving at an upward or a downward angle, in a straight horizontal line, or in circles. A profound mystery has been made to surround this fish-torpedo, its construction having been carried on at Chatham with the utmost secrecy. We, however, know somewhat of the weapon from our acquaintance with its performances at Fiume, and although its details may since have been slightly modified, yet its general principles remain the same. So, by the light of our previous knowledge, and the slight additions that have recently been made to it, we shall be able to give our readers a tolerably clear notion of this new wonder of the deep.

The conception of this torpedo is due to Captain Luppis, a retired officer of the Austrian navy, but the credit of its practical realisation belongs to Mr. Robert Whitehead, an English engineer residing at Fiume. Captain Luppis suggested a floating and travelling torpedo, the fore part of which should be filled with an explosive material, the after portion being occupied by the propelling power, which was to be steam. The practical mind of Mr. Whitehead at once saw that this was an altogether impracticable arrangement, and he at once set to work to design a torpedo according to his own notions of what such a weapon ought to be. He gave it a form approximating to that of the sword fish, but besides the projecting snout he added a vertical and two lateral projections, which are neither more nor less than triggers, and any one of which impinging upon an object with sufficient force fires the explosive compound, which is placed in the head of the fish-like structure. The body forms the engine-room and the storehouse for the propelling power, which is compressed air, and which works an internal engine by which an external four-bladed screw is actuated. Thus equipped, the fish-torpedo is stated to be capable of a speed of from four to eight miles an hour, the average being four. It is fitted with fins, for the purpose of guiding it through a tube attached to the torpedo ship, from which it is discharged into the sea for action. We thus have a submarine, self-propelling torpedo, a great improvement upon the crude notion of Captain Luppis.

Upon the occasion of the recent experiments, the *Oberon* was used as the torpedo vessel, having been specially prepared for that purpose. To this end, the *Oberon* has been fitted with a tube 2 ft. in diameter and about 28 ft. in length, which is situated in a line with her keel, and some distance below her draught line. This tube is closed externally by a cap, and is divided internally into two portions, each being rendered watertight by means of penstocks, which also prevent the admission of water into the ship. The torpedo is passed into the rear portion of the tube upon rollers, and the penstock behind it being secured, the one in front is opened, and the cap being removed from the orifice, the torpedo is expelled from the tube by a piston arrangement. The fins act as guides, bearing against four rails which are placed at the top and bottom of the tube. As the torpedo passes out of the tube, a trigger catches against a stud in the latter and starts the propelling machinery. As the tube is carried out from the stem of the ship in perfect line with her longitudinal axis, the direction of the submarine course of the weapon is exactly that of the direction of the ship, aim being taken by steering. The *Oberon* is fitted with a set of powerful air pumps, which are worked by a 12-horse engine, and by which the air with which the torpedo is charged is pumped into it to a pressure, it is stated of forty atmospheres, or 600 lb. per square inch.

The object of attack on Saturday week was the hulk of the *Aigle*, which lies in Sheerness harbour, and has long been used as a coal store there. The *Aigle* is about 120 feet in length, and about 30ft. beam; she was moored fast at stem and stern, with her head to sea, about a quarter of a mile from the fore-shore of the Isle of Grain. The *Oberon* steamed out towards the *Aigle*, the only visitors permitted on board being Captain Arthur, R.N., Captain Singer, R.N., and Lieutenant Wilson, R.N., the official committee appointed by the Admiralty to investigate and report upon the new weapon. The signal to prepare was made by flag on board the *Oberon*, at 1h. 11m., the cap covering the discharging tube being raised twenty seconds later, the ship still steaming on to the target. She kept on her course until 1h. 13m. 35s., when she commenced backing hard astern, and was finally brought to a stand at a point apparently about 120 yards from the broadside of the *Aigle*—certainly not more than 150 yards. At 1h. 14m., the flag of the *Oberon* was dipped as a signal that the torpedo had been liberated, and in about 25 seconds a lofty cloud of white foam, mixed with coal dust, rendered it apparent that the torpedo had exploded against the hulk. The *Aigle* instantly dropped by the stern, and her bows quickly came down to the same level, and at 1h. 16m. she was aground from end to end, having been moored in shallow water for the purpose of allowing the results of the explosion upon the vessel to be noted. The effects of the torpedo upon the hulk were very striking, as, indeed, they ought to have been, seeing that the weapon contained a charge of 67lb. of gun-cotton, and that the timbers of the *Aigle* were tolerably rotten. An examination of the wreck at low water showed that the starboard side was altogether cleared out for a length of over 26ft., and a depth of about 10ft. Half of the main deck was carried away, and the remainder broken up, the planking of the upper deck having been started. On the port side of the hull, the planking was blown outwards over an area 16ft. long by 2ft. deep. In short, the disruptive power of the charge was fully utilised, although we can in no way compare these results with those which would accrue to an iron-built armour-plated ship.

A subsequent experiment was made with a smaller torpedo, discharged from a gig 20ft. in length, and at about the same distance from the hulk as the previous one. The second torpedo measured 14ft. long, and was 14in. in diameter, its charge being 18lb. of glyoxaline. The discharging arrangement below the boat consists of a line of rollers carried by iron stanchions passing down from each side, and meeting beneath. And here we may observe that previously to the first experiment a length of 60ft. of netting was placed outside the *Aigle*, about 5 yards from her broadside—it was made of ¾in. rope, and had 4in. meshes. The object of this net was to test its efficiency as a protection for a vessel, and at the same time to indicate whether at such a distance away the explosion would have any effect upon the hull of the ship. All being ready, the torpedo was started on its way, being directed against the netting, in which it was caught and exploded. Notwithstanding the heavy charge in the torpedo, no damage whatever was done by it to the hulk, nor, so far as could be ascertained at the time, to the netting either, so that it was only demonstrated that the torpedo could be caught and would be exploded by such a contrivance.

So far as these bare experiments went, the results proved eminently successful, but, to our mind, there are other requirements which go to make a perfect torpedo, and

which are evidently not embodied in Mr. Whitehead's invention. The fish-torpedo undoubtedly does credit to Mr. Whitehead's ingenuity, when we consider its ability to move in any direction, and at any depth in the water. But it requires many experiments to show whether, under the varying conditions of calm and wind, light and darkness, the torpedo can be invariably relied upon for correctness of aim, and the distance determined at which it can effectually be run against a vessel. No doubt it was an easy matter to steer the *Oberon* direct on to the broadside of the *Aigle*, and to plant a torpedo upon her at a distance of 150 yards only in the comparatively calm waters of the Medway. If, as the inventor asserts, the torpedo can be run at ships at ranges of from 600 to 700 yards, why so short a range as 150 yards necessary, except to make sure of the aim and of the explosion of the torpedo, which everybody knew must explode upon contact? If we take winds and waves, tide and currents, weather, and the exigencies of warfare into account, we shall probably find a vessel anchored half a mile off from a torpedo ship to be a tolerably safe place, and a vessel moving at the same distance very much safer. If a steamer has to be run within 150 yards, as the *Oberon* had, and to back and fill, and to be brought to a dead stand before delivering her torpedo, we think she stands a very good chance of being disabled by the guns of the enemy before she can complete her mission. What is wanted in a moving torpedo is, that it can be guided with certainty towards an object, can be advanced or withdrawn as may be needed; that it can be rendered fatal to a foe, and innocuous to a friend; and, above all, that it can be directed unerringly at ranges relatively safe with regard to the position of the enemy's ships. Such a torpedo we believe the fish-torpedo not to be, but the details of such an one we hope shortly to place before our readers.

There is yet another element which has to be taken into account in considering the subject of moving torpedoes, and that is the question of cost; and we are the more induced to look at the matter from this standpoint, because the fish-torpedo appears to be an exceptionally expensive apparatus. The cost of acquiring the right to use it will undoubtedly be something considerable, if proportionate to the prices paid by other countries. When it was first submitted to the Austrian government, £56,000 was bid for the sole right to its use, the terms eventually being £20,000 for the right to use it in common with other states. The French government subsequently wished to join with Austria in a monopoly of the weapon, but this proposition was not acceded to—unwisely we think—by Mr. Whitehead. There can be no doubt but that the English government will have to pay a stiff price if they want the fish-torpedo. But we might overlook an extravagant price for the right of use, if it were justified by the purchase, which to our mind it is not at present. The expense of manufacture of the fish-torpedoes, too, will be very considerable, the smallest fry costing £200 each. These, moreover, appear to stand their only chance of hitting a ship when well within 200 yards range; what, then, are the chances of a larger one hitting the mark at 1,000 or 1,500 yards? And then there is the further expense of altering vessels for discharging them from, or of putting torpedo tubes in our men-of-war, as has been suggested, but which alternative we certainly deprecate for many reasons. The very character of the fish-torpedo is impressed with the stamp of costliness; its mechanism is liable to get out of order, necessitating special workmen on each torpedo ship to attend to their use and repair. We give—as, indeed, we have already done—every credit to Mr. Whitehead for his ingenuity, but we cannot give him much hope for the success of his invention as a torpedo to be used out at sea; and for coast and harbour defence we have others better suited to the purpose. For sea purposes, we have not yet seen anything better than the Harvey torpedo, with which our readers are well acquainted, through our columns. This apparatus has proved itself effective in all seas and all weathers, whilst we doubt the efficiency of the fish-torpedo in still water at even moderate ranges, and deny its reliability in a rough sea, and at the ranges required in active service.

EDUCATIONAL NOTES.

A very influential meeting was held at Preston, on the 20th inst., under the auspices of the Manchester Diocesan Board. Lord Derby, who presided, explained the object of the meeting as being "to increase in various ways the efficiency and to add to the number of the elementary schools in this part of the country which are in connection with the Established Church," and thus to avoid bringing into action the machinery provided by the Act. He pointed out that the Act held out to the various religious denominations into which the community is divided the very strongest possible incentive to exertion, because while, on the one hand, they are told that upon certain conditions their asistance and co-operation are invited and welcome, while Parliament wisely, in the circumstances of our country, does not refuse to avail itself of the powerful assistance of these ecclesiastical bodies, it, on the other hand, holds over them a very distinct and intelligible warning, that if the educational requirements of the country are not adequately met, either by the agencies now existing or those which have been recently sanctioned, they will have to be met in some other way. The meeting was afterwards addressed by the Bishop of Manchester and the Hon. F. A. Stanley, M.P.

A meeting of a somewhat similar character has been held at Gloucester, convened by the Bishop, at which resolutions were adopted to the effect that the Elementary Education Act imposed upon the diocese the duty of special effort in regard to Church schools, so that a religious education should be combined with the secular element; and that a special fund should be forthwith raised to supply educational deficiencies. Among those who attended and took part were Lord Bathurst, Sir M. Beach, M.P., Mr. Holford, M.P., &c.

A meeting, called by the High Sheriff of Yorkshire, was held at York, on the 21st inst., to promote the extension and improvement of middle-class education in the county. The Rev. Canon Robinson, one of the Endowed Schools Commissioners, explained the powers entrusted to that body, and the general terms on which they would be willing to co-operate with persons interested in endowed schools. The Archbishop of York said he regarded the Endowed Schools Act as an honest measure, and likely to do the greatest possible good to the country. It were better to deal with it in a friendly way than to wait until a scheme was forced upon them by the Commissioners. An association was formed to carry out the objects of the meeting.

At a meeting at Norwich, the Bishop of that diocese expressed a hope that the clergy would co-operate in carrying out the objects of the Education Act. He moved a resolution to the effect that steps should be at once taken to supply and maintain efficient and suitable schools on the voluntary principle, in order to secure in Church schools religious education. The resolution was adopted.

A similar meeting, at Leicester, was presided over by the Bishop of Peterborough, who, after expressing his fear that the rate-aided schools would become almost purely secular, thought that the clergy and churchmen generally should "help in giving the most efficient and least harmless direction to the working of the Act that they could."

An influential meeting was held, on the 25th inst., in the Guildhall, Cambridge. Lord Hardwicke, Lord-Lieutenant of the county, presided, and among those present were Mr. S. Walpole, M.P., Mr. Beresford Hope, M.P., Lord Royston, M.P., the Bishop of Ely, the Vice-Chancellor of the University, and several Heads of

Houses. The Chairman, while speaking well of the Act, said he desired to avoid school boards. In saying this, he was not speaking in a party or political sense, for he believed they had the sympathy of Nonconformists in upholding and maintaining a religious education. The Bishop of Ely moved that the passing of the Education Act appears to demand from all churchmen a strong and united effort to secure, as generally as possible, in public elementary schools, an efficient religious education. This was seconded by Mr. Walpole, M.P., and carried.

On the 24th inst., the Roman Catholics of Liverpool and neighbourhood held a meeting for the purpose of promoting denominational schools. The chair was occupied by the Roman Catholic Bishop of Liverpool; and among those on the platform were the Duke of Norfolk, the Marquis of Bute, Lord Edward Howard, Monsignor Capel, &c. Resolutions were passed, to the effect that the Act of last session, recognising the parents' right to control the education of their children, it became the duty of Catholics to make all possible exertions to afford parents the means of discharging the responsibility imposed upon them; and that the meeting acknowledged the urgent necessity of immediately and largely increasing the accommodation in the Catholic schools of Liverpool.

The annual meeting of the National Education League was held on the 25th inst., at Birmingham. The adoption of the report was moved by Mr. Dixon, M.P., and seconded by Mr. Vernon Harcourt, M.P. The latter announced his conversion to the free schools principle, and advocated moderation on the part of the League in endeavouring to accomplish the objects they had in view. He agreed with Mr. Fawcett, who wrote urging that the League should sink religion and work for compulsion. The Rev. Mr. Syme, of Southampton, moved, as an amendment, that the word "secular" should be substituted for "unsectarian" in the League's programme. A long discussion ensued, but eventually the amendment was withdrawn, and the resolution approving the adoption of the report was carried.

THE METROPOLITAN SCHOOL BOARD.

It may certainly be regarded as a hopeful sign that the greatest possible interest is being shown, in all quarters, in selecting candidates for this board, and that the press, almost with one voice, warns the electors against allowing the contest to degenerate into one of a merely sectarian character. A very important committee has been formed in the City, composed of men of the highest influence, including such names as Mr. R. W. Crawford, Sir John Lubbock, Mr. Glyn, Mr. Goschen, Mr. Thomas Hankey, Mr. P. Hanbury, Mr. J. P. Gassiot, Mr. B. W. Currie, Baron Lionel Rothschild, Sir Anthony Rothschild, Mr. H. C. Robarts, and others of similar standing, who have issued an address to the electors to the effect that, feeling "deeply the importance of electing the best men we can secure, irrespective of their religious persuasion or political opinions, we are anxious that the representatives of the City of London should be prepared to carry out the Act of Parliament in a generous and unsectarian spirit, with a view, not to the benefit or extension of any particular church or sect, but to the improvement and education of the children in our metropolis." This committee, therefore, invites all who are disposed to co-operate with them, firstly, in the selection of candidates, and, secondly, in taking such steps as may be necessary to secure their return, to communicate with the honorary secretaries of the committee, who are Mr. R. B. Martin, 68, Lombard-street, and Mr Frederick Lubbock, 16, Leadenhall-street.

As was mentioned last week, the addresses issued by some of the candidates are not very encouraging. For instance, one gentleman simply bases his candidature on the principle of providing "for every child in London a sound and religious education," but scarcely pretends ot have any special knowledge as to the best means of producing so desirable a result. Other candidates, however, come forward on the definite ground that they really understand the subject. For instance, the Rev. J. G. Cromwell, addressing the ratepayers of Chelsea, says:—"Having been engaged for many years in teaching, as the principal of two colleges for training schoolmasters, and as the acting manager of schools for 700 boys, I have acquired a practical insight into the question of popular education, which would probably be of service at a board that will have to solve the problem how to secure the most thoroughly practical and sound education."

Mr. E. H. Currie, who is also coming forward for the Tower Hamlets, says:—"For many years it has been my privilege to devote a large amount of time to promoting education, and for the last nine years I have had opportunities of almost daily intimate intercourse with the large Boys' School in Bromley, of which I am acting manager. As a Sunday and ragged school teacher, and a manager of the large Industrial Schools at Forest-gate, I have been able to acquire considerable experience in different kinds of school management."

Sir Fowell Buxton is coming forward for Hackney, and Mr. E. North Buxton for the Tower Hamlets. The latter in his address says:—"I am a Churchman, but I do not ask for your votes on that ground, as I expect that, on the religious question, there will be no radical difference of opinion between members of the Board who are Churchmen and those who belong to other Christian denominations."

Mr. Joseph Guedalla, in addressing the Marylebone electors, says:—"I care little about the advancement of this or that abstract set of opinions. I wish simply to get the conditions which will ensure to every child, at a small charge or at none, sound elementary instruction."

Lord Lawrence, who has been invited to stand for Chelsea, says:—"I am a strong advocate for religious education; but, at the same time, I should feel bound to carry out fully and faithfully the principles laid down in the Act under which the Board will be formed, and under which it is to be hoped that the people of England will have the opportunity of obtaining a sound elementary education for their children."

Dr. Frederick Tomkins, of the Inner Temple, formerly one of her Majesty's Commissioners of Education in British North America, has issued an address to the ratepayers of Finsbury. In offering himself as a candidate, he says:—"I pledge myself to co-operate with the earnest members of the School Board, so as to render our future schools a lasting benefit to all classes of the community. It would be a matter of extreme regret to me if the Bible were banished from the school; but I would not force its perusal upon the children of parents who object to its use.

Miss Garrett, M.D., who is a candidate for the Marylebone division, says:—"I should discourage sectarian teaching to the utmost of my power, believing that all that it is desirable to teach young children is that basis of elementary Christianity upon which the various churches are agreed. I am in favour of the principle of compulsion. . . . I may, perhaps, also claim to be specially conversant with questions relating to the physical well-being of the scholars, and to the education of girls."

Meetings are being constantly held in various parts of the metropolis. In Marylebone, on the 20th inst., at a gathering presided over by the rector, the Rev. Phipps Eyre, the religious question formed the main subject of discussion, and no definite decision appears to have been arrived at.

At a second meeting, held on the 25th inst., at the Langham Hotel, Mr. A. Currie in the chair, it was resolved to form a central committee, under the name of the Marylebone Division School Board Association, to promote the return of efficient representatives to the London School Board, desirous of making provision for

the educational wants of London and favourable to religious teaching. The meeting was addressed by the Rev. C. J. P. Eyre, Mr. Dudley Baxter, Mr. Arthur Mills, and others.

A third meeting was held, on the 25th inst., in the parochial schoolroom, Hampstead, which is included in the Marylebone district. The Rev. Charlton Lane, vicar of the parish, took the chair. It is stated that the lay element, both Church and Nonconformist, was well represented, and that the meeting was characterised by an evident desire for the harmonious working together of all parties in the matter of securing religious instruction.

At a conference of the clergy and other members of the Church of England, held at Sion College, a resolution was unanimously adopted, to the effect that the meeting, while convinced of the paramount importance of retaining religious instruction in rate-supported schools, is, nevertheless, of opinion that so far as is consistent with this object, and with the efficiency of the representatives, it is desirable that all classes and interests should be represented on the Metropolitan School Board, and that for this purpose members of the Church of England should co-operate in a spirit of conciliation with members of other denominations, in order to obtain a list of efficient candidates fairly representing the views of all parties, and in order to avoid, if possible, the bitterness that might arise from denominational differences.

The *Times* devotes a leader to the subject, urging the ratepayers not to allow the election "to be made in subservience to partisanship or sectarian passion." It points out that "a failure in London would discredit the entire system, and excite a new and mischievous agitation. The members of the Board are to be elected for a term of three years, and probably long before their period of office has expired the sectional influences to which they may have owed their appointment will have passed out of the memory of all sensible men. . . . . Will the electors permit the interests of education in the great centre of English enterprise and wealth to suffer by the absurd antagonism of extremes? The duty of the members of the Board is not to advance any particular theory of education, but to further, by every practical method, the teaching of the people in all places where a deficiency may at present exist. Whether candidates are competent or not to push on the latter cause should be the only consideration with the ratepayers." It expresses a fear that those whose influence ought to be for good in this matter will "by their divisions, their rivalries, and jealousies, give the supreme power upon the board, in this first and all-important year of existence, to the class which desires only to keep down the rates—to the vestrymen of London and their congenial constituents. Thus, for instance, at a recent meeting, the friends of education in Marylebone were holding a meeting with the intention of selecting eligible candidates for the borough, but they only succeeded in exposing the divergence of opinion between the advocates of religious and those of unsectarian teaching, and, in consequence of these differences, no practical conclusion was arrived at. In the meantime, the vestrymen of Lambeth, Camberwell, Newington, and Wandsworth were assembled to claim their right to nominate a 'ticket,' as the Americans say, for the district. This will happen everywhere, if the better informed and earnest friends of education allow their influence to be nullified by party divisions. What is more, the 'ticket' of the vestries will have a good chance of winning. We can hardly imagine a greater calamity than this."

The *Daily Telegraph* says:—"It is gratifying to see the lists of names which have been put forward as those of the candidates for places on the school boards. On the whole, they are admirable. We have again and again pointed out the necessity of choosing a far higher class of men than those who have been deemed good enough to sit in vestries. A mere local politician, whose soul is wrapped up in the rates, may sometimes make a good vestryman, through the vigilance with which he checks the expenditure; but as a member of a school board such a man might be mischief incarnate. There need be no fear that too much money will be spent in the education of the poor; the real fear is that the boards will be parsimonious. The members should be taken from the ranks of those who are distinguished by mental power and acquaintance with education, or by an indisputable claim to represent a large class of the community; and that, we are glad to see, is the principle on which most of the school districts are proceeding. Thus, as candidates for Marylebone, we find such names as Professor Huxley, Mr. Hepworth Dixon, Sir Sydney Waterlow, Mr. Blanchard Jerrold, and Miss Garrett. The list for Chelsea is at least as distinguished, since it includes the names of Mr. J. A. Froude, Lord Lawrence, Mr. Eastwick, M.P., and Dr. Lyon Playfair. Boards composed of such materials would be inferior in dignity to no assemblies outside the House of Commons."

PROCEEDINGS OF INSTITUTIONS.

Salford Working Men's College.—The annual distribution of prizes and certificates to the successful students attending the Salford Working Men's College took place on Friday evening, the 14th inst., the Mayor of Salford in the chair. Mr. Plant, the honorary secretary, read a report, which referred exclusively to the examinations of the past year. The general results were creditable to the teachers and students, especially in the subjects of a practical educational character like those fostered by the Society of Arts. In May, the college offered to the students in the evening classes, and to the scholars in the day schools, thirty-two separate examinations on the subjects taught at the college. Of these, 12 were under the Department of Science and Art, 11 under the Society of Arts, and six under the Council of the Lancashire and Cheshire Union of Institutes. In the 12 examinations in science, 125 students presented themselves and obtained two honours, five advanced, and 31 elementary certificates, with six book prizes. In the three examinations in art, 20 students and 207 scholars were examined. Fourteen students gained second grade certificates, with two book prizes; and 34 scholars gained first grade elementary certificates. In the eleven examinations under the Society of Arts, 71 students presented themselves; 18 took first-class, 32 second-class, and 13 third-class certificates, with four money prizes of the value of £18, for geography, Latin, and logic. In the six examinations under the Union of Institutes, 89 young students were examined, 64 of whom obtained certificates, 28 higher grade, and 36 lower grade. Three students also obtained prizes from the Union of Institutes. To those students in the college who had reached the highest success in the above examinations the council of the college awarded 21 money prizes of the value of £32. During the year there had been 665 members, and the income of the college amounted to £450. The Chairman distributed the certificates and prizes, which together amounted to 251, to the successful students.

CORRESPONDENCE.

PATENT LAWS.

Sir,—The number of abolitionists of the Patent Laws is becoming small, and, in the opinion of many, they will soon disappear. The ventilation that the subject has received of late has dispelled most of the misconceptions with which it was surrounded.

Even the strongest opponents of the patent system

could suggest no practical method of dealing with the interests involved in inventions which would work so satisfactorily, and would not inflict greater injustice. By proposing a theory of government remuneration to meritorious inventors, they admitted the principle on which the patent system is founded, merely displacing the burden, by transferring to the mass the payment of a benefit conferred on the few, and derogated to an incompetent body the apportionment of a reward which could only be fairly estimated by those immediately concerned, and who have the help of time and experience.

The argument that invention is its own reward, advanced by others, will not bear serious consideration, and must be dismissed in a question where capital and labour are the essentials. If abstraction be made of those who always will object to every species of protection for inventions, the small number of its opponents remaining consists of reformers; they are abolitionists only in form, because they do not consider the abuses that they may have to complain of arose from the imperfect machinery and not from the principle of the law; these will become its friends when the reforms generally admitted to be necessary are carried out.

Now, one of the objections under the law, prior to 1852, was the enormous cost it imposed upon the inventor before he could claim protection for his invention, necessitating the obtaining of letters patent, and involving an immediate outlay for England alone of about £130, and for the three kingdoms of upwards of £300. One of the great benefits conferred on inventors by the Act of 1852 unquestionably was the reduction of the cost of letters patent to £25 for the three kingdoms, and the facility of securing an invention at once for a term of six months for £5. This reduction of outlay with increased facility, however, while properly admitting nearly all to competition for the reward of merit, opened the way to a large number of aspirants to the title without the property or qualification of inventors. As the law institutes no investigation as to the reality or novelty of an alleged invention, it gives encouragement and sanction to fictitious or supposititious claims, and occasions many well-grounded complaints on the part of manufacturers and others against the patent system. This and some other defects in the machinery of the patent laws have given cause for a call for their abolition.

A cure for the evil of multiplicity of patents was proposed at the time of discussing the clauses of the proposed new law, viz., by instituting a preliminary investigation into the novelty of the alleged invention submitted, and limiting the allowance of protection to such as answered the test. Opinions then were divided as to the conditions under which this investigation was to be conducted, and doubts as to its working satisfactorily were so strong as to lead to its abandonment. Time, however, has removed some of the doubts then entertained, and shown a practical mode of overcoming the difficulties apprehended. This test will doubless be required, and form part of the next amendment Act, which it is expected confidently will be passed in the forthcoming session of Parliament, thus disposing of one of the chief objections to the patent laws. When that time comes it will open tho question of a further reduction in the cost of patents, so as to restrict the fund raised by the Patent-office to the amount required for defraying its expenses.—I am, &c.,

L. De Fontainemoreau.

4, South-street, Finsbury, October 17th, 1870.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

A meeting of Section D., Class 10, was held on Wednesday, the 26th inst., at the Society of Arts. Present —Sir Michael Costa (in the chair), Otto Goldschmidt, Edmund C. Johnson, Rev. John Curwen, Alan S. Cole, John Hullah, Arthur S. Sullivan, Captain Donnelly, Dr. Wylde, W. G. Larkins, and P. Le Neve Foster, General Secretary to the committees. It was resolved to recommend to her Majesty's Commissioners for the Exhibition of 1851, that persons having systems of teaching music should be allowed, subject to the approval of the Committee, to illustrate such systems by lectures, or performances, or otherwise, at the forthcoming Exhibition.

The Commissioners have sent out a letter to the manufacturers of pianofortes, stating, that although musical instruments, as a class, will not be included in the Exhibition of 1871, but will form part of some subsequent exhibition of the series, it will yet be competent to manufacturers to submit to the Committee of Selection for Class 10 (Educational Works and Appliances) such instruments as are specially adapted for school use.

The wonderful acoustic properties of the Albert Hall are daily becoming more and more marked. Any person visiting the building will be certain to hear one or more of the workmen singing, and the bell-like clearness with which the sound falls on the ear of the listener, in whatever part he may be, is very noticeable. This is especially so if he happens to be in the galleries in which the Exhibition of Educational Works and Appliances (Class 10) will be held. This is an important fact, as musical entertainments in connection with the Exhibitions will be given. The *Standard*, in a description of the hall, has the following:—"We stationed ourselves in various parts of the building, ranging from the depths of the arena, up through the amphitheatre and the boxes, to the topmost gallery, and, go where we would, at the end of the ellipse, or at its sides, we were able everywhere to hear with perfect distinctness the voice of a solitary singer standing on one of the lower tiers of the orchestra, in front of the spot to be occupied by the great organ. It was the dinner hour. One singer was a man, and the other a boy; the man a bricklayer, and the boy evidently going through an apprenticeship for some similar occupation. The lad pleaded 'a cold,' but said he would 'do his best.' Sweetly and clearly the tiny voice crept and warbled through the endless maze of scaffolding which occupied the core of the building, from the bare earth to the vaulted roof, the boyish notes piercing their way amid the poles and planks which thickly fringed the whole circuit of the hall. The deeper notes of the man travelled with similar facility, and the amplitude of the space seemed to have a sweetening effect on the tone of the voice, reminding one of music heard upon the water. Nor was the effect merely due to the peculiar properties of musical notes. It was with perfect ease that any verbal communication could be made from the gallery to the orchestra."

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

The following letter has been received from a correspondent:—

Sir,—Having recently had the privilege of viewing the buildings in course of preparation for the Exhibition of 1871, I have thought that I might ask permission to be allowed to state what are the first impressions which have been created in my mind by my visit to Kensington. I am fairly amazed at the magnitude of the works which are in hand, and which have been and are so quickly progressing. I feel that manufacturers and art producers are not at all aware of how vast an amount of accommodation is being prepared for the reception of their goods.

The establishment of annual exhibitions of industry appears to me to be a natural sequence to the establishment of exhibitions of art simple and pure; and when it is remembered that, in London alone, fourteen art exhibitions were open at one and the same period during the present year, it is not unreasonable to suppose that some of the advantages which artists derive by the exhibition of their works may be equally participated by the producers of art-manufactures.

As to the buildings in which the Exhibition of 1871 is to be held, I venture to predict that they involve another surprise for the public almost as great as was that of the parent Exhibition of 1851, and on the estate purchased by the profits of which the next and future exhibitions are to be held. Since 1851, we have seen created at South Kensington the Horticultural Gardens and their arcades, against which so much was said at the time of their erection. In 1862, a base to the arcades was erected, in the form of refreshment rooms of a permanent character; and now, on the north side of the Horticultural Gardens, has been raised the Hall of Science and Art, portions of which will be available as exhibition space, while wings on the east and west of the gardens connect the hall with the arcades, and form a whole, with the gardens as a quadrangle, of great beauty. The hall is, I understand, intended to accommodate 9,000 persons seated, and will be used on great ceremonial occasions, and afford facilities for musical performances calculated to illustrate the musical power of Europe, and advance the musical education of our own people. The wings to the hall consist of an upper and lower floor, the vistas through which are remarkably fine, the upper floor being in the character, but superior in proportion and effect, to the fine art galleries of the exhibition of 1862. The vista through the basement reminds one again of the parent Exhibition of 1851.

The arcades right and left of the Horticultural Gardens are now connected by wings with the great hall; and, viewing the whole from its base, viz., the refreshment rooms of the Exhibition of 1862, it is at once seen that, however gradual may have been the development of the plan, the whole was conceived long since though but partly executed.

Grand as was the Exhibition of 1851, beautiful as was its successor of 1862, and much as they both have been competed with in arrangement by the many exhibitions which have since taken place in Europe and throughout the world, I feel that the varied combination of nature and art at present being brought about in anticipation of the Exhibition of 1871, will cause the latter, in many respects, to far outvie its predecessors in variety, extent, and beauty. I am, &c.,

S. H. W.

NEW BOOKS.

The Elements of Mechanism, the first of a series of elementary works on mechanical and physical science, forming a series of text-books of science adapted for the use of artisans and of students in public and other schools. Edited by T. M. Goodeve, M.A. 3s. 6d. (*Longmans and Co.*).—Two editions of this treatise have already been published as a separate and independent work. It has been re-written and enlarged, in order to provide an elementary text-book on the principles of mechanism. The intention of the author has been to afford some aid in the systematic preparation which a student must pass through in order to understand the intricate combinations of modern machinery, and it is hoped by him that a statement of some of the leading principles which govern the applications of mechanism may be found useful by many who are engaged in occupations connected with applied mechanics.

The Natural History of Commerce, with a copious list of commercial terms and their synonyms in several languages. By John Yeates, LL.D. (London and New York: *Cassell, Petter, and Galpin.*) 1870.—The work before us, the first of a series, is one which will possibly be gladly welcomed and largely perused by those who must almost daily feel the want of a book of this nature. This volume delineates the principal divisions of the earth from an industrial point of view, and describes the contents of the inorganic and organic world, the raw materials of commerce, according to their material value and importance, and comprises the geography and natural history of raw materials. An appendix contains a vocabulary of the names of natural productions in the principal European and Oriental languages.

GENERAL NOTES.

Indian Coal.—The practicability of using native coal for Indian consumption is daily becoming more generally recognised. The Nerbudda Coal and Iron Company have just been advised by their manager, Mr. Adley, that the Bombay government have sanctioned the supply of 1,000 tons monthly of their coal, at 18s. per ton. As the contract extends to the end of 1872 from the present time, the advantage to the company will be a very important one. It may be added that trials of the company's coal have recently been made on other Indian lines, with the object of using it for locomotive purposes, and the results are said to be highly encouraging.

West Indian Immigration.—A return recently published by the Commissioners of Emigration gives the number and particulars of the ships despatched from Calcutta to the West Indies with coloured emigrants. During the season 1869-70, twenty-four ships left, with a total of 10,544 individuals, and no less than 401 deaths occured on the passage. The average number of persons carried in each ship appears to be about 400, but it is a notable fact that the number carried does not bear any proportion to the number of deaths. In one ship 458 embarked and 98 died, or 24 per cent.; in another 421 embarked, and 33 died; and in a third, 268, with 20 deaths as the result. The *Lancet* says:—"We submit that these figures show that there is something rotten in the state of emigration agency at Calcutta, if, indeed, any properly credited agency exist. We have reported in another column how excellently well the emigration business is carried on in this country; and to produce the above miserable result some one or more of the following causes must have existed:—1. Unfitness of the vessels for the work. 2. Bad provisions. 3. Culpably careless inspection as to the condition of the emigrants before embarkation. 4. Equally culpable carelessness or gross incompetency of the medical officer in charge. It is the duty of the authorities at the India-office to co-operate with the Commissioners of Emigration, in order that, if the continuance of emigration to the West Indies be still considered necessary, it may at all events be conducted on some sort of principle indicating common humanity and a sense of the value of human life.

Quicksilver.—The diminished production of quicksilver in South America, says the *Mining Journal*, is causing some discussion in the several States concerned, and a higher range of prices appears to be expected. In 1854, the new Almaden Mines produced 5,400 flasks per month; the present production is less than 1,000 flasks, and the whole of the mines on the Western Coast produced, in August last, less than 2,000 flasks.

Fighting by Steam.—Mr. Henry Bessemer has suggested a mode of making steam directly applicable for the purposes of warfare. He proposes to apply the principle of the steam fire-engine to the projection of bullets, and calculates that, with a pressure of 150 lbs. of steam, 1 oz. and 2 oz. bullets might be projected with an initial velocity of 1,600 or 1,800 feet per second, at the rate of 2,000 per minute of the smaller, and 1,000 per minute of the larger missiles.

British Columbia. — The Emigration Commissioners state, in their report this year, that there is practically no emigration at present from the United Kingdom to British Columbia. Only 21 persons sailed hence for that colony last year. Mr. Musgrave, the new governor, remarks that hardly ten emigrants of the mechanical or agricultural class reach British Columbia direct from the mother country in the course of a year. With as fine and healthy a climate as is to be found in the world, well suited to agriculture and stock-rising, rich in gold, and coal, and other minerals, and teeming with natural resources of every description, British Columbia is of no avail as a field for emigration in consequence of its heing so inaccessihle. The male population exceeds the female hy 277 per cent.

Statistics of the French Railways.—The length of railways in France, at the end of the year 1869, was 15,027 miles, of which 13,596 were definitely conceded; 573 lines for which concessions had been voted; and 858 lines projected, but not conceded. The expenses incurred up to this time, and to be incurred during the following ten years, in accordance with the convention of 1868, show a total of £411,471,840, of which £61,549,956 were treasury subventions, and £342,921,884 were companies' expenses. In the year 1868, the latest for which information of the traffic has hcen completed, the total number of persons travelling was 105,017,972, over an average distance of 23 miles. The quantity of goods transported was 42,078,413 tons, over an average distance of 93 miles. The net receipts were—for travellers, £8,449,640; for goods, £15,415,040; for baggage, £3,145,840; making a total of £27,010,520, which gives upwards of £1,500 per mile. These figures show a diminution in railway traffic for 1868, as compared with the previous year, as regards passengers, of £680,000, which is accounted for by the closing of the exhibition. It is calculated that, over a period of ten years, the average price for goods had diminished 1·10 centimes, which represents a difference in favour of the commerce and industry of the country of upwards of £2,760,000. During the same period the companies, aided by the State, had opened annually 497 miles, at an expense of £14,800,000. By the law of 1868, the lines voted were eagerly taken up hy the companies, and the government was enabled to save £1,500,000 in subventions. At the beginning of the present year, before the war, there were, it seems, 4,968 miles of railroad which still required completion. The statistics of 1869 are very satisfactory as regards accidents. Only two passengers and four railway servants were killed, and only 112 passengers and 61 servants received injuries, out of the 90,000,000 who travelled, that is to say, one passenger for every 45,000,000, killed; and one out of every 800,000 injured. Such a result has, it is helieved, been obtained chiefly by the adoption in working of the system of "centre-vapeur" applied to the locomotives, by which the speed in descending inclines can effectually be moderated.

Population of United States.—The census recently taken in the United States, shows that the population of the Union is now about 41,000,000. The population of New York is much less than what has been commonly supposed, being considerably less than 900,000.

An Indian Sewage Farm.—It would seem, according to an account in the *Standard*, that the system of sewage irrigation has been introduced into Madras, with every prospect of its turning out a great financial success. The sewage farm consists of about 37 acres of land; but of these only two are at present under cultivation. The land came into the possession of the Municipal Commissioners early in June, 1869, and operations were commenced before the close of that month. The site is an old swamp, where water used to collect and remain stagnant for weeks together, the ground not being more than four feet above sea level. The soil is said to be as bad as it can be, consisting of a stiff clay, mixed with much salt and a little sand. After being dug out and exposed to the sun, the clay splits up, and sand is readily washed out by a shower of rain. It was necessary to raise the land before cultivating upon it. For this purpose tanks were dug here and there, and the earth taken out of them was used to raise other parts; the tanks receive the rain, which is further kept off the ground by an embankment round the land. The sewage at present used comes from the Perambore Barracks and a village hard hy, and amounts to about 5,000 gallons in the day. It is run off morning, noon, and night, and is exhausted in about half an hour; flowing easily, and rapidly losing all smell. By the method of cultivation at present followed, a bed, two or three yards wide by six or eight long, is made, and sewage allowed to flow into it for two or three or four days. In a couple of days the seed is planted, and when the plants are up they are occasionally fostered with sewage. Any sign of bleaching is regarded as an index to the necessity of stopping or diminishing the supply of sewage. That which grows best is of the same class as in Europe. Captain Tulloch, R.E., who reports the doings on the farm, says, "If we continue to get as fine crops of Guinea grass as the one just cut, the yearly produce will be enormous." For example, the grass was put in from roots, July 11th; on August 27th a cutting $3\frac{1}{2}$ feet high was got; a second on the 21st of September weighing 248 lbs., the bed being 23 feet long by 18 feet wide—equivalent to 11 tons per acre per crop; or at 8 crops a year, 88 tons of Guinea grass per acre per year; representing about 20 tons of hay, and in Madras it would fetch 20 rupees per ton. The common hurriala grass, beans, radishes, marrows, potatoes, tomatoes, and also the cocoa-nut, the jack, and the tamarind trees have done well. But lucerne has not flourished. So far as the experiment has gone it promises well. But it is a question with some sanitarians in Madras how far simple irrigation with water would do as well as with sewage. The engineer says he has not yet found the limit to which the grass crops may be irrigated with sewage. At the suggestion of Captain Tulloch, some of the solid excreta, which is collected away from Madras, is to be used as a top-dressing, being ploughed in before the liquid is let over the land. The arrangements for carrying away the sewage of two other districts —Choolay and Erangoonum—and irrigating land therewith, we learn, are almost completed The authorities are quite alive to the fact that, after awhile, the land will probably become so rich, that grasses will fail to flourish upon it, and that a crop or two of grain, perhaps, will be got from it with advantage. So far as the experiment has gone, it seems to have led to very satisfactory results. No objections have as yet been made on sanitary grounds.

MEETINGS FOR THE ENSUING WEEK.

Tues.....Anthropological, 8.
Linnæan, 8. 1. Mr. Mansel Weale, "On the Fertilization of Orchids and Asclepiadeæ." 2. Mr. Mansel Weale, "On a Solitary Bee from South Africa."

Journal of the Society of Arts.

FRIDAY, NOVEMBER 4, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

NOTICE TO MEMBERS.

The One-Hundred-and-Seventeenth Session of the Society will commence on Wednesday, the 16th November, when the Opening Address will be delivered by Lord HENRY G. LENNOX, M.P., Chairman of the Council, and when the Prince Consort's Prize, awarded at the last Examinations to Mr. Edward Turner Sims, as well as the Medals awarded for Papers read during the past Session, will be presented.

The following are the dates of the Wednesday evening meetings, the chair being taken at eight o'clock:—

1870.	November	—	—	16	23	30
„	December	7	14	21	—	
1871.	January	—	—	18	25	
„	February	1	8	15	22	
„	March	1	8	15	22	29
„	April	—	12	19	26	
„	May	3	10	17	24	31
„	June	—	—	—	28*	

For the Meetings previous to Christmas, the following arrangements have been made:—

NOVEMBER 16.—Opening Address by Lord HENRY G. LENNOX, M.P., Chairman of the Council.

NOVEMBER 23.—"On South African Diamonds." By JAMES TENNANT, Esq., Professor of Mineralogy, King's College, London.

NOVEMBER 30.—"On Peat, and its Profitable Utilisation." By ROBERT M. ALLOWAY, Esq., M.A.

DECEMBER 7.—"On the American System of Associated Dairies, and its Bearing on Co-operative Farming." By H. M. JENKINS, Esq., Secretary of the Royal Agricultural Society of England. On this evening Lord VERNON will preside.

DECEMBER 14.—"On the Study of Economic Botany." By JAMES COLLINS, Esq., Curator of the Pharmaceutical Society, and Fellow of the Edinburgh Botanical Society.

DECEMBER 21.—"On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By ALBERT SILBER, Esq.

Each Member is privileged to introduce two friends to every Meeting, and a book of blank Tickets of admission will be duly forwarded for this purpose.

The first course of Cantor Lectures for the ensuing Session will be "On Artists' Colours and Pigments," by FREDERICK S. BARFF, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society. It will consist of five lectures, to be delivered on Monday Evenings, the 21st and 28th November, and the 5th, 12th, and 19th December, at Eight o'clock. These lectures will treat of—The Nature of Colour; Chemistry and Manufacture of Colours and Pigments; Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. Other courses of lectures are under arrangement for delivery during the Session. These Lectures are open to Members, each of whom has the privilege of introducing two friends on each lecture. Tickets for this purpose will be forwarded in due course.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

Members are reminded that, should any of their friends wish to join the Society, the opening of the Session is a favourable opportunity for proposing them.

COMMITTEE TO CONSIDER THE RELATIONS BETWEEN GOVERNMENT AND INVENTORS.

November 1st was fixed as the latest time for the reception of answers to the questions proposed by the Committee. Inventors who have not sent in their answers will, however, be permitted to do so till the 10th inst.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

When the penny post was proposed by Mr. (now Sir Rowland) Hill, he was looked upon as a dreamer. The Post-office for some years (previous to 1840, when the penny post was first introduced) had been in a stationary, if not in a declining position. The gross revenue of the Post-office, in 1840, was £1,359,466; in 1851, it had increased to £2,422,168, or an increase of nearly £100,000 per annum; for the year 1868, the last published, it amounted to £4,391,270. The number of letters which passed through the Post-office in 1838 was 76,000,000, while, in 1851, they had increased to 400,000,000, and in 1868 amounted to 808,118,000 letters, and 105,840,000 book-packets, newspapers, and pattern-packets, or a gross total of 913,960,000 letters and packets for the year.

Since the establishment of penny postage in the United Kingdom, the internal trade of the country has greatly increased, as also has our export trade. The establishment of steamers and railways have greatly added to our facilities of communication, and strengthened our relations with our colonies and foreign countries. The safe and speedy conveyance of letters for the benefit of trade and commerce was the primary consideration of the government in the establishment of the General Post-office; that also was the reasoning of the Committee of 1838, and the adoption of the penny postage was the result.

During the period in which the Society of Arts was actively engaged in fostering and helping to carry through the first Great International Exhibition of the industry of all nations, held in 1851, the necessity which existed for greater facilities for postal communication between the manufacturers of our own country and colonies, as well as with the industrial communities of foreign and remote States, was forced upon its attention. It also felt that greater uniformity and economy of postal charges would tend to increase friendly, industrial, and commercial intercommunication, and for the purpose of bringing about the desired alterations at home, in the

colonies, and in foreign countries, a Postal Association was established. At a breakfast given by the association at the Society of Arts, on the 17th November, 1852, Lord Granville in the chair, it was resolved that the subject of colonial and international postage was one of the highest importance to the trade and commerce of the country, as well as to peace, and to the physical and intellectual improvement of mankind. The association soon got into communication with about seventy of the principal commercial towns, the chambers of commerce throughout the country co-operated with the association, and letters were received from the representatives of nearly every important foreign country, and the association was thus assured of support.

It is not desirable that I should refer here to the history of all the various changes which have been made in the regulations of the Post-office since 1851; it is sufficient to say that the Society of Arts has never since ceased to take an active interest in every endeavour which has been made to obtain for the public a freer use of that national establishment, whenever it was felt that it could be rendered available in the interests of art, education, industry, or commerce, without loss to the country. Nor need I record by what other influences the changes which have been made have been brought about; the facts remain and speak for themselves. Our colonial postage has been reduced to a more economic and uniform rate than previously existed. Newspaper stamps have been abolished; an economical system of book-post and the carriage of printed matter is now at work; a pattern or sample-post has been introduced and permitted for the benefit of trade and commerce; and, during the present year, fresh powers have been granted to the Post-office authorities, to accord increased facilities to the people for making known their wants to each other at a reduced rate, by the issue of postal cards, England thereby following the example of Belgium and other continental states, in working the postal system for the advantage of the people and industry. The course of progress thus happily instituted, the public fully appreciates, and while thankful for the greatly increased facilities at present afforded it by the postal system, they, nevertheless, regret that the use of the parcels-post system in the service of trade which the Post-office affords, and is capable of affording to a still larger extent, for the growth and increase of commerce, has, during the month of October, been checked, by the new orders which have been issued by the Post-master-General, and which limit the extent to which the parcels post can now be rendered available by the public. This is the more to be regretted, as it must be remembered that many business relations have been entered upon, and permanent liabilities incurred, upon the faith of the Post-office continuing to act in the same spirit and on the same principles which it has acted upon for some years past. Moreover, "postal regulations, be it remembered, are not matter of parliamentary enactment, but they have all the force of law, and when they have been in existence for any length of time, they at least obtain, or ought to obtain, such sanction and legal stability as can be conferred by custom or commercial usage."

"When a public department inaugurates a system which by its very existence creates trade, and becomes an essential element in the life of that trade, and, moreover, is continued for such a length of time as, if such a thing were possible, to confer a prescriptive right on all persons transmitting samples and patterns by post, as a practice connected with business, to have such things carried by the public carrier, suddenly to limit the system, and extinguish the branch of commerce which has grown out of it, amounts, as we have said, to a breach of faith, of which the government surely cannot approve. No compensation for arbitrary measures of this kind is provided by statute yet."—(*Law Times*).

Upon what different principles other European governments are now carrying on their postal system, so far as regards facilitating the carriage of commercial parcels and patterns by post. The alterations which have recently been made in the parcels post system of England are injurious to our commercial and trading community.

The following is an epitome of the postal regulations of France, Belgium, Switzerland, North Germany, and England, and will serve to point out the spirit in which foreign governments conduct their postal establishments:—

France.

The French post-office possesses the exclusive right of conveying letters, newspapers, printed sheets and periodicals, packets and papers, weighing not more than one kilogramme (about $2\frac{1}{4}$lbs).

In addition to letters, publications, and papers, the post-office undertakes the following services:—

1. Transport of title deeds and papers of value of all kinds.
2. Transport of objects of value of small dimensions, under the designation of *valeurs cotées.*
3. Transport of books, engravings, lithographs, autographs, whether in sheets or bound.
4. Transport of samples.
5. Transport of visiting cards.

Small objects of value, called *valeurs cotées*, must be registered, and are charged at the rate of 1 per cent. on the estimated value, which must not be less than 30 or more than 1,000 francs, with a 20 cent. stamp in addition. The boxes or cases in which these objects are enclosed are required to be solid, and not to exceed 10 centimetres (4 inches) long, 8 centimetres in width, and 5 centimetres in depth, and the objects themselves must not exceed 10 grammes in weight (10 oz.). The boxes containing these *valeurs* are taken to the post-offices open, the contents examined by the inspector on duty, who may, if he sees reason to do so, object to the estimate of their value; when that has been agreed upon, they are fastened with string or otherwise in his presence, and sealed, both by the sender and the office. In case of loss the post-office pays the estimated sum.

These *valeurs* are not distributed in rural districts, but the person to whom one is addressed may obtain it through the rural postmen, on filling up a form, otherwise he must go to the post-office of the district for it himself, on receiving notice of its arrival there.

The arrangements respecting printed matter and samples present considerable complication; they comprehend five classes, three of which are subdivided.

Class 3 comprises circulars and all kinds of printed matter; also bound books, engravings, and samples, either singly or in parcels, or with printed papers which refer to them.

France has conventions with most of the States for the transmission of samples, and also of business papers and other matters. The postal unit for samples is, in most cases, the same as that for printed publications, namely, 40 grammes, and that for *papiers d' affaires* 200 grammes. The arrangement with the British Post-office, however, offers exceptions to both cases, as the following table, extracted from the tariff of foreign rates, will show:—

	Samples.				Papiers d'affaires.		
	c.		grs.		c.		grs.
Luxembourg ...... Switzerland	5	per	40	..	50	per	200
Italy	6	,,	40	..	—		
Baden	10	,,	40	..	50	,,	200
Bavaria	10	,,	40	..	50	,,	200
Belguim	10	,,	40	..	50	,,	200
Denmark	10	,,	40	..	(nil)		
Portugal	10	,,	40	..	—		
Prussia	10	,,	40	..	50	,,	200
Greece..............	12	,,	40	..	—		
Sweden	15	,,	40	..	—		
Norway	18	,,	40	..	—		
United States (by way of England)	20	,,	40	..	—		

Between France and Great Britain there is one uniform rate for samples and *papiers d' affaires*, including photographs, legal, commercial, and other documents, printed proofs and manuscripts, not of the nature of letters, namely, 30c. per 120 grammes.*

The post-office also, it is said, complains of the enormous increase in the quantity of matters which it has to carry, and proposes that some change be made with respect to newspapers, printed matter, and samples.

BELGIUM.

In Belgium the postage of patterns and samples is allowed upon the following conditions:—

Patterns and Samples.—The rates for this class is 10 cents. per parcel not exceeding 100 grammes in weight; 20 cents. per parcel between 100 and 200 grammes; 30 cents. per parcel between 200 and 300 grammes, 300 grammes being the maximum weight. Parcels insufficiently stamped are charged double the above rates, a deduction being made for the stamps on the covers. Parcels unpaid are taxed as letters. The maximum size of each parcel is 30 centimetres (12 inches) square. The samples may not possess any mercantile or intrinsic value; they must be so packed that the covers may be easily removed, to allow the contents to be verified. No parcels will be forwarded which contain—(1) jewellery or metallic objects of value; (2) objects liable to cause any damage to letters or injury to the employés, such as any inflammable matter, cutting instruments, or samples packed in glass.

Registered Letters.—There are two kinds of registered letters, *lettres chargées* and *lettres recommandées.*

Lettres et Objets recommandées.—All letters, newspapers, printed papers, patterns, &c., may be *recommandées*, on payment of 20 centimes in addition to the ordinary rate of postage. A receipt is given to the sender on payment, but the post-office is not responsible in case of loss. No values to bearer, jewellery, or coins, may be forwarded in such letters, as separate laws exist as to their transmission up to the value of 10,000 francs, and a penalty of fine or imprisonment is inflicted in cases were fraud is attempted.

Notice of delivery of *lettres chargées*, or *recommandées*, as well as those forwarded by express, may be obtained by the sender on payment in advance of the postal rate of an ordinary letter.

Patterns and samples are subject to the same regulations with regard to their nature and packing as for inland transport; they must have no mercantile or intrinsic value, nor liable to duty.

Patterns, samples, *papiers d'affaires*, &c., are charged as follows:—Between Belgium and

Great Britain.—Patterns and samples, 30 centimes per 120 grammes (maximum weight 250 grammes). Proof-sheets (with the original MSS.), *papiers d'affaires*, and manuscripts, by Ostend, 10 cents. per 50 grammes; by Calais, 12 cents. per 50 grammes.

France.—Patterns and samples, 10 cents. per 40 grammes; *papiers de commerce ou d'affaires*, proof-sheets, &c. (corrected), 50 cents. per 200 grammes.

Germany.—Patterns, MSS. of all kinds, 5 cents. per 40 grammes.

Russia.—Patterns, &c., 9 cents. per 40 grammes.

Austria.— Patterns, MSS., &c., 5 cents. per 40 grammes.

Holland,—Patterns, 10 cents. per 40 grammes. *Papiers d'affairs* and MSS., 30 cents. per 200 grammes.

Among Continental nations, Belgium certainly occupies a foremost position as regards the postal arrangements, and every year adds to the facilities for inland and foreign commerce.

SWITZERLAND.

Parcel Post.—The Swiss post-office undertakes the transmission of goods and merchandise of various kinds, and of articles of value done up in closed parcels. It does not undertake the transmission of articles which will readily become putrid, or anything explosive or liable to combustion, &c., such as gunpowder, gun-cotton, fire-works, ether, photogene, nitro-glycerine, &c. The post-office does not undertake, excepting under special restrictions, the conveyance of very fragile things, things difficult of transmission, or of too great a weight, or too bulky, live animals, or liquids. If posted, the sender is responsible for any damage caused. The terms for sending the parcels is determined by the nature of their contents, the distance they have to go, their bulk, weight, &c.

Additional Parcel Tariff.—The parcel tariff, which applies to parcels of no value as well as to parcels of declared value, varies from 15 centimes for 2lbs. to 210 centimes for 10lbs., according to distance. The sender may forward a parcel with or without declaring its value. In case of loss or damage, the post-office allows compensation on the declared value, or, in default of that, on the weight of the parcel. A parcel may be accompanied by a letter to the receiver of the parcel. Printed periodicals may also be added to a parcel. Parcels of value should be securely fastened by means of seals, &c. The address of a parcel may consist of a trade-mark or number, with the place of destination indicated, or in an open letter accompanying it, or in a written address affixed to it. Parcels may be addressed to the residence, or *poste-restante.* Parcels addressed to persons' residences are delivered free of expense, excepting when they exceed the weight of 10lbs. or the value of 1,000 francs; in this case they pay a uniform charge of 15 centimes for the delivery. They must be handed in direct at the post-office, and may not be put in the letter-box. They can be prepaid or not paid; they are registered; the sender receives a receipt if he wishes it; he may request it to be sent by express to the residence at any hour of the day or night (on condition that the parcel does not weigh more than 5lbs. or exceed the value of 200 francs). Parcels sent by express are charged an additional rate, according to the distance they have to be taken, and varying according to whether they are delivered by day or night. It must be added that the Federal post makes a regular exchange of dispatches with the German States, Austria, and Hungary, as well as with the French and Italian railways which join the Swiss frontier.

The post-office has the monopoly of the conveyance of closed parcels without value, or of declared value, and of money not exceeding the weight of 10 lbs.; and it enters into competition with the private conveyance companies, and conveys parcels to the limit of 120 lbs. Above that weight it does not take them, only conditionally and exceptionally. It effects their conveyance either by the medium of railways, or on other routes not served by them, by means of their own special conveyances; these conveyances also take passengers. The number of passengers taken by them in 1869 were 1,126,127. It is prohibited to do up in the same wrapper several closed parcels which, separately, would not exceed the weight of 10 lbs., and which are addressed to several persons, and to forward them any other way than by post.

The parcels transmitted in the interior and internationally in 1869 were:—

For the interior	4,774,171
,, Germany	180,179
,, Italy	16,277
,, France	75,307
,, Germany	179,936
,, Italy	12,434
,, France	92,995
	5,331,299

The monopoly of the post to closed parcels of the weight of 10 lbs. has not caused any unfavourable effect on the interest of commerce or freedom of industry in

* *100 cents is equal to 10½d., and 1 gramme is equal to 15.434 grains troy.*

Switzerland. On the contrary, it has been acknowledged that the Swiss post, from its low rates, its clearness and simplicity, the extension given to the postal service so as to benefit all localities, and the gratuitous distribution of parcels to the residences of the persons to whom they are directed, affords to the public much greater advantages than could ever be obtained by private means of conveyance.

North Germany.

In North Germany the post-office undertakes the conveyance and distribution of parcels, but there is no monopoly of the post-office for parcels; but the post-office has the privilege of free conveyance on railways by every train for all parcels of less weight than 20 lbs. It is largely used for all kinds of articles.

The post-office can forward all letters, newspapers, and also all parcels of less than 20 lbs. each in weight, either in separate bags and parcels, or in mail-wagons, by every train free of payment to the railway companies. This privilege arises out of the former monopoly by the State of the conveyance of persons and goods. When the railways were constructed, the State abandoned this monopoly, reserving, however, to the post-office the free conveyance of letters and newspapers, and also of parcels.

The post-office is self-supporting, and the annual amount of profit or net revenue amounts to about 400,000 thalers, equivalent to about £60,000.

The parcel rate is reckoned by distance and weight, beginning at 2 pfennige (or about $1\frac{1}{2}$d.), per lb., for five German miles, and rising at 2 pfennige per lb. for every five German miles, to 30 for every 10 German miles from 30 to 100, and for every 20 German miles from 100 to 160 German miles, making in all 17 progressive charges from 2 pfennige to 2 silber groschen and 10 pfennige per lb. The minimum charges are—

	Silber Groschen.		d.
For 5 German miles........	2	=	$2\frac{1}{4}$ nearly.
From 5 to 15 „	3	=	$3\frac{3}{8}$ „
From 15 to 25 „	4	=	$4\frac{1}{2}$ „
From 25 to 50 „	5	=	$5\frac{5}{8}$ „
Over 50 „	6	=	$6\frac{3}{4}$ „

All parcels must be accompanied by a separate addressed card or paper, for which no special charge is made. This card should contain the address, the outward description of the parcel, and the declared value (if any), and should be sealed with the same impression as the parcel. The parcels must be sent for by the receiver, to whom the post-office sends a notice, with a receipt for the cost to be paid to the district postman. If the parcel is sent out by the post-office, it is of course charged for in addition. If the value of a parcel be declared, the insurance against loss is—

	To 50 dollars.	From 50 to 100 dollars.	Over 100 dollars.
	Silb. gros.	Silb gros.	Silb. gros.
For 15 German miles	$\frac{1}{2}$	1	1
From 15 to 50 „	1	2	2
Over 50 „	2	3	3

Should the declared value exceed 1,000 dollars, then on the excess only one-half of the above insurance premiums is levied. Parcels not securely packed will not be received. All articles likely to damage other postal packages are of course forbidden, but otherwise there is no restriction as to the kind of article which can be forwarded by parcel post, except that in consequence of a live bear having been once sent, all living animals (except oysters) are forbidden. The limit of weight is now 100 lbs.

The abolition of the postal conveyance of parcels would be seriously felt in all districts in which private companies would not be tempted, for there would be no chance of profit, to undertake their conveyance. It is accordingly considered that this branch of the post-office is not only beneficial but is also essential in the interest of the whole kingdom.

Note.—The German mile is equal to about $5\frac{3}{10}$ English miles.

England.

The following are the new rules of the inland pattern and sample post in the United Kingdom:—

The postage is now one halfpenny for every weight of two ounces, or fraction of that weight; but the pattern and sample post is restricted to *bonâ-fide trade patterns or samples of merchandise.* Goods sent for sale, or in execution for an order (however small the quantity may be), or any articles sent by one private individual to another which may not actually be patterns or samples, are not admissible.

No packet must exceed 12 ounces in weight, or two feet in length by one foot in width or depth.

The postage must be pre-paid, either by adhesive stamps or by means of a stamped wrapper, or by a combination of both, except at the chief or district offices, and the branch offices at Lombard-street and Charing-cross, in London, and at the chief offices in Edinburgh and Dublin, where from 10 a.m, to 4 p.m., it may be pre-paid in money, provided the postage amount to not less than £1 in any one case, and provided the packets are posted in bundles, each representing a postage of 5s.

There must be no writing or printing upon any packet, except the address of the person for whom it is intended, the address of the sender, a trade mark, or number, and the price of the articles; nor may there be any writing or printing or other thing enclosed except such address, mark, number, and price, and a written or printed description of the articles; and these particulars may be on labels attached to the samples. If this rule be infringed, the packet will be treated as a letter.

Any prohibited enclosure will be taken out and forwarded to the address on the packet, charged with full postage as an unpaid letter. It is the duty of postmasters, whenever they have ground for suspecting an infringement of any of the above conditions, and occasionally, even when there is no ground for suspicion, to open and examine pattern packets posted at, or passing through their offices.

Patterns or samples, when practicable, must be sent in covers open at the ends, and so as to be easy of examination. In order to secure the return of pattern packets which cannot be delivered, the names and addresses of the senders should be printed or written outside; thus:—"From ——— of ————." Samples of seeds, drugs, and such like articles, which cannot be sent in covers — but such articles only — may be posted enclosed in boxes or in bags of linen or other material, fastened in such a manner that they may be readily opened; or in bags entirely closed, provided such closed bags are transparent, so as to enable the officers of the Post-office readily to satisfy themselves as to the nature of the contents. If this rule be infringed, the packet will be treated as a letter.

If a packet be not sufficiently prepaid, but bear a stamp of the value of one rate, it will be forwarded charged with double the deficient postage; a packet posted wholly unpaid will be charged with double the pattern postage.

Such, then, are the parcels post systems of France, Belgium, Germany, Switzerland, and England. Each of the continental states appears to aim at affording its communities the greatest possible freedom of postal parcels communication, at the least possible cost, and it is found that the people gladly avail themselves of it. The recent modifications of the parcels post system in England has tended to diminish its commercial utility, by limiting its use to "*bonâ-fide* trade patterns and samples of merchandise only," instead of allowing parcels of identically the same weight and

character in general, however small the parcel may be, or, in fact, the same parcel, if sent in execution of a trade order, or from friend to friend as a gift to be sent. But why, it may be asked, should our Post-office be required to distribute parcels for the public at all, seeing that we have railways, steamboats, delivery companies, and commercial enterprises established all over the conntry for the purpose of doing such work? The answer is simple and conclusive, viz., that between the weight of a letter and that of such parcels as the railway companies find it convenient and profitable to carry and deliver, there is much that it is desirable should be sent, but which is prohibited by the cost involved, or the want of existing means for its prompt delivery. The Post-office has in this country an agency of some 26,000 officers, and upwards of 12,000 postal stations, available for the collection and distribution of small parcels not exceeding in any instance 2lbs. in weight. The Post-office does at present distribute the commercial products of the printer and publisher of books, newspapers, and other classes of printed matter, and it is impolitic and unfair to prevent commerce in general and the public from availing itself to the fullest extent to which it is capable in other directions. Lord Hartington stated to a deputation from the Society of Arts that "the Post-office was intended and fitted, not for the carriage of large parcels, but for the rapid distribution of small ones."

Since the new orders of the post-office have been in force (though for one month only) many and loud have been the complaints which have been raised; and a general feeling now prevails that the question of the sample post should be reconsidered, and put upon a broader base. Many commercial enterprises entered upon in faith of the system formerly existing remaining in force, but now withdrawn, have been entirely destroyed. Trade establishments have been crippled, the public have been inconvenienced, charitable works interfered with, individuals inconvenienced while seeking health and recreation; scientific clubs destroyed; and anomalies of all kinds have been brought to light, in the endeavour to work on a limited scale a system which, if left free, would work itself, and give employment to many who now want it. The Society will, it is to be hoped, follow out the course of action which it instituted years since, and which it has continued to act upon, till the public obtained the privileges which they now enjoy of sending printed matter throughout the length and breadth of the land at an economic rate, and will afford such facilities for the expression of public opinion upon the parcels post question as will lead the government or authorities at the General Post-office to reconsider their parcels post rules and regulations.

"To destroy trade to suit the views of a particular department of the public service is even more serious than the compulsory taking of lands and houses, for which compensation is provided. There is no compensation for trade and commerce destroyed, or for injury done to it by withdrawing a privilege which has been permitted for years past, and the value of which has daily been felt to be greater and greater." The whole action of the Post-office in its recent parcels post orders is retrograde, and opposed to the spirit of the age, destructive to much of the inland trade of the country, and prejudicial to the best interests of the community.

The Council of the Society of Arts have collected much information relative to the postal systems in use abroad; and having compared them with the rules recently introduced in the Post-office at home, have published the following resolutions:—

"That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

"That traders and others who feel themselves aggrieved be requested to act with the Society of Arts' Committee, in promoting a reform of the existing system."

"That a special subscription for this purpose be opened, to which contributions are invited."

The following complaint is taken from the *Times*:—

"SIR,—I have been hoping to see the new postal grievances attacked by abler pens than mine, but in vain. I therefore beg you to afford me a very small space in your paper, to state the little hardships inflicted on country people by the lately-passed regulations; and if you can help us by your influence to get them removed, many people will, I think, be grateful. We live three miles from the nearest railway station, and nearly six from one on the main line to London. Why should we be taxed for the benefit of the railways first, and next for that of a carrier to bring the small articles which we have been in the habit of receiving by parcels post? There are many little things which cannot be procured at a village shop frequently wanted in a large family, and I think it is very hard that we must either go without, or pay a much higher price than the real value. Braid, for instance, is very often dear and bad in country shops. I could formerly have a large quantity by post by writing to London, but it is quite another thing to have it sent by train, and then, in all probability, having to wait two or three days, sometimes much more, before I can get it, in addition to the much greater cost of carriage when it does arrive.

It is always harder to be deprived of a boon than never to have had it conferred, and if the Post-office had never given us the great convenience of the parcels post, we should, of course, have nothing to complain of.

Pray use your influence to get it restored, and you will greatly oblige me, and many another

COUNTRY PARSON'S WIFE.

October 31.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lieut.-Col. Scott, R.E., secretary.

Intending Exhibitors who have not yet intimated their wish to submit objects for selection, are reminded that they must do so not later than the 10th November, 1870, on a form provided for the purpose, which may be obtained on application to the Secretary.

Wool.—Some fine collections of wool will be exhibited from California and Nevada next year.

Norway has asked for additional fine-art space.

Educational Works and Appliances.—A meeting of Section II, Class 10 (Sub-section, Natural History), was held on Wednesday, November 2nd, at the Society of Arts, to determine the various classes of objects which it is desirable should be admitted for exhibition. It was resolved to recommend to the Commissioners that the following classes of specimens, if prepared and arranged from an educational point of view in the widest sense, should be received:—Prepared skins of birds and animals (prepared by new processes), skeletons, anatomical figures, microscopical objects and preparations, mineral and geological series and specimens illustrative of the geology of various districts, fossils, maps (physical), Ward's cases and aquaria, botanical specimens, and educational works on natural history.

Glass Cases.—The following tenders have been sent in for the supply of glass cases and plate-glass, to be used at the Exhibition:—For the frames, John Drew, £1,725 15s.; Howard and Sons, £1,557 1s. 5d.; George Smith and Co., £1,467; Lucas Brothers, £1,446 8s.; Johnstone, Jeanes, and Co., £1,315 6s.; Gillow and Co., £1,271 4s. 8d.; Frederick Sage, £1,176 17s. 10d.; and Holland and Sons (accepted), £1,167 15s. 6d. For the glass, Thames Plate Glass Company, £512 11s. 7d.; William Ramsay, £428 18s.; London and Manchester Plate Glass Company, £411; Savoy Glass Company, £406 14s.; Birmingham Plate Glass Company, £400 6s. 5d.; and Willmore Brothers (accepted), £384 16s. 10d.

Protection of Inventions.—It cannot be too widely known that the rights of all new inventions exhibited at International Exhibitions have been secured by an Act passed on the 14th July, 1870. This affords the greatest facilities for bringing before the public new unpatented inventions without prejudice to their rights. The Act also applies to the publication of any description of, or the use of any such invention during the period of the holding of such exhibition. The words of the Act are as follows:—"The exhibition of any new invention at any international exhibition shall not, nor shall the publication during the period of the holding of such exhibition of any description of such invention, nor shall the user of such invention for the purposes of such exhibition, and within the place where the same may be held, nor shall the user of such invention elsewhere by any person without the privity and consent of the true and first inventor thereof, prejudice the right of the exhibitor thereof, he being the true and first inventor, within six months from the time of the opening of such exhibition, to petition for the grant of letters patent for such invention, or to obtain provisional protection or letters patent for such invention, nor invalidate any letters patent which may be granted for such invention upon any such petition. The exhibition at any international exhibition of any new design capable of being registered provisionally under "The Designs Act, 1850," or of any article to which such design is applied, shall not, nor shall the publication during the period of the holding of such exhibition of any description of such design, prejudice the right of any person to register, provisionally or otherwise, such design, or invalidate any provisional or other registration which may be granted for such design. The term "international exhibition" shall mean any of the Annual International Exhibitions of select works of fine and industrial art and scientific inventions to be held in the year one thousand eight hundred and seventy-one and succeeding years, under the direction of her Majesty's Commissioners for the Exhibition of 1851."

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

The following letter has been received from a correspondent:—

Sir,—I have read with interest your correspondent's letter, in the last *Journal*, relative to the buildings at present being erected at South Kensington, in anticipation of the Exhibition of 1871; and though I agree with him on many points, I also differ from him as to the effect realised on viewing them as a whole, from the base-line of the Horticultural Gardens. There is, I think, much want of unity of effect in the buildings which have been raised. The fine arts and machinery wings do not connect themselves with the great hall. The base of the hall is cut off by the conservatory, and the result is most unsatisfactory. A huge mass of colour rises above a mist, and the building appears to want support. Possibly it may be intended to remove the conservatory to some other part of the gardens; if so, the result would be more satisfactory.

Thus much as against the opinion of your correspondent. There are, however, some other things at Kensington which are, I think, worthy of note, viz., the extensive use of encaustic tiles and terra-cotta. The frieze round the great hall is a development, on a large scale, of the capability of encaustic tiles being used in the ornamentation and enrichment of our brick-built architecture, in combination with terra-cotta columns and enrichments, both materials being capable of resisting the destructive action of our London atmosphere.

Having alluded to terra-cotta and encaustic tiles, as already adopted at Kensington, I should like to ask how the external walls of the fine art and machinery wings are ultimately to be finished. At present, they present great masses of colour, with blank spaces upon them, which remind one of the Cromwell-road front of the picture galleries of the Exhibition of 1862. If I remember rightly, the façade of that building was proposed to be filled-in, in such blank arched space, with pictures formed in tessera. Is it the intention of her Majesty's Commissioners ultimately to fill up and harmonise the walls of the wings by the introduction of tesselated pictures, such as were then proposed? Are any buildings to be raised right and left of the hall, so as to bring the whole pile together? It may be thought unfair to ask such questions, or to unduly criticise so vast a work as that which is now in progress. Immense sums must be required to complete such an undertaking as has evidently been conceived, and is gradually being realised without charge to the nation; moreover, one which is calculated to give rise to the establishment of new art-industries.

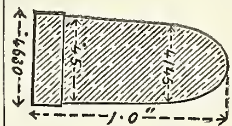
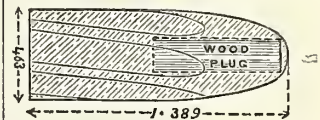
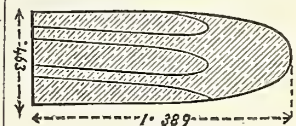
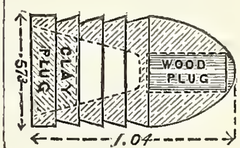
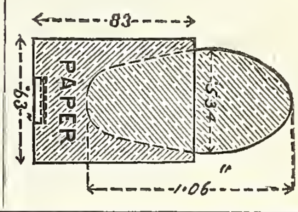
I quite agree with your correspondent that, if manufacturers and art-producers know their own interests, they will gladly support the able and energetic men who are now working to afford them constant opportunities of exhibiting their products to a larger public than, without exhibitions, they are able to appear before.—I am, &c., H. G. H.

THE PAINTINGS IN THE TUILERIES.

When the danger of the pictures and objects of art in the Tuileries from the impending siege and bombardment of Paris became apparent, Mr. Edwin Chadwick, with the concurrence of some members of the Council of the Society, wrote a letter to M. Michel Chevalier, suggesting that the pictures might be sent over to this country for security, and publicly exhibited for the benefit of the French sick and wounded. It was mentioned that her Majesty had allowed her paintings and objects of art to be lent for exhibitions for public purposes, and that such an exhibition of the paintings of France (of which the Society of Arts would undertake the responsibility) might not be deemed inappropriate, even under ordinary circumstances. An answer has only been recently received from M. Michel Chevalier, in which he states that he had submitted the suggestion to the authorities who had charge of the *Musée*, but that they had already taken their measures. They charged him, however, to convey to the Council of the Society of Arts, and to Mr. Chadwick, their deep acknowledgments for the suggestion.

SOME PARTICULARS OF BREECH-LOADING RIFLES AND THEIR AMMUNITION,

ALSO THE RANGES OBTAINED WITH AN ELEVATION OF 48 MINUTES.

RIFLE.			AMMUNITION.			
Name.	Diameter of Bore.	Weight.	Powder charge.	Projectile weight.	Projectile length in diameters.	Form of Projectile (full size).
	inches.	lbs. oz.	grains.	grains.		
Chassepot	·436	9 2	85	382	2·22	
Whitworth...............	·45 × ·475	9 8	85	480	3·0	
Whitworth...............	·45 × ·475	9 8	85	530	3·0	
Enfield	·577	9 2	70	480	1·81	
Prussian Needle Rifle	·6105	10 6	70	480	1·98	

The Chassepot bullet is light, and is fired with a large charge of powder, and therefore has a high initial veloeity. Its diameter being small, the resistance of the atmospherc is also small, and it eonsequently flies low and ranges far. With an elevation of 48 minutes, the range is 500 yards; the Enfield, with the same elevation, goes but 295 yards; the Prussian needle-gun bullet only 206 yards. Up to about 1,500 yards, the range and lowness of flight of the Chassepot are superior to those of the other bullets; but its penetrating foree is small—very small at long ranges.

The Whitworth bullet of 480 grains (with wooden plug) is 100 grains heavier than the Chassepot, and is fired with the same eharge of powder. It neeessarily, therefore, has a less initial veloeity. Its diameter is slightly greater than the Chassepot (when the latter has left the gun), and the atmospherie resistanee is consequently somewhat greater. At low elevations, therefore, the range is less than the ehassepots, although mueh more than the Enfield or Prussian guns (giving 345 yards at 48 minutes' elevation, against their 295 and 206 yards respectively). At greater elevations this bullet ranges further than the Chassepot, and, being heavier, is of mueh greater penetrative power, espeeially at long ranges.

The wood plug shown in the bullet is employed in order to make a light bullet as long as possible, and was patented along with an armour-piercing shell by Sir Joseph Whitworth.

The Whitworth bullet of 530 grains (without wood plug) is essentially a long-range bullet. It ranges 1,500 yards at the same elevation as the Chassepot, and therefore travels that distanee in the same time as the Chassepot. But as the latter goes the first 500 yards while this bullet goes only 298 yards, it is obvious that the Whitworth must subsequently do 1,202 yards while the Chassepot does 1,000 yards, and therefore that during the latter part of the 1,500 yards the Whitworth bullet must have a much greater veloeity than the Chassepot, which, with its greater weight, gives it a penetrative power at long range enormously superior to that of the Chassepot. As long ago as 1857, when the Whitworth rifle, firing this bullet, was first tried against the Enfield, the *Times* reported the result thus:—"In aceuraey of fire, in penetration, and in range, its rival exeels it (the Enfield) to a degree which hardly leaves room for eomparison." In 1870, the War-office is still ordering the Enfield rifles in large quantities.

The Enfield bullet being 100 grains heavier than the Chassepot, and being fired with 15 grains less powder, it has a mueh lower initial velocity; being of large diameter, the atmospheric resistance to it is great, so

that even its comparatively small initial velocity is rapidly reduced. Even the first 300 yards is traversed by the heavier Whitworth bullet (of 530 grains) in less time, and from that point onward its superiority in accuracy and penetrative power increases with the range. The shooting of the Enfield at 1,000 yards is too wild to admit of comparison with the other.

The Prussian bullet is of the same weight as the Enfield, and fired with the same charge. Its diameter is somewhat less, and, if other things were equal, its range, &c., should be for that reason superior to the Enfield's; but as a matter of fact they are worse, owing to its large bore and the large paper envelope of the bullet.

Sir Joseph Whitworth, writing to the *Times* on "Rifled Small Arms," says:—

"SIR,—Permit me to make an appeal through your columns against the arming of our troops and volunteers with short-range rifles, whether of the Snider-Enfield or any other pattern. Other nations are rapidly abandoning their use, and are arming their troops with long-range rifles. The supply of the more powerful weapon to our own troops has already been too long delayed.

"It may be well to mention that the Snider-Enfield is a large-bore rifle, firing a bullet ·577in. in diameter. To give a bullet of this diameter great range, accuracy, and penetration, it would be necessary to make it much longer, and to fire it with an increased powder-charge, and this would occasion too great a recoil in a gun of 9½lb. weight. If the soldier could carry a rifle weighing 14lb., and increased weight of ammunition, then the Enfield bore with a longer bullet would be right; but, as this is not practicable, and as the bullet must be long in proportion to its diameter, in order to range far and accurately, the bore has to be reduced. All the facts involved in these and similar considerations were fully worked out by me in 1857, by the desire of the government, the result being the adoption of a bore ·45in. in diameter, and a bullet three diameters long. From 1857 to 1862, some of our military officers gave great opposition to the introduction of the small-bore, but in the latter year a committee reported strongly on the advantages of the new arm, and recommended its partial adoption. Their recommendation was carried out, and the War-office have supplied small-bore rifles to the volunteers at Wimbledon ever since, for shooting for the Queen's Prize, for all ranges above 600 yards. That the proportions were right is shown by the fact which the committee reported, viz., that 'the makers of every small-bore rifle having any pretension to special accuracy have copied to the letter the three main elements of success adopted by Mr. Whitworth, viz., diameter of bore, degree of spiral, and large proportion of rifling surface.'

"In all discussions upon the performances of guns, small or large, it ought to be most carefully borne in mind that the primary element of success in long-range shooting is length of bullet. I mention this because I continually see the good and bad shooting of guns attributed to methods of loading and to other merely secondary causes. Methods of loading merely affect the rapidity with which guns can be fired; great range, accuracy, and penetration are obtained by employing the long bullet, with the proper twist of rifling, and the greatest powder charge the bore can consume, and by no other means. It is of the greatest importance that this should be more clearly understood than it has hitherto been. Of the two rifles used in the present war, the Prussian needle-gun is wrong and the French gun right, as regards bore. The Prussian bore is larger even than the Enfield, although this defect is partly remedied by the bullet being smaller, a *papier-maché* envelope embracing it, and filling up the bore. The bullet proper is, however, ·534 in. in diameter, and only two diameters long. The French bore and twist of rifling are right, being practically the same as those of our small bore, and the bullet is two and a half diameters long. Fired with a large charge of powder (85 grains against the 70 grains of the needle-gun) this bullet, although shorter and lighter than it should have been, ranges low and with great velocity up to 1,500 yards. The Chassepot is, therefore, a very deadly weapon at long range, as compared with the Prussian arm, and must have been very destructive when properly used. The superiority of its shooting at moderate ranges may be inferred from the fact that, with a given elevation, the Chassepot will range 500 yards, and our own Enfield only 295 yards.

"The superiority of my small-bore at all ranges, when all its conditions are observed, is well known. Last year, a special committee on breech-loading rifles concluded their labours, and addressed an elaborate report to the War-office, in which they said,—'The calibre is to be ·45 in., as appearing to be the most suitable for a military arm, not only from the results of the experience already gained, and from the evidence received, but also from the reports of the previous committees, who had recommended that bore as likely to produce the best results.'

"It is not right, in the face of these facts, and of the far-hitting rifle by other European governments, that we should go on ordering rifles of the old large-bore type for the use of our army and volunteers. The government should, without further delay, begin to arm our troops with breech-loading small-bores. If the Henry-Martini plan of breech-loading is not found altogether satisfactory, have others as well—the Westley-Richards, for instance, the mechanical arrangements of which are superior. There is but little objection (as is found by sportsmen) to having guns from two or three makers, with different breech-loading arrangements, care being taken that all use the same cartridge. Whichever proves best on actual service can afterwards be exclusively adopted.

The selection of the best form and dimensions of cartridge is a mechanical and not a military question, and may have presented a difficulty to the War-office, but the existence of such a difficulty is no excuse for giving our troops short-range rifles. The proper course to take is to determine upon a standard cartridge of well-considered form and proportions, and to adopt it in connection with the ·45-inch bore, for all military arms. The disadvantage sustained by troops armed with large-bore guns in presence of others armed with the small-bore is terrible; the superior weapon has been, and is being very largely manufactured in this country for European governments, and I hope that, in case we are involved in war, our men will not be sent into the field with short-range muskets. There is nothing so likely to shorten the duration of war, and to prevent the resort to war, as the horrible effect of destructive power at long distances.

"I had written thus far when the remarkable letter of your Berlin correspondent, in the *Times* of yesterday, came under my notice. It furnishes a practical comment upon what I have written above, and I ask your permission to quote the following brief extracts:—

"'It is a curious but well-authenticated fact, that many German soldiers in the hospitals only saw what the French look like, having been wounded at distances where all they could discern of the enemy was a dark, indefinite mass.

"'Diplomatic circumstances combined with the inferior mechanism of their gun to the disadvantage of the Germans. Diplomacy demanded that they should assume the offensive in every encounter, though the arm they were going to face rendered such bravery extremely dangerous, while, as regarded Dreyse's original invention, specimens of which they held in their hands, it had been surpassed by Chassepot, and there was nothing left but to offer themselves to be slaughtered, without being able, at least in the introductory stages of the fight, to reciprocate to the same extent.

"'Among the many memorable facts of the campaign,

it will, no doubt, be duly chronicled by history that the range of the Chassepôt being 1,800 paces, and that of the needle-gun only between 600 and 700, the Germans in all their charges had to traverse 1,200 paces before their arm could be used to some purpose.'

"These extracts make a stronger appeal to our authorities than I can offer, and I hope that appeal will not be in vain.—I am, &c., Joseph Whitworth.

"Manchester, September 9th, 1870."

CAPTAIN WARREN'S COOKING APPARATUS.

Some trials of Captain Warren's cooking apparatus have been recently made in public by Messrs. Adams, of the Haymarket. The trials took place at their workshops in Marshall-street. According to the *Standard*, there was an ordinary £6 cooking range at one end of the place, and a Warren's hospital cooking stove at the other. Here is the bill of fare—"Poor man's soup;" "Warrenised turbot, lobster sauce, stewed eels;" "Warrenised leg of mutton;" "Warrenised fowls, afterwards browned in oven," to be cooked in the small cottage-range, fitted with Captain Warren's cooking pots; "compressed vegetables and patent biscuit soup;" "roast mutton and potatoes;" "Irish stew;" "rice puddings;" and "omelettes," to be cooked in Captain Warren's patent army apparatus for hospitals. There is not an hotel or club in London sends up for its best customers more palatable soup than Captain Warren's "poor man's." The compressed vegetables and patent biscuit soup were a meal fit for anyone. The turbot and the leg of mutton were cooked absolutely to perfection. How was it all done? Very simply. Imagine a square tin-box, without a lid, put into another tin-box about an inch bigger all round, and both closed by a double tin-lid, with an inch space between its top and bottom plates. Three such tins were connected together by a small steam-pipe passing from the boiler of the cottage grate. A two-inch tube was carried from the boiler through the fire, and the water in this generated plenty of steam. The steam flowed from the boiler through the steam-pipe, and then all around the tin cans in the interspaces between them; it then flowed through two holes in each of the lids, and escaped by a tiny hole in the top, and so released each from pressure. The inner chamber is thus heated all round and above and below. What occurs? The meat, potatoes, or other food placed in the inner tins is never scorched by fire nor sodden by water; never even, unless desired, damped by steam. The food rests in a chamber of hot, dry air, which never, of course, exceeds the temperature of the circulating steam. The food is subjected to a constant penetrating heat, never rising quite up to 212° Fah. There is no evaporation of its fluids, no dissolution of its soluble salts. If any of its juices vaporise, they are retained in the chamber, and condense in the gravy. The flavour of one dish is not commingled with that of another, and every part is equally cooked, every joint thoroughly done through. Burning, scorching, over-boiling, and smoking are impossible, and dressed meat may be kept hot for a considerable time without spoiling. The saving of fuel is very great by this arrangement, and the convenience for cooking a number of things at the same time ought to be understood in every household. Any common range in existence could be fitted with Warren's cans with the least possible trouble and expense. All that is required is about a foot of two-inch iron pipe let into the side of the boiler; about four feet of one-inch pipe, to serve the cans with steam, and a common wood bench at the side of the fireplace to stand them on.

For hospital, camp, and ship purposes this system is most convenient and desirable, the cooked food being nutritious in the highest degree. For camp purposes—the apparatus has already been officially adopted for the army—the Warren stove is a nearly square iron block, constituted of a wrought-iron stove and two boilers, upon which the fire acts direct, without the intervention of any brickwork whatever. The fire, after passing through these, is conducted entirely round a roaster or oven, placed over the lower part of the boilers, one of which is continued behind the back of the oven to the top of the stove. The ash-door regulates the draught. On the top of the stove are stood two of the tin cooking-cases, and at each side a bracket holds two more, one above the other; in all, six large square-sided cases. Into the whole of these the steam is passed from the boilers, and the cooking capacity of the lot is equal to the supply of from 80 to 100 men. Divested of its appendages, the stove itself measures 2 feet 2 inches wide, 1 foot 10 inches deep, and 3 feet 7 inches high. The hospital stove is similar, but modified by an extension of the furnace forward, and a hot-plate arrangement over it for the cookery of nic-nacs. For this last service, Captain Warren's system possesses this important advantage, that the meals can be served hot in a number of rooms and to a number of persons at the same time. The meals prepared can be taken direct to any number of stations at once in the covered tin cooking-cases, and there served by the attendants to their patients. The like convenient method can be followed in the service of any other large number of persons, as in camp or on board ship, at hotels and dining-rooms.

COMMUNICATION BETWEEN ASSAM AND CHINA.

In a letter addressed to the President of the Bengal Chamber of Commerce by Mr. T. T. Cooper, and dated Debrughur, Upper Assam, July 29, 1869, he refers to the Conferences held by the India Committee of the Society as follows:—

Remembering the very great interest that your chamber feels in the matter of communication between Assam and Bathang, it is my duty to refer in this letter to the conference which was held at the Society of Arts in London on the 28th May last, on "Trade with Central Asia, Tibet, and China." In several speeches delivered at that conference and the succeeding one, statements were made calculated to dishearten your chamber in the undertaking into which it has entered with so much liberality and energy. I have thought it desirable to refer shortly to statements made by members of the conference, who appear to have lacked information on the subject discussed.

Beginning with Dr. Campbell's speech, on the 28th May, he says:—"Taking trade between India and Tibet, it means trade between the rich and populous countries of India and China by overland routes." This statement appears incorrect, when it is considered that the trade of the Chinese province of Sz-chuan belongs to the eastern seaboard of China, flowing down the Yang Tzu river to the British settlement of Hankow from the great western trading mart of Chung King; and that the trade with Yunnan belongs to Burmah, flowing thither by the old Tali and Bhamo route, and the Irrawaddy river to Rangoon. When we speak, therefore, of trade between India and Tibet, it means really that the trade with Tibet belongs exclusively to India, and that to think of a great trade between the populous countries of India and China is a huge mistake.

Again, he remarks:—"The great fact, however, remains, that there is not one road through the Himalayas except for carriage on men's backs." From my own personal knowledge, supported by the writings of Huc, thousands of yaks and mules annually cross the Himalayas, on their way to Lassa, laden with tea purchased at Tatsianloo and Bathang; while the Bhootanese, in company with Tibetans, come down to Tezpore, in Lower Assam, with numbers of ponies and mules. I quote Col. Hopkinson's statement in this, and also the extract

relative to the murder of the good Fathers Crick and Boury. In the face of facts such as these, it would appear that Dr. Campbell has been misinformed with regard to the passes of the Himalayas, and that passes for pack animals really exist in numbers.

Colonel Hopkinson, in his paper speaking of routes between Assam and China, says:—"Such a probability has, indeed, been assumed from the fact only of the proximity of the north-eastern corner of Assam on the left bank of the Brahmapootra (so far as the mere distance in miles measured on the map goes) to Yunnan in China." I know of only two routes from the north of Assam that have been assumed as practicable, viz., that proposed by Mr. F. A. Goodenough, of your chamber, through the Patkoi Pass and Hookung valley into Talifoo, in Yunnan, and the route I shortly hope to travel. Speaking, I presume, of these routes, he goes on to say, "and supposes that the mountainous region which intervenes may not be found on closer examination so impracticable, as all inquiries, and indeed, experience has hitherto led us to believe it to be. Now, applying these remarks to Mr. Goodenough's route, it is with some astonishment that I find Colonel Hopkinson saying—"There is no doubt that it was by the pass that derives its name from the Patkoi hill, over which it leads, that Assam was originally invaded by the Burmese; and as every successive wave of conquest or immigration has followed the same channel, I think it may be inferred that the Patkoi Pass is the only route that presents any facilities for transit."

I believe it is a fact well known to your chamber that, when Mr. Goodenough advocated the expediency of exploring this route, Colonel Hopkinson, in reply to inquiries made of him by the government, wrote strongly condemning this route. Putting aside, therefore, Colonel Hopkinson's doubtful authority on the practicability of Mr. Goodenough's route, there is the incontestable fact that an army of 40,000 Burmese entered Assam by the Patkoi pass, which is ample proof that experience leads us to believe this route is quite practicable, instead of leading us (as Colonel Hopkinson says) to believe that it is impracticable.

To dispose of Colonel Hopkinson's remark, "that not the faintest trace of any commercial intercourse between China and Assam exists, and we are absolutely without any data whatever for the presumption that we could call it into existence," I would point to the fact that the Mishmee tribes wear Chinese beads and bells with Chinese characters on them, and smoke Chinese-manufactured pipes, facts which seem to have escaped the observation of Colonel Hopkinson during his term of commissionership, and which, I think, point to something more than a slight trace of intercourse between China and Assam; while the letter hereafter quoted from the Rev. Mr. Higgs will, I think, satisfactorily prove actual communication between this country and Tibet Proper.

Avoiding carefully remarks on routes other than those proposed by Mr. Goodenough and myself, I come to the remarks of Mr. Wyllie. He says:—"It is more important that we should extend our trade with China than with Tibet." It is true that our China trade is most important, even in its present state of infancy, requiring only inland steam navigation to increase it to gigantic proportions; yet this fact is not sufficient excuse for neglecting the importance of trade between Tibet and Assam, which, to the Indian merchant, would, I fancy, stand in the same relations as trade with China to the English China merchant.

When Mr. Wyllie says "that the whole of Western China, when he visited it, was in a condition of rebellion, and for the past six or seven years had been the home of banditti and of every form of civil misery, spoliation prevailed in every form, and the governor of the province was living in a miserable shed," I am led to infer that Mr. Wyllie has fallen into a geographical error; for when we read of the low condition of the governor of the province, it is natural to suppose that he speaks of Western China as one province, whereas it is comprised of the provinces of Sz-chuan and Yunnan, the boundaries of which, on the west, form the great western wall of China; and unless Mr. Wyllie has travelled in Sz-chuan or Yunnan, he labours under an error in supposing that he has visited Western China.

Referring to the adjourned conference, I would particularly call the attention of the Chamber to Mr. Hyde Clarke's letter, containing, as it does, many valuable suggestions, which, if acted upon, might induce her Majesty's government to remove many of the political mole-hill mountains which at present shut us out of Tibet, while weak and vain nations like the Nepaulese and Chinese have unrestricted intercourse with all parts of it.

Mr. Spencer Price, doing me the honour of quoting me as an authority on matters relative to Western China, speaks correctly of the nature of those difficulties which drove me back from a point within twenty days' journey of Assam.

Mr. Trelawney Saunders' observations with regard to the natural barriers between Assam and Tibet—and, indeed, his remarks generally on this route—seem to be borne out by what I have said above.

One remark made by this gentleman, as being pregnant with importance and confirming a preconceived opinion of my own, is worthy of serious consideration in connection with making roads into Tibet beyond our frontiers. He said he believed there was no occasion to make great roads like that projected by Lord Dalhousie; he believed that it was a huge mistake, and if they gave people power to find a way, they would find it." I know not how Mr. Saunders arrived at this conclusion (presuming that he has not travelled in Tibet), while it seems to be the opinion of all who interest themselves in the matter of communication with Tibet and China that we must carry our merchandise by made roads to the trading marts of those countries, which, if attempted at the outset, must result in disaster.

THE METROPOLITAN SCHOOL BOARD.

The Education Department has, under the powers conferred by the Act, issued an order regulating the election of the School Board.

The day of election is to be Tuesday, the 29th inst., and on or before Monday, the 14th inst., the deputy returning officer of each division shall, in each parish, publish the notice of election, which is to specify the place for the reception of the nomination papers.

After publication of the notice of election, but not later than Thursday, the 17th inst., any person may be nominated as a candidate by a nomination paper stating the division for which he is nominated, and his Christian name, surname, place of abode, and description, the paper being subscribed by two qualified voters.

On or before Monday, the 21st inst., the names, abode, and description of the several candidates nominated are to be advertised by the deputy returning officers in one or more of the newspapers circulating in the respective divisions. On or before Wednesday, the 23rd inst., any candidate may be withdrawn, by a notice signed by himself.

The poll will be taken on Tuesday, the 29th inst. between eight a.m. and eight p.m., and the particulars of the polling places must be published not later than the 25th inst. No public-house is to be used as a polling place, or for the purposes of the election.

The persons entitled to vote in the City division are the same persons as would be entitled to vote in case of an election of common councilmen; and those entitled to vote in the divisions other than the City are be the ratepayers, as defined by the Education Act.

Each voter is to give his vote in the place in which the property in respect of which he is entitled to vote is

situate, and if it is situate in more than one place within the same division, he may vote in such place as he selects.

In the divisions other than the City, the poll is to be by ballot, and the ballot-boxes are to be so arranged that the voters may have the means of filling up the voting-paper without being overlooked.

The polling is to be conducted in the manner following:—

(1.) Before the commencement of the poll the person presiding at the poll and the inspectors shall ascertain that the balloting boxes are empty.

(2.) The person for the time being presiding at the poll shall ascertain that the person claiming to vote is entitled so to do, and his decision as to any such claim shall be final.

(3.) The person presiding at the poll shall hand to the person whose claim to vote has been ascertained a voting paper (to be provided by the deputy returning officer) containing the names of the candidates printed in alphabetical order, and in the form following:—

OFFICIAL VOTING PAPER.

Christian Name, Surname, and Description of Candidate.	Number of Votes, if any, given to each Candidate, must be entered opposite his name.
A	
B	
C	
D	
E	

N.B.—The voter has votes, all or some of which he may distribute among the candidates as he pleases. If anything but the number of votes given is written on this paper, or if any other paper than this is used, the votes are not counted.

(4.) The voter shall take the official voting paper to the place appointed for him, fill it up with the number of votes he gives to each candidate, and then fold up and deposit the said paper, and no other, in a balloting-box.

On the poll being closed, the person presiding, and the inspectors, shall forthwith examine the votes until they have decided the number of votes which have been given to each candidate, and if the inspectors are divided in opinion as to the validity or effect of any voting paper, the presiding officer's decision shall be final.

In reference to the City division, the voting is not to be by ballot, but the poll is to be taken by each voter delivering to the person presiding at the polling-place, or in the manner appointed by him, an official voting-paper in the form above described, except that such voting-paper shall, before delivery, be signed with the name of the voter, and contain the description of the property for which he claims to vote. The person presiding at the poll may put certain questions as to the identity, &c., of the voter. It is provided that, in case of an equality of votes, the returning officer shall determine by lot the persons to be elected. The expenses incident to the election are to be paid out of the rates.

The *Times*, commenting on these regulations, is of opinion that, as in all the metropolitan districts except the City the vote is secret, and, moreover, as any one occupying a rateable tenement, whether he pays rates or not, whether he is rated or not, whether he is entered on the overseers' lists or not, is, according to the received interpretation of the Act, a voter, the necessary consequence will be that anyone who says he occupies a rateable tenement may rely upon voting if he is bold enough to claim the privilege. "A man, for example, attends at a polling-booth at Marylebone. The presiding officer may ask his name and qualification, and he gives a name and qualification. The name is found in no overseers' list, but the claimant says, with truth, that his right is independent of any such registration. The officer can only guess whether the claim is genuine, and his decision is final. He gives the claimant a paper, as in the City, and the claimant fills up his votes without subscribing his name, and the paper is folded up and dropped in an urn without any mark for identification. There are regulations for keeping the polling-place free from the intrusion of all beyond the presiding officer and his assessors, and only such a number of voters as can fill up their papers without being overlooked, and the security for secrecy is perfect. The secrecy is, however, purchased at the cost of unlimited facilities for recording fictitious votes. Any person who can stand the gaze of a presiding officer may vote, and he may do this at every polling-place in the district." The same journal also points out "that the combination of a secret ballot with the privilege of the cumulative vote, will introduce elements of great uncertainty in the coming elections. The cumulative vote itself is well understood. It is practised every day during the season at the asylum elections at the London Tavern and elsewhere; but in these elections, where there is only one voting-place, and the voting is open, the progress of the poll is constantly known, and the holders of votes take care not to heap them up in unnecessary profusion on one candidate. The state of the poll cannot be known in the metropolitan districts, and it may be found at the close that two or three candidates have received a superabundance of support, while others have lost their election because their friends have split their votes among many candidates."

Meetings are being constantly held in the various districts of the metropolis, in reference to the choice of candidates, but as a rule, the proceedings possess merely local interest. Upon the whole, however, the agitation may be described as of a wholesome character, and there is no want of candidates of ability and position. There appears also to be an increasing tendency to waive religious differences, and, as the *Times* says—"Churchmen and Dissenters appear to combine at such meetings, and agree in maintaining that unsectarian religious teaching is equally possible and desirable. Here, again, the Act has vindicated the foresight of those who maintained that if religious people were compelled to teach children without introducing topics of dispute, they would readily find the means of doing so."

It is remarkable that not a single candidate has ventured to claim the support of the electors by virtue of his preference for purely secular education. "Persons whose names as possible candidates would have excited great alarm in the religious world six months ago, and who have, in reality, rather advanced opinions respecting the relative practical value of religious and other knowledge, nevertheless announce that they have no wish to disturb the ordinary customs of religious instruction. It is unquestionable that the people, as a rule, wish their children to be religiously trained, and, in England, even philosophers are free from the folly of insisting in practice upon the application of all their abstract theories. The simple object of all men of ability and experience who may be elected to the School Board will be to render elementary instruction as effective and as general as possible. They will soon find that the most important part of their task will consist in the appointment of schoolmasters, and they will know or discover that the best masters will resemble in spirit the distinguished men who have revolutionised our public schools. Not the least fear, in short, need be entertained on this point; and we believe we may safely advise the most anxious friend of religious education to dismiss the question from his mind, in estimating the claims of such candidates as are likely to be brought before him." The ratepayers of the metropolis should "employ their attention in sifting the practical ability, experience, and representative character of the various candidates. These are the points of real importance. We want, above all, to ensure the election of men who will be capable of rising to the performance of a great public duty, and who can bring to their task a real knowledge of the intellectual needs of the day. For the latter

purpose we should be glad to see the working men directly represented on the Board. One or two genuine members of their class—and the qualification is not unnecessary—would afford the Board very valuable information respecting the defects in education of which they are most keenly sensible." Speaking of certain well-known bankers and members of Parliament who are candidates, the same journal says:—"We trust no secondary considerations will lead to the services of such men being declined. It would be a mistake, we think, to lay too much stress on the leisure which will be necessary to discharge the duties of the Board, First-rate men are very seldom unemployed men; and it is often the busiest men who prove the most active in the discharge of new duties."

The *Globe* says that the Board "should include men of all classes; and, in their proper proportion, we shall be glad to see some of the 'working men' candidates upon it. They would be quite unfit to assume the lead, but they can give valuable suggestions, and still more valuable information."

Dr. Lankester, in a communication which appears in *Nature*, protests against the principle "that only those should be placed on the Board who are already acquainted with the details of education." He thinks that "the public should look to that instructed body of men who are known as cultivators of science to represent them on the Board;" and he is "glad to see signs that this class of persons have found favour in the eyes of London electors," instancing Professor Huxley and Dr. Elizabeth Garrett. The points to which he thinks the earliest attention of the School Board ought to be directed, and in which men of science are likely to give the greatest assistance, are—1, the sanitary condition of the schools; 2, the times of study; and 3, the course of studies to be pursued. In reference to the second point, he says that "children are kept at their studies or in school for much longer periods than they can successfully learn. The consequence is that they remain in the close school-room whilst they ought to have been in the yard at play. This system is doubly wasteful, for both health and learning are sacrificed." With regard to the third point, he urges the introduction of natural science into all schools. He thinks that "to delay it is to shelve it, and to commit an irretrievable error. It is now or never. If the present opportunity is neglected, all is lost. Let no heed be given to the cry that it is impossible to find teachers. If teachers cannot be found they must be made, and all old teachers must be told that unless they qualify in this respect they will be of no use." What he now "asks the people of England, and especially the people of London, is to put men of science on their School Boards."

GENERAL NOTES.

Experimental Physics.—The Duke of Devonshire Chancellor of the University of Cambridge, has offered to establish a professorship of experimental physics, with the requisite buildings and apparatus, so soon as the University shall have in other respects completed its arrangements for teaching experimental physics, and shall have approved the plan of the building.

Iron Ore in Scotland.—In Scotland, an iron district, said to be of extraordinary richness, is about to be opened in the vicinity of the Pentland Hills, a few miles from Edinburgh. The Glasgow Iron Company and the Shotts Iron Company have already concluded leases with the proprietors. The new fields include 20 workable seams of coal, of an aggregate thickness of 100 feet., two seams of cannel coal of 24 inches and 18 inches thick, a 15-inch seam of very valuable oil shale, and two seams of blackband ironstone, 2ft. 9in. and 18 inches thick respectively. The ironstone yields a ton of pig from 32 cwt. of ore.

New Mineral Field.—The *Iron and Coal Trade Review* announces that an immense deposit of iron ore, lying in one of the newer geological formations, has recently been discovered in the south-west of England. It is reported to occur in a seam of considerable thickness, and to contain on the average 30 per cent. of metallic iron.

Instruction in Science and Art for Women.—The following courses of lectures will be delivered in the lecture theatre of the South Kensington Museum:—"On the Elements of Physical Science," by Professors Huxley, Guthrie, and Oliver, commencing Wednesday 9th of November, at 11 a.m., to be continued every succeeding Saturday and Wednesday. Fee for the course, two guineas. "On Physics and Human Physiology," by Professors Huxley and Guthrie, on Tuesdays and Fridays at 11 a.m.; first lecture, November 15th. Fee, two guineas. "On the Clavecin and Pianoforte," by Mr. Ernst Pauer, on Wednesdays at 2.30 p.m.; first lecture, November 16th. Fee, half-a-guinea.

Institution of Naval Architects.—The Council of the Institution of Naval Architects have prepared a list of subjects on which they will be glad to receive communications for the annual general meeting in March, 1871; all such communications should be forwarded to the secretary of the institution not later than the 1st March, 1871. Gentlemen proposing to read papers should announce their intention to the secretary as soon as possible:—1. The armament of ships of war. 2. The construction and armament of ships of war for the protection of commerce. 3. The construction of vessels for vessels for coast-defence. 4. The effect on naval construction of torpedoes, or other modes of submarine attack. 5. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements, such as surface condensation, superheating, compound engines, and the like; also the value of each of these taken separately, and especially the results of any actual experiments to test this point. 6. On economy of fuel in marine engines, with detailed results. 7. On the life and cost of maintenace of merchant steam-ships. 8. Composite ship-building. 9. The design and construction of yachts. 10. On legislative interference with the construction, stowage, and equipment of ships. 11. The effect upon ship-building of Lloyd's rules, the Liverpool rules, and the rules of other similar societies for the classification of ships, and on ships not classed. 12. On methods for the proper sttrengthening of ships of extreme proportions, and on the precautions necessary to ensure their safety at sea. 13. On the present state of knowledge of the strength of materials as applied to ship-building, with especial reference to the use of steel. 14. On the masting of ships, and on iron and steel masts and yards. 15. On the disposition and construction of bulkheads, and on their attachment to the sides of iron ships. 16. On the prevention of fouling of the bottoms of iron ships. 17. On machines for economising of labour in the construction of ships. 18. On the use of machinery for economising labour on board ship, whether merchant ships or ships of war, and whether for loading or manœuvring. 19. On telegraphic or other communication of orders on board ship. 20. On the conveyance of passengers and goods over estuaries and straits, and on railway ferries. 21. On floating structures for special purposes, such as docks, lighters, tank vessels, light ships, telegraph ships, and others. 22. On ships' boats, especially those propelled by steam power, and with particular reference to vessels having little or no rigging. 23. On the steering of ships, and on steering apparatus. 24. On the correction of compasses in iron shps. 25. On the measure and amount of resistance opposed to a ship's progress by the water through which it moves. 26. Exact information (either experimental or theoretical) on the efficency of propellers. 27. On the economic value of form and proportion, both in merchant vessels and in ships of war.

Cotton Dressing. — In the *Berichte der Deutchvn Chemischen*, No. 14, the author of a paper on cotton dressing, O. Meisler, states, at Zurich, a parcel of white calico, manufactured in England, was found on analysis to be dressed to the extent of over 25 per cent. of the weight of the fibre, 5 per cent. of which dressing was mineral matter. The calico was sold at a price below the value of the yarn it was made of.

The Angora.—The Sydney Exhibition had a pen of Angora goats, which obtained a great deal of attention. The *Sydney Herald* says:—"We hope to see further interest taken in Angoras, as it appears now only one enterprising colonist can be found who is really prosecuting their culture. There are vast tracts of miserable country which might be turned to profitable account by depasturing goats. The hair is sold in England at prices varying from 1s. 6d. to 3s. and 4s. per pound, and the fine quality is much used in the manufacture of silks for mixing purposes, thereby strengthening the fabric; also in the manufacture of the Cashmere shawls so generally admired. The Angora goat is extremely hardy, and very prolific. The kids make excellent mutton, and their management is easy. They require shearing twice a-year, and yield about 2lb. a-head at every clip. The well-bred Angora is covered with fine silky hair, all over the body, sides of the head, and back, and, in addition, is generally judged by the absence of kempy or coarse hair. The fleeces of young animals are the most valuable in quality. The pen exhibited showed considerable merit, especially the ewe, but the fleece shows evident mismanagement in its culture. The skins properly dressed make beautiful mats for carriages, and the leather is superior to common goatskin."

American Steel Manufactures.—A special correspondent of the *New York Times* is supplying to that journal an account of the steel manufactures of the United States. He visited the Pennsylvania Steel Works, located on the east bank of the Susquehanna, about three miles south of Harrisburg. This establishment was built in 1866-67, by Mr. Holley, now of tho Troy Bessemer Steel Works, and cost about a million dollars. A description is given of the plant and of the process of making steel rails, as follows:—"The Pennsylvania Steel Works have been uniformly successful with their product, and make a metal of absolutely uniform quality. I regret to say that they are content to use three-fourths foreign iron, and only one-fourth American. It is true that very little Bessemer pig is made in this country, and, as a disinterested party, I sincerely hope that the Bessemer steel makers will be compelled to adopt measures to produce domestic irons for their own consumption. In truth, blast furnaces are as much a part of a Bessemer plant as a rolling mill, and no company ought to undertake to manufacture the steel unless they are able and willing to build them. It is impossible to doubt that suitable ones may be found in many localities, and, with patience, enterprise, and a judicious outlay of capital, may certainly be smelted with profit to the steel maker. English irons used at Troy and Harrisburg cost over 40 dollars per ton, while domestic iron used at Cleveland cost 35 dollars. But it will require a better blast-furnace practice than that which is now in vogue throughout Pennsylvania, and which is simply horrible in a majority of cases. The cost of making Bessemer rails is nearly 100 dollars per ton, and as that is now the market price, the margin of profit is small. The retrenchment must be chiefly in the cost of pig-iron. It will require vast research, innumerable analyses, and the most thoroughly scientific and skilful blast-furnace practice to effect a reduction of the cost; but in a state so rich as Pennsylvania in mineral wealth, there certainly seems to be no sufficient reason why the effort should not be successful. The annual product of the Pennsylvania works may be practically estimated at 15,000 tons of rails, all of which are consumed by the Pennsylvania Railroad Company."

Property in Paris.—It is stated by the *Economist* that the value of destructible private property in Paris is as follows:—Value of buildings, £154,350,000; value of furniture and other contents of dwellings, £77,175,000; value of stock in in trade, £77,175,000—making a total of £311,700,000.

Cotton Seed Utilisation.—The following is the mode of treating the cotton seed at Sankey Mills, Earlstown:—The seed as it comes from the gin—in fact from America—is first fed in between a pair of rollers, running at differential speed, and not quite in contact. This cracks the shell or husk, and allows the solid kernel, about the size of a hemp seed, to fall out and be easily separated. A system of riddling further separates a great deal of the dry, broken husk. After this, it is boiled in caustic soda, in a revolving boiler, by which means much of the remaining husk is got rid of, and final washings so completely liberate the cotton that it is ready for bleaching. After this process it is reduced to pulp and converted into paper. A letter in the *Bolton Guardian* says:—"Of course, from such a material, there can be no reason why an excellent paper should not be produced. Supposing this to prove a success commercially, which there seems every reason to hope it may, it will accomplish two objects of national importance; first, by utilising a vast waste of product in the growth of cotton—the seed over and above that needed for sowing; it will virtually increase the produce of his fields to the cotton grower, and make a lower price remunerative; while, secondly, it will introduce a large addition of excellent material for paper-making, of which the manufacturer is so greatly in need. Moreover, in opening up a new source of oil, it will tend to reduce the price of a costly article of immense consumption, nor will the additional supply of cattle food, in the form of oil cake, be an item unworthy of consideration."

The Foreign Trade with Belgium. — The official returns relating to the principal articles in the foreign trade of Belgium, show that the value of the imports, in the first half of the year 1870, was 2 per cent. less than in the corresponding period of 1869, but the value of the exports was 12 per cent. greater than in 1869. The export of arms was of the value of 6,187,926 francs, an increase of above a million; the exports to France amounting to 2,673,564 frs. in the first six months of 1869, and 2,989,540 frs. in 1870; to Zollverein countries, 979,368 frs. in 1869, and 854,019 frs. in 1870; to the United Kingdom, 512,331 frs. in 1869, and 915,411 frs. in 1870. The export of coals increased to 1,844,147 tons, nearly all sent to France, as usual. The export of machines and machinery increased to 9,291,655 kilogrammes (of 2·2 lb. each), Russia taking 2,000,000, Zollverein countries nearly as much, France not greatly less, the United Kingdom only 64,728 kilogrammes. The export of rails continues to increase, and reached nearly 67,000,000 kilogrammes; Russia, the Zollverein, and Turkey were all large customers. The export of iron wares show an increase; and the export of lead, unwrought, a large increase, France taking this year more than 2,000,000 kilogrammes. The export of Belgian window glass shows a considerable decline; that of paper advanced to 7,645,146 kilogrammes, the United Kingdom taking more than 4,000,000. More than 1,300,000 kilogrammes of meat, rabbits, and poultry were exported, chiefly to the United Kingdom. Beetroot sugar increases in importance as an article of export, and the amount in the six months exceeded 17,000,000 kilogrammes, more than 11,000,000 going to France. The import of corn into Belgium from Zollverein countries, France, and Holland continued large, though less both in 1870 and 1869 than in 1868. The import of iron ore and filings, in 1870, exceeded the export by 240,000,000 kilogrammes, and of pig and old iron by 47,000,000. The import of machines and machinery exceeded 2,000,000 kilogrammes; more than half was from the United Kingdom.

COAL MINING STATISTICS.

The following is a return showing the number of male coal miners employed in the coal mines of Great Britain, the number of fatal accidents and lives lost, the quantity of coal raised, and the proportion of accidents and lives lost to the number of persons employed and the tons of coal raised, in the year 1869 :—

NAMES OF DISTRICTS.	Number of Male Coal Miners Employed as per Census, 1861.	Quantity of Coal Raised.	Fatal Accidents.	Lives Lost.	Persons employed per Life Lost.	Tons of Coal raised per Life Lost.	Number of Collieries.
Northumberland, Cumberland, and North Durham	22,719	11,660,000	72	80	400	145,750	183
South Durham	30,805	15,636,000	74	79	478	197,924	163
North and East Lancashire	23,525	7,020,000	74	76	345	92,368	297
West Lancashire and North Wales	24,302	8,018,939	101	234	139	34,269	200
Yorkshire	31,938	10,893,500	62	69	522	157,877	413
Derby, Nottingham, Leicester, and Warwickshire	23,434	8,100,000	70	78	365	103,846	200
North Stafford, Cheshire, and Shropshire	16,427	6,200,000	45	50	420	124,000	225
South Stafford and Worcestershire	25,235	10,408,000	96	104	274	100,076	550
Monmouth, Gloucester, Somerset, and Devonshire	21,762	6,250,000	51	68	382	91,912	210
South Wales	26,292	9,180,000	115	181	160	50,718	300
Scattered over other Counties	148	..	..	..	..	..	..
England and Wales	246,587	93,366,439	760	1,019	..	..	741
Scotland	35,886	14,637,043	94	97	..	..	465

NEW BOOKS.

An Introduction to the Osteology of the Mammalia, being the substance of the Course of Lectures delivered at the Royal College of Surgeons of England in 1870. By W. H. Flower, F.R S., F R.C.S. (Macmillan and Co.)

The Loss of H.M.S *Captain*, illustrating a new principle of Naval Architecture, for the first time enunciated. By E. Gardiner Fishbourne, retired Rear-Admiral. 8vo., sewed, with four plates. (E. and F. N. Spon.)

A Cyclopædia of Quantitative Chemical Analysis. By Frank H. Storer, A.M. Part I. 8vo., sewed. Price 7s. 6d. (E. and F. N. Spon.)

A Pocket-book of Useful Formulæ and Memoranda for Civil and Mechanical Engineers. By G. L. Molesworth, M.I.C.E., Commissioner of Public Works, Ceylon. 16th Edition. Royal 32mo., roan. Price 4s. 6d. (E. and F. N Spon.)

The Elementary Education Act, 1870 (33 and 34 Vict., c. 75), with Analysis, Index, and Appendix. By Francis Adams, solicitor, Secretary of the National Education League. 8vo. 2s. 6d. (Simpkin, Marshall, and Co.)

A Text-book of Geography for the Use of Schools. By James Douglas, Ph D., author of the "Principles of English Grammar," &c. New Edition, carefully revised. Fcp., 2s. 6d., or with Ten Coloured Maps, Fcp , 3s. (Simpkin, Marshall, and Co.)

The Education Act Manual; or an Analysis of "The Elementary Education Act, 1870" (33 and 34 Vic. cap. 75). With Notes and Suggestions, and the Education Department Order for the Metropolis. By Samuel Stone, Town Clerk of Leicester, and author of the "Justices' Manual," &c. Fcp. 2s. limp. (Simpkin, Marshall, and Co.)

Engineer's Guide to the Naval and Local Marine Boards, By D. Thompson Third Edition enlarged. Crown 8vo. 5s. (Simpkin, Marshall, and Co.)

Educational Legislation, consisting of—1. The Elementary Education Act, 1870. 2. The Revised Code of the Council of Education, 1870. 3. Endowed Schools' Act, 1869. 4 Endowed Schools' Bill (No. 2). With an Introduction by Thomas Turner, F S.S. 8vo. 1s. limp. (Simpkin, Marshall, and Co.)

Choice Stove and Greenhouse Ornamental-leaved Plants. Vol. 2. Comprising Descriptions of Eight Hundred Species and Varieties, accompanied by Instructions for their Cultivation and Management. With Illustrations. By Benjamin S. Williams, F R.H.S., author of "The Orchid-Grower's Manual," &c. Crown 8vo. 5s. (Simpkin, Marshall, and Co)

IN THE PRESS.

Metals, their Properties and Treatment. Including an account of the ordinary Metals, from their occurrence as Ore until they pass into the Workshop of the Turner or Fitter. By Charles Loudon Bloxam, Professor of Practical Chemistry in King's College, London. Small 8vo., with numerous woodcuts, price 3s. 6d. cloth. Being the Second of a New Series of Elementary Works on Mechanical and Physical Science, forming a Series of Text-books of Science, price 3s. 6d. each, adapted for the use of Artisans, and of Students in Public and other Schools. Edited by T. M. Goodeve, M.A , Lecturer on Applied Mechanics at the Royal School of Mines, and formerly Professor of Natural Philosophy in King's College, London. (Longmans.)

Technical Arithmetic and Mensuration. By C. W. Merrifield, F.R.S., Principal of the Royal School of Naval Architecture, South Kensington. (Longmans.)

Principles of Mechanism, designed for the use of Students in the Universities, and for Engineering Students generally. By Robert Willis, M.A., F.R.S., &c., Jacksonian Professor of Natural and Experimental Philosophy in the University of Cambridge. A new and enlarged edition. 8vo., with many woodcuts. (Longmans.)

A General System of Descriptive and Analytical Botany. In Two Parts. Part I. Organography, Anatomy, and Physiology of Plants. Part II. Iconography, or the Description and History of Natural Families. Translated from the French of E. Le Maout, M D., and J Decaisne, Member of the Institute. by Mrs. Hooker. Edited, and arranged according to the Botanical System adopted in the Universities and Schools of Great Britain, by Joseph Dalton Hooker, M D., &c., Director of the Royal Botanic Garden, Kew. With 5,500 Woodcuts from Designs by L. Stenheil and A. Riocreaux. (Longmans.)

A System of Logic, and History of Logical Doctrines. By Dr. F. Ueberweg, Professor of Philosophy in the University of Königsberg. Translated, with Notes and Appendices, by Thomas M. Lindsay, M.A., Shaw Fellow, and Examiner in Philosophy in the University of Edinburgh. 1 vol. 8vo (Longmans.)

Inorganic Chemistry. By William Allen Miller, M.D., LL.D., F.R S., late Professor of Chemistry in King's College. London ; author of "Elements of Chemistry, Theoretical and Practical." (Longmans.)

MEETINGS FOR THE ENSUING WEEK.

MON. ....Entomological, 7.
British Architects, 8.
Royal Institution, 2. General Monthly Meeting.
Society of Engineers, 7½. Mr. E. S. Crompton "On the Economies of Railway Maintenance."

TUES. ...Ethnological, 8. 1. Mr. Hector McLean "On the Kimmerian and Atlantean Races." 2. Mr. C. R. Markham, "Note on the name Aymard." 3. Mr. David Forbes, F.R S., "Reply to this Note."
Civil Engineers, 8. Mr. T. D. Ridley, "Description of the Cofferdams used in the execution of No. 2 Contract of the Thames Embankment."

WED. ...Royal Society of Literature, 4½.
Royal Microscopical, 8. Mr. S. J. McIntire, "Notes on the Minute Structures of certain Insect Scales."

Journal of the Society of Arts.

FRIDAY, NOVEMBER 11, 1870.

ANNOUNCEMENTS BY THE COUNCIL.

NOTICE TO MEMBERS.

The One-Hundred-and-Seventeenth Session of the Society will commence on Wednesday, the 16th November, when the Opening Address will be delivered by Lord Henry G. Lennox, M.P., Chairman of the Council, and when the Prince Consort's Prize, awarded at the last Examinations to Mr. Edward Turner Sims, as well as the Medals awarded for Papers read during the past Session, will be presented.

The following are the dates of the Wednesday evening meetings, the chair being taken at eight o'clock :—

1870.	November	—	—	16	23	30
„	December	7	14	21	—	
1871.	January	—	—	18	25	
„	February	1	8	15	22	
„	March	1	8	15	22	29
„	April	—	12	19	26	
„	May	3	10	17	24	31
„	June	—	—	—	28*	

For the Meetings previous to Christmas, the following arrangements have been made :—

November 16.—Opening Address by Lord Henry G. Lennox, M.P., Chairman of the Council.

November 23.—" On South African Diamonds." By James Tennant, Esq., Professor of Mineralogy, King's College, London.

November 30.—" On Peat, and its Profitable Utilisation." By Robert M. Alloway, Esq., M.A.

December 7.—" On the American System of Associated Dairies, and its Bearing on Co-operative Farming." By H. M. Jenkins, Esq., Secretary of the Royal Agricultural Society of England. On this evening Lord Vernon will preside.

December 14.—" On the Study of Economic Botany." By James Collins, Esq., Curator of the Pharmaceutical Society, and Fellow of the Edinburgh Botanical Society.

December 21.—" On a Method of Lighting Towns, Factories, or Private Houses by means of Vegetable or Mineral Oils." By Albert Silber, Esq.

Each Member is privileged to introduce two friends to every Meeting, and a book of blank Tickets of admission will be duly forwarded for this purpose.

The first course of Cantor Lectures for the ensuing Session will be " On Artists' Colours and Pigments," by Frederick S. Barff, Esq., M.A., F.C.S., and Fellow of the Cambridge Philosophical Society. It will consist of five lectures, to be delivered on Monday Evenings, the 21st and 28th November, and the 5th, 12th, and 19th December, at Eight o'clock. These lectures will treat of—The Nature of Colour; Chemistry and Manufacture of Colours and Pigments; Vehicles and Media used in Painting; Fresco and Silicious Painting; Destructive Influences on Colours, &c. Other courses of lectures are under arrangement for delivery during the Session. These Lectures are open to Members, each of whom has the privilege of introducing two friends on each lecture. Tickets for this purpose will be forwarded in due course.

Members are reminded that, should any of their friends wish to join the Society, the opening of the Session is a favourable opportunity for proposing them.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed " Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

INLAND PATTERN AND SAMPLE POST.

The Council have passed the following resolutions :—

" That some of the recent alterations in respect of the inland pattern and sample post are injudicious, illogical, and contrary to sound principles of political economy; and that measures be taken to induce the Postmaster-General to render the rules at least as good as those of North Germany, Belgium, and Switzerland."

" That traders and others who feel themselves aggrieved be requested to act with the Society of Arts' Committee, in promoting a reform of the existing system."

" That a special subscription for this purpose be opened, to which contributions are invited."

CORRESPONDENCE.

PARCEL AND SAMPLE POST.

Sir,—Lord Hartington, the Postmaster-General, has said that the Post-office was intended and suited for the carriage of small parcels. The Post-office, as at present conducted, does facilitate intercommunication between the merchant and manufacturer, as well as between the manufacturer and the retail dealer, by the carriage of parcels and samples by post. Why, then, if the post-office can carry parcels of from half an ounce to 2lbs. weight for the merchant and manufacturer, cannot it carry parcels of like weight for the retailer and the public in general. It cannot be urged that the carriage of parcels would injuriously affect the revenues of the post-office, for by reference to the return of the Postmaster-General of the general progress of business for the year 1868, it will be seen that the total cost of the post-office service amounted to £3,226,724, while the gross revenue collected by the Post-office service was £4,566,882, leaving a net revenue of £1,416,922. The Post-office was not established for the purpose of creating a revenue for the State by means of indirect taxation; it does, however, realise nearly one million and a-half of money per annum over and above its expenditure; and it cannot be urged that the labour and cost attendant upon

a greatly increased amount of parcel and sample-post service could not be paid for out of the present Post-office revenue; nor need we stop to point out how that the present revenue would probably be largely added to by a free use of the parcel-post system throughout the United Kingdom, instead of its earnings being diminished.

The progress which the General Post-office has made since 1840, and the public approval with which each succeeding measure taken for its expansion has been received, is due to the fact that the principles, adoption, and the rules, laid down for the guidance of the public in its use, have been broad, and of general application. Though the Post-office regulations were from the first confined by law to samples, still the practice was permitted of interpreting samples as meaning a small packet of goods within the weight and dimensions directed by the Postmaster-General. The withdrawal of the privilege, which, by lapse of time and usage on the part of the public, had assumed the appearance of a concession permanently made in favour of the public and commerce, has involved many establishments in great difficulties, and created obstacles to the free exchange of objects conducive to an extended education of the people. A restricted interpretation also involves the servants of the Post-office, in many instances, in a greatly increased amount of labour. The truth of these statements are forcibly illustrated by the following cases, which may be cited, and the number of such cases is legion.—

A friend of the writer's desired to send from London to his son, who was residing in a mountainous district, far away from tradesmen's shops of any kind, a dozen neckties, and knowing nothing of the new postal restrictions, bought them, and made up his parcel; but upon inquiry at the Post-office, before sending it, ascertained that it was a parcel of value, and, therefore, could not be sent except at letter rate. He, at the same time, ascertained that a single tie could be sent as a sample. Thankful for the information gained, but disappointed at his inability to use the parcels post freely, he returned home, and did up one of the neckties according to the rules prescribed, and at intervals of a few days repeated the process till the twelve ties had been dispatched. Now, in this instance, the Post-office carried, according to its prescribed rules, twelve ties separately, and had twelve parcels to stamp and despatch, and the poor, unfortunate postman had to go twelve times up the mountain, when a single walk would have done the work, as the weight and bulk of the whole of the parcels did not amount to twelve ounces. Surely such wasted labour and unnecessary toil was never intended to be put upon our poor, underpaid letter-carriers, nevertheless the restricted interpretation now put upon the meaning of sample post involves it in thousands of cases. While we have been extending the system of book and pattern post to China and Japan, the United States, and all the States of Europe with which we have postal conventions, and that upon a reduced and at a more uniform scale of charge, a free use of the system at home has been prohibited.

Again, Mr. H. Reeks, in a letter dated 7th October, and recently published in *Nature*, says:—"For several years I have been in the habit of sending herbarium specimens by 'book post,' by merely placing the plants between sheets of white cardboard, which were inwardly fastened by string, without wrappers, and the address written on the cardboard itself, so that, in fact, the parcel was open at both ends. On Tuesday last, I did up a small packet of green or living plants, and sent them to the village post-office. As the parcel weighed under four ounces, I affixed two halfpenny stamps. On calling at the post-office the next day, imagine my disgust at seeing my parcel of plants stuck up in the window to be sundried. Upon inquiry, I found that the postman had very wisely declined taking it to the borough office, as 'several similar parcels were lying about there now, and would not be forwarded until the senders had prepaid the postage at letter rate.' I say the postman acted wisely in refusing to take my parcel, because in taking it to the Newbury post-office myself, on Thursday, I found that, unless I paid eightpence, or rather put on seven more stamps, double that amount would have actually been charged to the recipient, at which I should have felt much grieved, as the specimens were really not worth half the amount.

"Another gentleman of my acquantance sent a parcel to the same office, with a fourpenny stamp on. This the clerk kindly defaced, and returned the parcel as 'not sufficiently paid.'

"I have read the new rules, and can see no clause bearing on this subject—either for or against herbarium specimens, or other objects of natural history, being sent between cardboard with open ends, at the old rate of four ounces and under for one penny, and should therefore be glad of any correct information from you or the readers of *Nature*."

Natural history collections are at all times difficult to bring together, and the use of the post-office, as formerly permitted, was tending greatly to improve their character and completeness, by affording facilities for the exchange of specimens; and the means of extending the education of the people was thereby advanced, but the withdrawal of the privilege has retarded so desirable a movement.

A writer in the *English Mechanic*, signing himself "Achromatic" says:—"Our English Mechanic Microscopical Society has received its death-blow, in the regulation concerning the pattern and sample post, issued by the Postmaster-General, and which came into force on the 1st of October. As the chief and most valuable feature of 'our' society was the interchange and lending of prepared objects, the new rule must necessarily interfere greatly with its purposes, as 'letter rate' upon an object would be, to the mass, prohibitory."

Surely, it was never intended that when a step had once been taken by the Post-office, which aided the accumulation of knowledge, the spread of education, and a more intimate acquaintance with nature in all its varied forms, that impediments should be put in the way of the people obtaining that increased knowledge, by the withdrawal of a privilege which had been acted upon for years, at the very time when the government had decided that every child throughout the length and breadth of the land shall receive instruction.

The instances already made public through the press, of the interference with trade which the recent postal arrangements have induced, are too numerous to admit of reproduction. It is sincerely to be hoped that the Postmaster-General will see the necessity for an immediate reversion to the broad interpretation of the sample-post privileges, which were in force previous to the 1st of October, and re-enact them.

I am, &c., H. G. H.

ANNUAL INTERNATIONAL EXHIBITIONS.

The offices of the Commissioners are at Upper Kensington-gore, London, W., Lt.-Col. Scott, R.E., secretary.

The days named for the reception of the different classes of objects are as follows:—Machinery, February 1, 2, 3, and 4; scientific inventions, Feb. 6 and 7; educational works and appliances, Feb. 8 and 9; pottery and raw materials, Feb. 10 and 11; woollen and worsted fabrics and raw materials, Feb. 13 and 14; sculpture not applied to works of utility, Feb. 15 and 16; paintings applied to works of utility, Feb. 17; sculpture applied to works of utility, Feb. 18 and 20; engraving, lithography, photography, &c., Feb. 21; architectural designs, drawings and models, Feb. 22; tapestries, carpets, embroideries, etc., Feb. 23; designs for all kinds of decorative manufactures, Feb. 24; copies of pictures, mosaics, enamels, &c., Feb. 25; paintings not applied to works of utility, Feb. 27 and 28.

GENERAL NOTES.

On a New Mode of Employing Silk in Photography.—In a paper read before the Chemical Section of the British Association for the Advancement of Science (Liverpool meeting), Mr. John Spiller, F.C.S., pointed attention to the fact that silk differs from all other known fibres in being easily soluble in concentrated hydrochloric acid, forming a mucilaginous solution which, when mixed with ammonia in excess, and carefully evaporated to dryness over a water-bath, gives rise to the production of a new organic salt, which promises to play an important part in photography, by virtue of its producing, with nitrate of silver, an extremely sensitive form of argentic chloride. The precipitate obtained by mixing the two solutions is no longer curdy, like the ordinary condition of chloride of silver, but appears in the form of a flocculent white substance, which remains for a considerable time in suspension, and, owing to the presence of the organic matter, is much more quickly affected by light. The author has investigated the chemical properties of certain salts formed in this manner from silk, and exhibited at the meeting a photograph printed on paper prepared with a 10-grain solution of the new organic chloride, and afterwards sensitised with a 60-grain solution of nitrate of silver. Comparative tests showed a considerable advantage in point of rapidity over a plain salted paper similarly treated; and the author urged the superiority of this salt when employed for matt-paper prints and solar-camera enlargements, and further hinted at the possibility of using it in the collodio-chloride process.

The Photographic Society of London.—This society opened its 14th session on Tuesday evening last, the 8th inst., with an exhibition of photographs illustrative of the present capabilities and condition of the art. The specimens exhibited show marked progress in many directions. Some of the specimens of landscape photography are unequalled, and have rarely, if ever, been surpassed by any specimen of the engraver's art. Composition pictures and mechanically-printed photographs have evidently commanded more general attention than in former years, and the results in many instances are in advance on former productions. The specimens of American work which Mr. E. L. Wilson, of Philadelphia, has sent over, and the enlargements by Mr. Albert Moore, seem to mark an era in the art. M. Emile Bondonneau shows also some fine enlargements and reproductions, together with a collection of enamels by Lafon de Camarsac. The portraits of Messrs. Bullock Brothers, Valentine Blanchard, Marshall Wane, and Henry Ashdown will be much admired. The contributions from the Continent are not so numerous as last year, but that is probably due to the war. Colonel Stuart Wortley, Captain Lyon, Mr. R. M. Gordon, Mr. T. M. Brownrigg, Messrs. F. and W. Bedford, Mr. Netterville Briggs, and Mr. Vernon Heath have sent in specimens of their best work, and Messrs. Robinson and Cherrill's "The Trysting Tree" and "The First Hour of Night" cannot fail to receive the attention they deserve. Captain Bedford Pim exhibits an interesting collection of photographs representing the "Passion Play" as performed last summer in Ober-Ammergau. The exhibition will be open to the public daily until the 30th November, from 9 a.m. till dusk. Free admission during the first five days in the week is granted to all comers, on complying with the usual formality of presenting the address card or signing the visitors' book. On Saturdays the privilege of free admission will be reserved for members (and their friends on presentation of a member's ticket), the general public on these days being charged an admission fee of one shilling each person.

Rocket Telegraph.—Captain Papafy, a Hungarian officer in the United States service, is the inventor of a new nocturnal military telegraph, which he has just sold to the Prussian War Department. By means of this telegraph, which consists of rockets of different colours, a communication can be established between two armies stationed at a distance of twenty miles from each other. Each rocket represents six words, and an order containing 300 words can thus be conveyed by 50 rockets. The key to this telegraph, which may be altered so as to make it unintelligible to the enemy, contains all the words used in strategy and tactics. The price of one of these rockets is said to be about two shillings.

Sea Messenger.—Mr. J. Black, of Bennet-street, Greenwich, has contrived a sea messenger of a spherical shape, to be kept ready for an emergency on a stem fixed on some part of the ship's deck. It has a tube in it for passing over the stem, which tube is watertight at the seams. The tube carries a rubber ring or a metal spring, which is caught hold of by a hook on the inner face of the cover, when the cover is in place over the opening or mouth of the spherical vessel. The top of the stem is threaded for the reception of a nut formed with blades like a screw propeller. The nut is screwed down upon the sphere with a slight grip, so that, should the vessel go down, the rush of water against the blades will unscrew it, and allow the sphere to rise up the stem and free itself. The capacity of the sphere is sufficient to hold the ship's papers and jewels, or other property of great value and small compass, on board, and these would be kept quite dry by the close fit the cover obtains through an india-rubber flange pressing upon the mouth, against which it is kept by the power of the spring or ring before referred to. It requires no preparation or care on the part of any person on board. All that has to be done is to place the papers, &c., inside, and then close up the opening, when it is free to release itself as before named.

Buhsa.—Dr. Palm, in a paper on "Some Narcotics, used by the Inhabitants of Central Asia," in *Pharmaceutische Zeitschrift für Russland*, No. 4, 1870, describes "buhsa" a fluid which appears to possess such highly intoxicating powers that, according to the author's statement, the Russian military authorities have been obliged to forbid the preparation of this beverage, which being in great favour with the troops, and preferred to other spirituous fluids, renders the men unfit for duty in a very short time. "Buhsa" is prepared by the Kirghisen in the following manner:—Millet is rubbed to a pulp with water, and, after having been diluted with more water, and occasionally with mare's milk (this milk is largely used by the inhabitants of Central Africa) the mixture is poured into large stoneware jars, which are tightly corked, and afterwards buried in earth. The vessels containing the liquid are left embedded for about ten days, and, after having been dug up, the fluid is transferred to glass wine-bottles, which, after having been well corked, are left standing for a few days, and then offered for sale at the rate of from three to five kopecks each (6d. to 10d.). The liquid thus prepared exhibits a greyish colour (somewhat akin to thin barley-water), and is turbid, there being a thick sediment in the bottles. On being uncorked, supposing the liquid to be matured, the beverage escapes in a very brisk manner, owing to the very large quantity of carbonic acid present. The taste of this fluid is tart and spirituous, but the after-taste is very unpleasant, owing to the presence of fusel oils. Although the ingredients from which this drink is prepared are somewhat innocent, the effects of the imbibing it upon the system are not by any means mild; these the author refers to the presence of the alcohols of the higher fatty acids, in addition to alcohol, aldehyde, acetic, lactic, valerianic, and traces of fatty acids and their alcohols or fusel oils. Not-

withstanding that the Russian government takes all possible measures to prevent the preparation of "buhsa," it is a popular drink; and, moreover, its mode of preparation from millet yields a substitute for yeast for baking purposes, and the prepared "buhsa" is largely applied for that purpose.

Ammonia and Vegetable Dyes.—M. Vogel has recently published the results of some experiments on the changes produced by ammonia in some vegetable colours, especially those of flowers, which he thinks may be of practical importance in the manufacture of vegetable colouring matters of a character similar to aniline dyes. The colouring matter he states to be of two kinds, united with a different degree of persistence to the tissue of the flower itself, and requiring a shorter or longer time to produce any alteration. The change produced in the colour of some flowers, as the rose and phlox, by the fumes of tobacco, is entirely due to its ammoniacal element. M. Vogel found that some colours are altogether unchanged by lengthened exposure to ammonia, as, for instance, yellows, all reds (except in the case of the *Zinnia*, which is converted into a brown-red), and dark violets. Blue is sometimes unaltered, sometimes changed into a dirty green, and then bleached. In some cases, not only the colour, but the tissue of the flower is destroyed. The changes are generally the same as those that take place during the withering of the flower.

MEETINGS FOR THE ENSUING WEEK.

Mon. ....Institution of Surveyors, 8.
London Institution, 4. Dr. Odling, "On Chemical Action."

Tues. ...Royal Geographical. 8½. 1. President's Opening Address. 2. Last letters of Mr. G. W. Hayward "On the Geography of Gilgit and Gassin." 3. Letter from T. Douglas Forsyth "On the Yarkand Expedition." 4. Letter from Dr. Cayley "On Routes between Ladak and the Kuen Sun."
Civil Engineers, 8. Mr. Alexander Leslie "On the Water Supply of the Town of Paisley."
Zoological, 9.
Anthropological, 8.
Statistical, 7¾. Dr. Guy, F.R.S., "On the Claims of Science to Public Recognition and Support, with Special Reference to the so-called Social Sciences."

Wed. ....SOCIETY OF ARTS, 8. Opening Address by Lord Henry G. Lennox, M.P., Chairman of the Council.

Thurs. ...London Institution, 7½. Dr. W. H. Stone "On the Acoustics of the Orchestra: Wind Instruments."
Chemical, 8. Professor N. Story Maskelyne and Dr. Walter Flight, "Mineralogical Notices."
Linnæan, 8. 1. Dr. M. T. Masters "On the Passiflore." 2. Dr. James Murie "On the White-beaked Bottle-nose."

CONTRIBUTIONS TO THE READING-ROOM.

The Council beg to acknowledge, with thanks to the Proprietors, the regular receipt of the following Journals and Periodicals during the year:—

WEEKLY.

Asiatic.
Architect.
Athenæum.
British Journal of Photography.
British and Foreign Mechanic.
Builder.
Building News.
Builders' Weekly Reporter.
Chamber of Agriculture Journal.
Chemical News.
Choir.
Colliery Guardian.
Cosmopolitan.
Cosmos.
Electric Telegraph and Railway Review.
Engineer.
Engineering.
English Mechanic.
European Mail.
Farmer.
Gardeners' Chronicle.
Journal of Gas Lighting.
Land and Water.
Les Mondes.
Mechanics' Magazine.
Mining Journal.
Nature.
NorthBritishAgriculturist.
Photographic News.
Sessional Proceedings of the Social Science Association.

FORTNIGHTLY.

Cotton Supply Reporter.
Spon's Dictionary of Engineering (in continuation).

MONTHLY.

Art, Pictorial and Industrial.
Artizan.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
Bulletin de la Société Imperiale Zoologique d'Acclimatation.
Bulletin du Musée de l'Industrie.
Canadian Naturalist and Quarterly Journal of Science.
Civil Engineer and Architects' Journal.
Educational Times.
Engineers' Journal (Calcutta).
Food Journal.
Indian Economist.
Journal of Applied Science.
Journal of the Chemical Society.
Journal of the Board of Arts and Manufactures for Upper Canada.
Journal of the Franklin Institute.
Journal of the Horticultural Society.
Journal of the National Life Boat Institution.
Journal of the Pharmaceutical Society.
Journal of the Quekett Microscopical Club.
London, Edinburgh, and Dublin Philosophical Magazine.
Practical Mechanics' Journal.
Presse Scientifique des Deux Mondes.
Photographic Journal.
Revue du Monde Colonial
St. Crispin.
Symons' Meteorological Magazine.
The Horological Journal.
The Institute and Lecturers' Gazette.
The Portfolio.
The Stationer.

QUARTERLY.

Journal of Mental Science.
Journal of the Geological Society.
Journal of the Linnæan Society.
Journal of the Royal United Service Institution.
Journal of the Statistical Society.
Journal of the Victoria Institute.
Popular Science Review.

INDEX TO VOL. XVIII.

* *disc.*, discussion at a meeting.

T.

The following Supplements have been issued:—

Programme of Instructions to Delegates to the Meetings held for the consideration of an improved National System of Education.

Educational Organisation—Report on Existing State of Education in Ealing and Brentford, by T. P. Allen; and on Infant School Teaching, by E. Coghlan.

The Educational Condition and Requirements of One Square Mile in the East-end of London, by G. C. T. Bartley.

Existing State of Education in Richmond, Twickenham, and Mortlake, by T. P. Allen.

Existing State of Education in Battersea, by T. P. Allen.

Supplement to the "Journal of the Society of Arts," No. 891, *Dec.* 17, 1869.]

Society for the Encouragement of Arts, Manufactures, and Commerce.

PROGRAMME OF INSTRUCTIONS

FOR

DELEGATES TO THE MEETINGS

TO BE HELD FOR THE CONSIDERATION OF

AN IMPROVED NATIONAL SYSTEM OF EDUCATION.

1. The investigations carried on in the Society have established the conclusion that, for the attainment of its general objects—the advancement of Arts, Manufactures, and Commerce—a general system of improved technical education is necessary. It is, however, agreed on all hands that, for an improved and extended system of technical education, to enable this country to maintain its position as regards the industrial arts, an improved general system of primary education is an absolutely indispensable condition. But the present system of primary education, with some exceptions of large schools in the chief cities, is one which, for the great bulk of the middle classes, as well as for the children of the artisan class, positively excludes technical instruction, and excludes any express preparation for technical instruction in the usual school stages. By the existing common methods of teaching, consequent on the common school organisation, children entering the school by their seventh year are not taught, even by trained teachers, to read intelligently, to write a fair hand, or to acquire the elements of arithmetic, in less than six or seven years—that is, before their thirteenth or fourteenth year. Parents of the wage-classes, however, will have their children away from school, for some remunerative service, before their eleventh year, and even much earlier in the agricultural districts. It is the general complaint of school-teachers that the children are now taken away from school half-taught. Parents of the great majority of the middle-classes also must have their children away by their thirteenth or fourteenth year;—that is to say, by the time they have received the most simple elementary instruction, and before they can have acquired any important amount of technical instruction.

2. Under these common conditions, therefore, technical instruction is only acquired—and can now only be acquired—by a few in evening schools, or by the children of the more wealthy. Only some hundred thousand youths, taught in evening schools, or under exceptional conditions, are in communication with the Science and Art Department; —whereas, under the educational conditions required for the technical and art progress of the empire, at least a million of children ought to be under special training for the augmentation of their productive power and service. It has been established by various and long-tried examples of improved educational organisation examined by members of the Council, and by the information of teachers of the highest practical experience (*vide* Appendix) that the elementary teaching may be greatly improved, and the time of teaching, in hours daily and in years, may be reduced by fully one-half—in years to three, instead of six or seven (*vide* information from Mr. Morrison, the Rector of the Glasgow Free Church Training College; Mr. Imeson, of the Central District School of London; Mr. Longford, and others); and, in hours of daily desk-work in school, to three instead of five.

3. By such improved educational organisations, and by improved means of educational art-teaching, the children of the wage-classes may in general be prepared and sent away, if needed, before their eleventh year, adequately versed in the elements of instruction—enabled to read intelligently, to write clearly, to cipher up to decimal fractions, with some initiation of the hand and eye in elementary drawing, with improved physical as well as mental aptitudes for all sciences, by complete drill, music, and manual and gymnastic exercises.

4. With such aptitudes, the children of the

wage classes will be widely and better prepared—as they are found to be in Holland—for art, and science, and technical instruction, which are there in prosperous progress beyond this country. (*Vide* information obtained from Dr. Lindo, Government Inspector of Primary Schools, and of Dr. Bosscha, Government Inspector of Secondary Schools in Holland.) But by the gain of two years or more—by these improved organisations and methods of elementary teaching in the primary stages—the means of direct art and technical instruction may be provided for *all* the children of persons of themiddle classes, as well as for children of the more advanced of the artisan classes.

5. It appears that, by these long-tried improved educational organisations, the required improvements in the quality of trained teaching power may be generally attained, not only without any increase, but even with a reduction of the total common annual expenses, and that given amounts of elementary attainments may be imparted, of a superior quality, to three at an expense now commonly incurred for one. (*Vide* illustrative table by Mr. Allen, and information by Mr. Imeson, of the Central District School of London). It follows, however, that whilst exertions should be made to extend the existing means of art, and science, and technical instruction by institutions, by evening schools, and by colleges, for all who may now be ready for them,—the great legislative and administrative policy of the country is to concentrate attention on the improvement and the extension of an improved elementary education—to the shortening of the years as well as hours of the day for the elementary training of the population of this country. To this end, exertion is required to be directed to the improvement and the general extension of infant-school teaching, by which it is now proved that an advanced preparation may be made, and from one year and a-half to two years of valuable elementary school-time may be saved.

6. Having regard to the hard necessities of common life, and the economical condition and welfare of the many, one great object for saving school-time is, as early as practicable, to let earning and learning go on, as much as possible, together. The great practical object of school teaching is not to make superior scholars, but superior artisans;—not to impart to the middle classes the accomplishments of the leisure classes, but applied science and productive art for actual service. It is desirable, for the progress of Arts, Manufactures, and Commerce, to make the school itself primarily a manufactory, and a labour mart for available service. (*Vide* testimony of Mr. Longford, of the Forest-gate District School.)

7. The half school-time principle, and all reductions of school-time, is conducive to this end. It is now proved that the capacity of the beneficial attention and mental labour of children is exhausted in the good primary schools in less than three hours of good sustained teaching, and that all labour beyond that is detrimental or pernicious. The combination of book instruction with physical exercise, or with actual productive avocations, is proved to be advantageous to both, and this is true of middle-class or superior as well as inferior teaching.

8. Professor Bain, of Aberdeen, the eminent psychologist, states that he has in his classes in the university there, the hardest heads and the hardest workers in the United Kingdom, and that four hours of daily mental labour is as much as is good for them. In the Owens College, Manchester, the majority of the students attend only the night classes, being engaged in various occupations during the day; and, of the day-students, a considerable number are engaged in manufactories, or in professional pursuits, to which the science-teaching of the classes they attend are conducive. Numbers of the students so engaged in studios, manufactories, or counting-houses during the day, have, by ten hours of weekly attendance at the college classes, aided by home preparations, been enabled to pass the strict examinations for degrees at the London University. At that advanced college the need of improvement in primary elementary teaching for the middle-classes is strongly felt. From the information given by Dr. Bosscha, the Inspector of Secondary Schools in Holland, it will be seen how much of science and art teaching is there imparted on what may be termed the half-time system, or three hours of daily teaching in the secondary schools.

9. In respect to primary instruction, it appears that much time may be saved, and that the efficiency of the three hours' available desk-work may be doubled by improvements in the teaching art.

10. As to the art of reading—methods are in use by which it is declared that reading and writing are better taught together, in less than half the time now occupied in common school practice.

11. The Council has had brought under its consideration the means of improving the common spelling. The difficulty of teaching spelling to children, and the cruel perplexity inflicted upon them in learning it, is well known to teachers. There can be no doubt that reform of our common corrupted spelling would be not only a great shortening of school-time, and a relief to the torment of children in learning, but likewise a relief and a removal of grievous obstructions to foreigners in learning our language.

12. As to the art of teaching handwriting, a new method has been recently introduced into Germany, by which it is asserted that children are taught in half the time now occupied by the common methods.

13. As to the art of teaching arithmetic, new methods are in use, by cards with varied sums already set, for individual work in classes, by which the time of the teacher as well as the time of the learner is considerably saved. But it is stated by first-class school-teachers that, by the general adoption of the decimal system, fully one-half the time of teaching children arithmetic may be saved, their torment in learning conflicting tables relieved, and their habits of thought improved in this primary branch of elementary instruction, which has been properly termed "the geometry of the poor." For the improvement of the primary instruction of the population under a national system of education, and for art and technical education especially, the general adoption of the decimal and metrical system will be found to be deserving of a national effort.

14. Time saved in learning is, to the mass of the population, time gained for earning. Time saved in improved primary learning is also time gained for improved art and technical learning, and for the augmentation of efficiency in the great national earning.

15. It is considered, therefore, that improvements in the teaching art for elementary instruction should be sedulously cultivated separately. Various methods are stated to have been in long and successful practice. It is proposed that the Council shall institute examinations, and give prize medals for the best of these methods that have been, or may be, proved by actual trial.

16. To the improvements practicable in the mental training by book instruction, there is to be added the improvement of the means of physical as well as of mental training; in the infant school, by the exercise of the fingers; in the primary schools, training the hand and eye by teaching elementary drawing; and on the playground, by improved gymnastic and bodily exercises.

17. It is declared that, by improved gymnastic exercises, superadded to the common military drill, the efficiency of five is given to three for all purposes of ordinary labour. The military drill is an exercise of mental habits, of visible and undoubted habits of attention, and of all that is implied in the word discipline—self-restraint, patience, silence when under orders, prompt and exact obedince, and highest respect for gradations of authority. For industrial occupations it prepares them for combined action—to move together, to lift together—by which the increase of efficiency for civil work is imparted.

18. It will be conducive to the proper discussion of the question of national education, now about to be raised in various directions, to endeavour to get clear ideas of what is required to be done, and clear undoubted proof of what is actually done, as a basis for the consideration of the application of administrative and legislative art and science for doing it.

19. For the saving of the time of teaching, and also for the improvement of the quality of teaching, without any considerable augmentation of expense, the great means will be the application of the improvement of the teaching art, by the division of educational labour and simultaneous class-teaching, by trained teachers of the different gradations of age, and competing by different classes in the same school, or by gradations of classes in different buildings. (*Vide* the example of the Faversham School Union, and the accounts of the school union at Merthyr Tydvil, and of the great Jews' Free School in London.) For these purposes, it is necessary that aggregations of children should be made, for their segregation into the best appropriate classes. It is desirable that these means should be early considered practically. It is, therefore, proposed that medals should be given to school-teachers, for the best six schemes for actual purely urban districts, and for the best six schemes for the classification and teaching of the children of six small town districts, of not more than six thousand each, comprising adjacent rural population, showing the extent to which the education and training may be advanced; 1st, before the eleventh year, for the children of the wage-classes; and 2nd, from the eleventh to the fourteenth year, for the children of the middle classes; and the amount and description of art and technical education that may be imparted to them, without greatly-increased expense, within that time, by an application of the principles specified, by better classification, and by a division of skilled teaching and training power. In addition to these schemes it would be of use to send one or two teachers acquainted with improved school organisation to examine and report how much of time may be gained by it for art and technical education, and of what class, within the day school time, in one or two places to which they may be directed as specimen places. It is suggested that gentlemen locally interested in the improvement of the population should promote such investigations for themselves, and that local committees of educationists may well be formed for the purpose.

20. Such schemes which may comprehend the improved application of existing educational and charitable endowments, may well be published locally, for local examination and discussion.

21. In respect to the question of compulsory education, it may be observed that the shortening of school-time practicable for teaching reading, writing, and arithmetic from six years to three, will render unnecessary a great part, if not the whole, of the compulsory action now sought for to retain the children of the wage-classes in the school to their thirteenth

year, and that, of the children of the wage-classes who do not now attend school, their voluntary attendance will be greatly conciliated by the reduction of the daily hours of teaching on the half-time principle from six hours daily attendance to three, and which, to a great extent, enables domestic service and earning and learning to go on together. Such compulsion as may be necessary, in relation to the children of the wage-classes, may be best applied by an extension of the principle of the Factory Acts. The needed exercise of a serious amount of compulsion will then be restricted to destitute orphans now chargeable on the poor-rates, and, as a measure of police, to the varying numbers of the vagrant and criminal classes. The example of the mixed physical, industrial, and mental training of the district schools visited by the Council is decisive as to the efficiency and economy of an application of an improved teaching and training power, for the extirpation of juvenile mendicity and of juvenile delinquency, the great seed-plot of the criminal population which fills the gaols of the country.

22. In relation to this class especially, experience confirms the great old Hebrew aphorism, "that he who fails to teach his child a trade, teaches him to become a thief." In one mode of teaching—the common mode—with common teaching power, but without industrial training, the great mass went to the bad, and became paupers, mendicants, or delinquents. By another mode, with physical and industrial training, the failures have been under three per cent. Good expenditure, under this experience, may be set down as a means of economising two millions annually of expenditure for penal administration and ineffective repression. Finally, it is to be observed that the question of compulsory school-teaching must be assumed to have relation to *good* school-teaching. Of the present school-teaching in England, it has been stated by a distinguished Government inspector, the Reverend Mr. Fraser, that about one-third of it is tolerably good—that is to say, in the common accepted term of the goodness of the schools which impart the "three R's" in about six years instead of three, and that are destitute of physical training—that about one-third of it is indifferent, and another third of it utterly valueless. Moreover, it has been a subject of complaint by the Government Inspectors in their reports that the condition of many of the schools into which children are now crowded is most grievously injurious to their health, as well as to the health of the teachers. The medical officers of health of the metropolis have represented that a great portion of the schools which come within their cognizance, and which are by no means the worst—are sources for the generation and spread of epidemic disease, and that an excess of nine thousand deaths annually in their districts, was largely attributable to them. In respect to the teaching power supplied from the training colleges, inasmuch as the only material on which those colleges can depend is the pupil-teachers, whose numbers are now much below what is necessary to supply the wants of the colleges, and, what is worse still, their quality is pronounced to be very inferior to what it was five years ago—the quality of the teaching which required elevation is being lowered. Now, it would be a false movement which should effect a compulsory school attendance indiscriminately on such inferior conditions, and which did not provide for something other and better. "As is the teacher so is the school," is a condition now of general experience; and the first condition of a national education is to obtain, through training colleges, efficient school teachers. The training colleges, in their present condition, are pronounced by the highest authority to be quite incapable of supplying the wants of the country.

23. In respect to instruction in religion, the only desire must be that it may be improved beyond that now given, as described by the clerical inspectors in the last report of the Committee of Privy Council on Education (which *vide*). Merely for industrial purposes, what is needed is the substitution of habitual liars, cheats, and drunkards, requiring perpetual, painful, and expensive supervision, by a commandment-keeping, truthful, sober, law-abiding, contract-performing, conscientious, trustworthy class, thoroughly imbued with practical Christianity, for which the clergymen of all denominations ought to be made really responsible. The Faversham School Union, approved by the late Archbishop of Canterbury (Sumner) and the Protestant Dissenters living there, is an admitted example of how the anticipations of the late Dr. Chalmers may be realised, and religious differences set aside, and education be placed on the basis of a common Christianity. Since 1857 this system has been in vogue in Holland, and the Council is assured that it works excellently.

24. These facts and outline conclusions, which have regard to the advancement of the art and technical education, as well as the simple primary education of the wage-classes, are not put forth dogmatically, but are submitted with a view to the independent examination and consideration of the facts and reasons indicated, on which they are founded. It is hoped that they may be examined and discussed by the Institutions in Union, and by those who take part in the meetings to be held on the deeply important questions raised.

(By order of the Council) P. LE NEVE FOSTER,
Secretary.

APPENDIX.

LARGE SCHOOLS.

The gain of educational power, in quality and in time of instruction, is exemplified in two large schools, both giving elementary instruction in two languages—the Dowlais School, where the children of the Welsh mining population, upwards of two thousand, under one direction, speaking Welsh, are taught in English; the other, the great Jews' Free School of Spitalfields, where upwards of fifteen hundred boys, and more than a thousand girls, are taught Hebrew at the same time that they receive elementary instruction in English. This aggregation may, however, be presented as displaying the administrative arrangements practicable for a town of twenty thousand of population. By this administration is gained combination for the teaching each child, in the place of a single master or a single mistress, a subdivision of labour amongst thirty teachers and pupil-teachers, including amongst the teachers three B.A.'s of the University of London, and having for their general direction a man of distinguished general ability and high intellectual rank. The annual cost per head of a single trained teacher of a small school of fifty pupils, it is to be borne in mind, is not less, on the average, than £2 per annum, and the time of teaching six or seven years, at a total cost of from £12 to £14; whilst the annual cost of the larger teaching power is £1 12s. 3d. per head (including the extra expense of professors of Hebrew); the time of teaching the equivalent elementary knowledge, with Hebrew in addition, about four years; and the total expense, about £6 9s. But the effect of the teaching-power, in quality and amount, can only be estimated by an examination of the very inferior material operated upon, the greater proportion of the children being of the poorest and most abject in the metropolis; and by examining the low intellectual condition in which they come in, and contrasting it with the condition to which they are brought before they leave. A very large proportion of foreign-born children is admitted to the school every year. Mr. Angel, the head-master, states that the "proportion is about seven foreigners to ten natives. Between 600 and 700 boys are admitted every year, and of these at least 90 per cent. do not know either the English or the Hebrew alphabet. Foreign boys also have to unlearn their native jargon as well as to acquire our vernacular; and some idea may be formed of this hindrance to improvement, when I state that I admit many boys who can give themselves no intelligible English name; who frequently fail to answer to the nearest approximate name into which I can translate the home appellation, and who not seldom come into school with one name, and leave school with another name. The same details apply to girls." As to their social position, he states that "the parents of every child may be said to belong to the labouring classes. Many are so poor that they are thankful for a loaf of bread given in charity. Of my 1,520 boys, not more than 1,000 can afford to pay the small weekly penny charged for school fees; the remainder are excused. All are glad to accept a suit of clothes and a pair of boots annually given by the Rothschild family."

In answer to the question as to the attainments imparted in the schools to the pupils of different ages, Mr. Angel states:—"By the age of seven, few children are advanced beyond the first standard, especially so as to enable a child to be moved from the lower classes. Progress in Hebrew and English must be analagous. Some children have a speciality for Hebrew, some for English, and this demands care on the part of the teachers, to ensure uniformity of improvement. By the eleventh year, children have attained the fourth and fifth, and in a few exceptional cases, the sixth standard. Contemporaneously they have acquired fluency in Hebrew reading, and facility for translating easy passages from Hebrew into English; they have, moreover, committed to memory several long Hebrew prayers and formulæ.

"By the 14th year, children have passed the sixth standard, and have attained a fair knowledge of grammar, geography, history, social and general science, physiology, Euclid (1st Book), Algebra (to simple equations). They are all able, moreover, to translate the entire Scriptures from Hebrew to English and *vice versa*; they know Hebrew grammar, and have some acquaintance with Rabbinical literature. But these are exceptional cases, as few boys stop beyond thirteen years of age. As a sample of what is done in the school, a set of five examination papers is sent herewith. These papers are set by the several examiners, without any communication with the teachers, and the boys examined are called on to answer in writing, on the same terms that are employed at a university examination. Such an examination is carried on (under different examiners every year, the programme varying according to the curriculum of study laid down by the managers."

What do you consider to be the advantages of your large aggregation of pupils?

"1st. Better classification.—There are as many grades of intellect and intelligence in 50 children as in 1,500 children. Increased numbers of teachers admit of minute subdivision of classes, to meet the diversity of powers in the pupils.

"2nd. Better character of teachers.—Centralisation produces economy in management, and thus sets free funds for the better remuneration of teachers. The hope of rising is the great stimulus to exertion. A system which recognises only small schools is fatal to that honest ambition which prompts men to qualify themselves for high positions while filling low positions. In schools of 50, a teacher attains the top of the tree at the very outset. Compelled to be content with the small salary commensurate with his small field of duty, and to be satisfied with the trifling results possible among numbers so contracted, his desires and his energies vegetate together. Poverty cripples his means, intellectual no less than tangible, and the insignificance to which his narrow sphere of action condemns him has a damaging effect on his character. On the other hand, the fact that capabilities in teaching may attract pupils without limit, just as skill in any industrial or commercial pursuit may secure increased patronage, is a powerful stimulus to excite talent to exertion, and to prompt mediocrity to aspire to excellence. Teachers who know that their position, social as well as scholastic, may be whatever they choose to make it by exertion, have an interest in their work independent of the ordinary interest which conscience alone should engender. Thus, where a system sets no limit to the

numbers of a school, it will happen in any neighbourhood that the school conducted by the best teachers will gradually absorb other schools, and will even attract children from distant localities. The teacher will be urged to self-culture, both as a scholar and a teacher, by the success he has achieved, and by the further success he hopes to achieve. His position will be an improving position, and so will prevent his being tempted to seek a better paid appointment; and in this way his experience of the wants of the particular class of pupils with whom he has to deal will be another element towards securing improved results. But even here the benefits to the teacher will not stop. By degrees the original sole teacher will become the director, and other teachers, graduated according to what may be required of them, will conduct classes under him. The promotion possible will urge these to deserve it, and thus not only will every teacher be actuated by the desire to improve, but all the higher classes will be taught by adults, and pupil-teachers will be entrusted with only the lower classes. The above is an hypothesis. Thirty years ago, when I became master of the Jews' Free School, it contained 216 boys; I was the only master, and my teaching-staff was composed of the monitors I could train. Now, my school contains above 1,500 boys. All the other schools about have been long closed, and my teaching-staff, besides pupil-teachers, consists of four certificated teachers and ten adult assistant teachers, included on the list being three B.A.'s,* and several undergraduates of the University of London, not one of whom is not, in some way, a constant student. Of course, simultaneously, the social progress has advanced in a like way, the salaries paid to assistants varying thus:—£180, £150, £120, £100, £80, £60, £50, &c.

"3rd. Higher character of instruction, and better training, mentally, morally, and intellectually, follow from the higher character of teachers. I have met several teachers of small schools, many holding certificates, and my experience is, that the great majority know little more than the mere routine necessary for their position. Well-up in all the mechanism and book-theories of school management, they have been mostly ignorant of literature, deficient in general information, and as narrow in mind as they have been contracted in circumstances. Originally rising from the ranks of the school, what have been their opportunities? As children, they had a home little calculated to enlarge and elevate the teaching of school; as youths, they had to struggle to maintain the equilibrium between the tutorial dignity of apprentices and the social humility of birth, without any superior intellectuality to preserve the balance; as young men, they were subjected to the semi-monastic seclusion of the normal college, which troubles itself with little but the course necessary for the certificate examination, and not at all with the formation of those business-like and worldly habits which should be an integral portion of the character which has to mould children to be useful and reputable members of society. In my school, the teachers have the same origin as other teachers, but I believe that there the parallel ends. Many of my pupil-teachers have matriculated and passed the first B.A. examination before completing their apprenticeship, and more than one has held the degree of B.A. before he has been old enough to sit for his certificate. For general scholarly attainments, high and refined perceptions of morality, an elevated idea of duty, and a corresponding zeal in its discharge, I think my teachers may challenge comparison. And I attribute this result entirely to the system which has placed within their reach the best and most enlarged training concomitantly with such means as enables the gentleman in mind to be a gentleman in position—humble, it may be, but still free from the galling restraints of absolute poverty, and with the prospect of promotion to cheer the present and to benefit the future."

* One is about trying for the degree of M.A.

The Dowlais schools, which are under one direction, and practically form one school, have 2,653 scholars on the books, and an average attendance of 1,950; and had 2,015 for presentation to the inspector at the last inspection. They are almost exclusively children of the wage-classes. The teaching power consists of six principal teachers, seven assistant-teachers, 27 pupil teachers, and 20 probationers for pupil teacherships. The cost per head of the scholars on the books for teaching power is 15s. 3d., or per head of average attendance is £1 0s. 9d. Mr. Hurst, the head master, in answer to the questions as to the attainments imparted by this teaching power, at different ages, states:—

The point of attainment reached in the infant school may be fairly represented by standard 1 of the Revised Code; but this, in a school in Wales, indicates a greater amount of work than would be required to attain the same point in an English infant school; inasmuch as at least 90 per cent. of the children speak Welsh only when first admitted, and of course a knowledge of English must be imparted before much progress can be made in other subjects.

Presuming that a boy is fairly regular in his attendance, from the time he is transferred from the infant to the boys' department till he is ten and a-half years old, he would have acquired a knowledge of vulgar fractions, pass with ease the fourth standard of the Privy Council, have become familiar with the definitions of grammatical and geographical terms, be able to parse a simple sentence, and have a fair acquaintance with the geography of the British Isles. This is the point of my own third class of 55 boys, with an average age of ten years and two months.

Boys remaining at school to the age of fourteen and a-half years would have acquired considerable fluency in reading, great correctness in writing from dictation, and a thorough knowledge of every useful rule in arithmetic, mensuration of superficies and solids. He would also possess a very fair practical acquaintance with the geography of the whole world, the history of England, and the analysis of sentences.

The girls are taught sewing one and a quarter hour per day, but deducting the time devoted to this, the progress of the girls is much on a par with that of the boys. As a rule, I think the girls are somewhat sharper in reading than the boys, and the boys quicker than the girls at figures.

Having the honour to hold a commission as ensign in one of the companies of Colonel Clark's battalion, I take pleasure in instructing the elder boys in the volunteer military drill, having been provided with 100 rifles of suitable size for that purpose. A gymnasium and circular swings are erected in the large play-ground adjoining the schools, of which the children are not slow to avail themselves. Though teaching swimming forms no part of the school routine, there are ample facilities in the neighbourhood for acquiring the art, and these are readily embraced by the boys in the summer time.

My experience is, that the better the education the better the workman. Those boys who remain in school to 13 or 14 years of age, and have had the advantage of being for some time in the first class, are invariably drafted to the superior kinds of employment in the works; while, on the other hand, a boy leaving, say from the lowest class in the school, naturally graduates to that inferior kind of labour for which his degree of intelligence alone fits him. It would not be difficult to tell, from the occupation of a boy in the works, the position he held in the school. I may state, by way of example, that the post of chief coal agent, that of manager of the mills and forges, of the principal check clerk, of the heads of various departments, with their numerous subordinates, are filled by persons who have received their education in the Dowlais schools. Similar situations in neighbouring works have also been filled by men formerly trained in these schools. I may also mention that a collier's son, solely educated here, and recommended by

me as errand boy and junior clerk in a lawyer's office in Merthyr, is now practising himself in the town of Aberdare. I know of no single instance of a person, native or imported, of neglected or inferior education rising to any position of importance in the works.

PRACTICAL EXPERIENCE OF THE RESULTS OF TEACHING IN SMALL AND LARGE SCHOOLS ON THE HALF-TIME SYSTEM, AND OF THE GAIN OF TIME OBTAINABLE FOR TECHNICAL EDUCATION.

Mr. Thomas Langford, first-class certificated Master of the Forest-gate District School (half-time school of pauper children.)

At what other schools than this, and with what numbers have you taught?—I taught for about four and a-half years in the school of the West Malling Union, where there was an average of forty-five children. Then I taught at the Fulham Union School, where there was an average of about fifty children. I have taught for four years here, where there is an average of 315.

Now, in your experience of teaching in the schools with fifty pupils and under, in what time could you there teach the children to write a clear hand, to read intelligently, enable them to pass creditably the ordinary examinations in arithmetic approved by the Privy Council, to master thoroughly the four rules, including proportion, as far as decimal fractions inclusive?—In the small schools it took nearly seven years to attain that standard, for in a school of forty or fifty pupils they have to be sub-divided into four or five classes, and require more individual teaching than in a large school; for, as the pupils forming the classes are necessarily few in number, that spirit of emulation is almost wholly wanting that marks the progress of a large school, and the energy of the master himself is oft-times sorely taxed when he places on the one side his few in number, and on the other his scanty harvest of results; and in a large school, too, it requires more that supervision should be exercised that all classes are working, rather than the irksome task of individual teaching.

In this school with the 315 pupils, in what time do you impart the same amount of instruction?—In a little more than three years and a-half.

Now, in the small union schools what must have been the total cost of teaching power to impart the amount of instruction stated?—It was about £1 13s. per head per annum.

What is it here?—About £1 5s. per head per annum. But this includes military music and drill.

This school is on the half-time system?—Yes.

What amount of instruction do you impart to this class of children, about the tenth year and a-half, or less, in the three years, by teaching with a staff of teachers and a division of educational labour such as you have here?—To read intelligently the standard reading books generally used under the Revised Code, or any other secular reading book suited to their capacity, with the meanings of the more difficult words; to master the four compound rules, and to answer with tolerable accuracy questions in mental arithmetic; to know the general geography of England; to write legibly and correctly simple sentences from dictation; and to answer such questions in Scripture history as is generally expected from a child of that age. The arithmetic would include simple proportion; geography more fully; to write a neat small hand, either in copybooks or a slate dictation. In a small school such a standard is seldom obtained. One cause of this failure may be attributed to the absence of an infant school.

What amount of instruction do you impart here by about the thirteenth year?—To read intelligently from a secular reading book, and to be able to supply the meanings of the words; to master proportion and practice, including fractions, and to solve questions in mental arithmetic with rapidity; to be able to write neatly, and with tolerable accuracy, a subject from dictation; geography of Europe in particular; to have a knowledge of our colonial empire, and to be acquainted with the several parts of the world where we procure the various articles in common use; a knowledge of map-drawing in the first-class.

Do you not find the time of school teaching, on the alternate day system, somewhat in excess of the children's capacity of attention?—Yes.

Have you seen any reason to prefer the practice of teaching three hours daily?—Not by actual experience, as I have been always accustomed to work upon the alternate day system, but my opinion would go in favour of three hours' daily teaching.

Have you observed any and what results on the pupils, of the military drill and physical training in this school, as compared with the results obtained in your two first schools, where there was no such drill or training?—A very marked difference is always to be seen in the schools where the pupils are taught military drill, inasmuch as it accomplishes a two-fold object. In the first place, no one doubts that it is conducive to good health, as every part of the body is called into action by the many and useful evolutions they perform, but it does something more, it acts upon the pupil in a moral sense; it teaches him to be smart in his deportment, lively and quick in his motions, tidy and orderly in his habits, and sharpens the intellect, and oft-times makes him feel what is so often wanted in our pauper schools, "self-respect." The system of military drill in our schools cannot be too widely diffused. The benefit of this, too, is wholly lost in a small school, as the numbers are too small to admit of the expense, and it is the nature of boys, more particularly of the lower order, to lounge and to become careless and idle in their walk and habits.

Have you observed any, and what differences in the rates in which children were got into productive employment, and kept there, or the the sorts of employment into which they were got, from the small union schools of which you were the teacher, as compared with the results that are obtained in the Forest-gate School?—In the small schools of which I have been the master the demand for boys was very small. Those who left me to take situations while I was at Malling were, with three exceptions, engaged in farm labour, and it was at all times difficult to keep up communication with them, from the precarious nature of their employment, such as cow-keeping in summer time, frightening birds from the growing crops in spring season, and, as a consequent result, would wander about in search of other employment so soon as those were over. I strongly object to this kind of labour for this class of boys. I always found that it never raised a boy; on the contrary, it made him loose in his habits, gave him every opportunity of mixing with bad companions, and training and education was lost upon him. The demand for boys to fill respectable situations was very scanty. During the whole time I was at Malling, one left as clerk in an office at Woolwich, doing well; one left as an apprentice to a grocer, doing well; and another, I think, to live in a gentleman's family; but with these three exceptions, during the four years and a-half at Malling, all the others were engaged for agricultural labour. The average number in each year that left the school for employment was about five, sometimes less. In the case of the three boys before alluded to, they obtained those situations through my own personal influence with friends. They are doing exceedingly well. The others I know nothing of. After a great deal of persuasion, I prevailed upon the guardians of the Malling Union to let me have a drum and flute band, with the view of training boys for the army and navy bands, and had I remained, I think I should have rendered it a success; as it was, I bespoke six vacancies in the 33rd Regiment, and one boy filled a vacancy, a week or two after I left,

in a regiment at Portsmouth; but, of course, a band cannot be made successful, to any great extent, only in large schools, as it requires much care in the selection of suitable boys, it being an essential point that a boy should be able to distinguish time and tune. In the Fulham Workhouse School, where there were a few more boys than at Malling, and being nearer London, the demand for boys was a little more brisk, as apprentices for tailoring and shoemaking, hair-dressing, and baking; but the school being small, I had but few suitable boys to select from, consequently the average result in a year presented a poor return; and in each case had the schools been large, I could have had a good school band, and transferred them into army bands; but the smallness of the schools in both cases, I feel persuaded, was the great hindrance to their success. In this school we have, on the whole, a well-sustained demand for boys as apprentices to the various kinds of trades, such as tailoring, shoemaking, &c., the guardians first of all ascertaining whether the situation is suitable for the boy, and he is from time to time visited by the chaplain for a period of two years after he has left the school; and we are enabled, in most cases, to follow up a boy for several years, and thus a wholesome influence is brought to bear upon the boy, and very few indeed are the cases where a boy fails to do well. The chief success of a large school like this, as regards the boys, is to be attributed to the band maintaining in regular training not less than 40 boys. There at once we have, in one branch of real productive industry, a small school averaging 40 boys; and with regard to the boys so trained, when once they had left the school and obtained situations as band boys in the army, they are well and permanently provided for, and having a good general knowledge of military music, combined with drill, are always sought for in preference to those not so taught and drilled. For instance, we sent six boys at one time, last year, into the 39th Regiment of Foot. There at once we cover the average return of those who obtain situations in a small school during a whole year; and many of these boys rise to good positions. One boy that I had in my school here, four years ago, is now the best euphonium player in her Majesty's Life Guards' Band, and others that I could mention have been very successful. Next to the band, our greatest demand is for shoemakers. Perhaps the subject of "supply and demand" is even better substantiated in the case of the girls. I might observe, in the first place, that there are but few applications for domestic service in a small school, and I have observed that they seldom remain long in one situation. This may, perhaps, in some measure, be owing to the fact that they are not watched after for the first year or two, and even when they obtain the situation, being so small a number to select from, a child is often sent ill-suited to fulfil the duties expected of it, and more than this, she has not had the advantage of being properly trained and taught for domestic service in a small school, for the very reason that the means are not deemed of sufficient importance, and are, therefore, not provided, for instance—cooking, house-cleaning, washing, &c. In a school of this kind, where everything must be done properly, and in a fixed space of time, a child acquires habits of quickness, care, and tact, so essential to their success. The demand here for servant girls is very considerable; oft-times we send one girl per week, for months in succession, and they are regularly visited by the chaplain in the same manner as the boys; and we have but few cases where a girl fails to become a good servant, and to advance her own interest in life. One girl, for instance, I could quote, whom the matron herself trained as a cook and general servant, has now a good situation as head-cook in a gentleman's family. I thought I would mention this fact, though it does not bear any particular connection with the question before me. With regard to the teaching in a small school, it is a well-substantiated fact that the teacher, for several months of the year, does not what is called teach in the proper sense of the term at all, but trusts rather to expediency. In this I have the ready assent of many schoolmasters; nor is the case so much a matter of surprise when we take into consideration the few scholars, and those with ages and intellects so widely differing; and it is a practice with many teachers to neglect, in these schools, teaching the boys at all until within a short time of the inspector's annual visit, when the cramming of a few of the principal facts into the boy is the only object sought, and more than this, many schoolmasters carry on a system of petty bribery, to induce them to "learn up" ready for the inspector's visit. Now, in a large school it would be almost impossible for this to be done, from the fact that the school is often visited by strangers. There is, as a rule, more than one teacher, and the inspector's examination is far more testing; and, too, the apparatus and general appliances of a small school are, as a rule, very defective, and, in many instances, wholly wanting. The same books are used in secular reading year after year, for instance, and thus a boy acquires a habit of reading from memory and rote, instead of gaining, by progressive standards, a well-grounded knowledge of words, from which good reading can only be attained. And, in a small school, too, the teacher gets very much dissatisfied with his position, and, on the first opportunity that presents itself, he seeks another field of labour, where he fancies at least he shall obtain better remuneration, and have scope to illustrate and develop the attainments which years of patient study seemed to demand.

SCHOOL-TIME OBTAINABLE FOR TECHNICAL EDUCATION IN SCOTLAND.

J. Morrison, Esq., Rector of the Free Church Training School, Glasgow.

1. What, under the best school-training in its present condition in Scotland, is the amount of attainment you may impart in the infant half-school stage, by three hours' labour per diem?—The infant-school stage may be taken as extending from four to six years of age; in addition to numerous lessons on objects, training mainly the faculty of observation. It is, in my opinion, quite possible, in the infant-school stage, to teach children to read a plain, simple, story with considerable fluency; to write on slate or paper the various letters, and to transcribe from their reading books to slate with fair rapidity. Ciphering, also, in its simpler ideas, might be taught.

2. What is the amount of intellectual attainments that one can impart by the best school teaching up to the age of 10½, when children of the wage-classes are required to be bread-winning?—Assuming that children make the attainments specified in answer 1, between the ages of four and six, there should be no difficulty in giving, in the next four years and a-half (provided the schooling is continuous), a sound elementary education in the ordinary branches, *i.e.* the power of reading English with ease and intelligence; the power of writing clearly and legibly; and of performing intelligently all the arithmetical operations required in the ordinary business of life. On the conditions supposed, much general information would have been communicated. As much attainment could easily be made by the age of 10½ as, under present general arrangements, is made by the age of 12½, *i.e.*, under a proper infant-school system, carried on to a properly equipped juvenile system, we might save two years before 12½ years, and have the work at least as efficiently done. I do not advocate this saving but on the assumption that children *must* be bread-winning when 10½ years of age. I can see no difficulty in the world, under proper administrative aggregation, and with a proper system of infant and juvenile school teaching, of giving them, before that age, a good elementary education—a better education

than the majority attain at present at the age of 12½ years.

3. What amount of attainment may be imparted after that to the boy or the girl of the shop-keeping or middle-class, up to the time when his assistance may be required in business?—The age for business may be taken as 14½ on an average. This allows four additional years of schooling to this class. Assuming that they have gone through the English and juvenile school system of queries 1 and 2, and have made at 10½ the attainments specified in last question, it is clear that the four additional years can enable us to accomplish much. In that time a thorough English education, including an acquaintance, more or less, with our literature, and a knowledge of grammar and analysis could be given. Arithmetic, history, and geography, and particularly some acquaintance with the elementary principles of science-instruction, *i.e.*, in some branch of technical education, could all be taught. By 14½, in one word, well-educated youths should be the rule, and not the exception, in all our schools. On the conditions specified, every child aged 14½ should be well educated.

	Age.	
(*a.*)	4 – 6	Able to read simple stories, spell simple words, write easy words, and know the figures and simple exercises.
(*b.*)	6 –10½....	Read well and fluently, write with ease and legibility, and do all the arithmetical operations required in common life.
(*c.*)	10½–14½....	In addition to *b*:—History, our own and general. Geography, our own and general. Grammar and analysis. Composition—write a plain letter. Drawing. Music; and more or less of science, say physiology, or the laws of health, &c.

4. What, in your experience of schools in Glasgow, would be the gain in time and teaching power of a common education for boys and girls?—The gain in time would be considerable; the gain in teaching power still more so. My experience leads me to the opinion that the influence of the sexes on each other in school tends to stimulate both. Voluntary attention is thus kept alive, and greater results will, in the nature of the case, follow. I cannot condescend upon any numerical expression of the gain in time. The gain in teaching power can be more easily approximated. If the boys and girls of the whole country are to be taught separately, it is evident that the teaching power must be increased to an enormous extent. Thus, merely by way of illustration, suppose each unit of the teaching staff capable of teaching 100 pupils, and that in any given school area we have 100 scholars of school age, one half being girls and the other boys, it is clear that one person could do the work, on the principle of common or mixed education being the rule, whereas, on the opposite principle, two would be required. The saving of teaching power would in this case be one-half. This figure is too high for the country taken in the aggregate, but in a large proportion of our rural districts, where the number of children of school age within any reasonable school area does not exceed 100, the figure may be taken as approximately correct. In town districts, and in thickly peopled manufacturing districts, the gain would not, of course, be so high. Still, looking at the relative proportions of the population in town and rural districts, I should be inclined to say that, on the principle of common education, there might be a gain of about two-fifths in teaching power in the kingdom as a whole, compared with what would be requisite were a separate education the rule.

5. Will you state any disadvantages of a common education under proper superintendence? I can conceive no special disadvantages. My experience on this point has been this—For 16 years I have been at the head of a school where, on an average, 1,100 meet daily, nearly equally divided into males and females, whose ages range from 4 to 24. During all that time nothing has occurred to lead me to alter the opinion which I strongly hold, that good, intellectually and morally, results from a common education. I assume that the superintendence is vigilant and constant, and that the moral tone of the school is high. Without these conditions, I would modify my opinion on the advantages of a common education after the age of 12 or 13.

GAIN OF TIME AVAILABLE FOR TECHNICAL INSTRUCTION IN ENGLAND.

W. T. Imeson, Esq., B.A., Head Master of the Central District Half-time School of London (with 500 boys).

What is the amount of attainment imparted in the infantile stage of from four to six years of age?—I do not impart instruction in the infant-school. Giving it as my opinion, I would state that reading and writing may both be acquired there, so as to be effective instruments of development, by children of six or seven years of age. Children, even in infant-schools, must be allowed a sphere for their own efforts. To observe with effect should be their great object. They are never too young for this. Under skilful management, a year or two passed in an infant-school may save years of instruction. Otherwise, except as preventing bad impressions, the time is lost.

What is the amount of attainment you impart from six to 10½ years of age?—The continuation of a course of judicious teaching and wise inspection will bring children of 10 years of age to the standard of development usually attained at the age of 12 or 13. The teaching must be thorough—not "fast" in the usual sense; and there must be no "cram," in the apprehension of the inspector's visit, nor forcing appliances to make the "system" pay. The time of the children's application must not be regulated by the teacher's power of endurance, nor must the value of teaching be estimated by the time over which a routine may be spread. Industrial pursuits, valuable in themselves, must not present industrial impediments to education. The half-time system is sufficient for all the purposes of ordinary education, and *cæteris paribus*—it is superior to the whole-time system.

What is the amount of attainment imparted from 10½ to 14½ years of age?—An extension of the scholar's time from 10½ to 14½ would admit of a very extended course on the half-time system. Habits of self-development should be fostered, so as to supplement the teaching of the master. It would render doubly effective what is too frequently lost to the pupil on leaving school. The amount of attainment secured would depend on the existing conditions of success. Reading, with understanding of the subject; arithmetic, including vulgar and decimal fractions; writing, geography, and history, with many important exercises, may be included in the half-time system. The fact that boys, from 10 to 14 years of age, are to be found pretty equally distributed in every class of a district school, does not interfere with the conclusions which suggest the above remarks, although they cannot by statistics be made available for popular conception.

PROGRESS AND STATE OF ELEMENTARY EDUCATION, IN ITS RELATION WITH SECONDARY EDUCATION, IN HOLLAND.

Dr. Lindo, Government Inspector of Primary Instruction in South-Holland.

In 1835, an English Poor-law Assistant-Commissioner, Mr. Tufnell, brought over to Holland with him another, Dr. Kay, and examined the state of primary education. They

were deeply impressed with the advantages of the system of training colleges and of trained teachers, and they succeeded in implanting that system in England, Mr. Tufnell devoting three years of his salary to aid the foundation of the first training-college there. Since that period, what improvements in national elementary education do you consider to have been made here?—The whole system of education was re-organised in 1857. No subsidies are now granted to denominational schools. The leading principle of the law now is, that all schools subsidised from the public funds shall be open to pupils of every religious sect. Article 23 of the present law requires the master to inculcate "all social and Christian virtues, and carefully to avoid all dogmatical religious instruction." At the same time, it is provided that, between the school hours, the school-room may be made use of for the religious instruction of the pupils by the ministers of the several religious denominations. The law further provides that, in every commune, sufficient primary instruction shall be given for the wants of the population, in the primary schools; the number of the schools to be regulated by the provincial states (which are equivalent to English counties), acting on the advice of the government inspectors; and all salaries are regulated in the same manner. No schoolmaster or mistress, or usher, can now be dismissed, except with concurrence of the district sub-inspector. Head-masters are appointed after a competitive examination by the district inspectors. The district inspector, after a competitive examination, selects from three to six candidates, out of whom the town-council appoints one. The ushers are appointed in the following manner:—The head-master, the burgomaster, and aldermen submit the names of three candidates for the approval of the district inspector, and the town-council elects one of them. The principle of the measure is, that the head-master has the greatest interest in appointing a good usher; but he is controlled by the district inspector, who prevents mere favoritism on the part of the head-master. The town-council retains the right of appointing its own officer. The sub-officers are dismissable in the same manner as the head-master. All public schoolmasters have retiring pensions on the following grounds:—That he has a right to two-thirds of his full pay after forty years' service, and attaining the age of sixty. If pensioned before this time, he has one-sixtieth of his salary for every year's service, with the proviso that the pension shall never exceed two-thirds of the salary. The standard of the qualification of the school-teachers is much higher than before 1857. No monitors are allowed to give instruction beyond the age of 18. They must then pass the government examination as ushers, or they must leave the school. They must be 23 years of age before presenting themselves for examination as head-masters. The examiners are the government inspector and four district government inspectors, assisted by such persons as they please to appoint. Formerly, the system was very defective in the securities for the efficiency of the teaching, the requisite qualifications, and the positions of the teachers. The law provided, too, for the now existing government training colleges.

What changes have been made in the organisation of the schools?—A great many; the law now provides that no more than 75 children shall be entrusted to the care of one master. In a school of from 75 to 100 there must be a pupil-teacher, and, for every fifty more, an usher. This is the law. Experience has, however, proved that no master can efficiently teach more than 25 pupils at once in elementary instruction. It is a fact, too, that, with our trained teachers, very few are first-rate practical masters in all the different branches. One will excel in teaching arithmetic, but be defective in reading and writing. The best lessons are always given in the master's favourite branch of instruction. The effect of this is visible in almost all our smaller schools. Hence, obviously results the great advantage of the division of the labour of instruction in our larger schools, where there is a better opportunity of allowing each master to teach his favourite branch.

Is it to be understood that the denominational schools, being necessarily for the greater part small schools, were of defective school organisation as compared with the neutral schools, in which the children of the different sects were brought together, and that an improvement in the amount and quality of the instruction has been the result of the change?—Most decidedly. The denominational schools, of which there are nearly as many as the public schools, are defective, too, in the following respects:—The law does not insist on any fixed number of masters for a certain number of pupils. There is, therefore, a very general want of teaching-power in such schools. There is also the defect that, whilst the law renders instruction in all branches of primary instruction obligatory in the public schools, the private schools, some of which are not denominational, are left entirely free in this respect. A great deal of the school-time, in many of these denominational schools, is wasted in efforts to teach religious dogmas utterly beyond children's capacities.

From your observation of the outcome of the neutral schools, can you aver that truly religious qualities of truthfulness in thought and action are maintained in them, and that a God-fearing population will be produced by them?—Most certainly.

How as to the school hours, under the present system, in Holland?—They are generally from nine to twelve, and from two to four; Wednesday and Saturday being half-holidays. This includes, however, instruction in music everywhere, and, in some cases, drawing and gymnastics, which sometimes are called relief lessons. But I am of opinion that, at schools where the teaching power is adequate to the number of pupils, a reduction of the school-hours would be most advantageous. The strain on the capacity of attention of a child between six and twelve ought not to be extended above one half-hour consecutively. Between every lesson there should be at least five minutes' rest. A lesson in grammar ought to be succeeded by a lesson in arithmetic or some other branch. Varying the subject eases the strain, and in many respects is equivalent to repose.

How many of these half-hour lessons do you find here can be given in a day?—Productively, six may be very well given.

That is to say with skill?—Yes, that is with intervening play-time and relief lessons, which may bring the school-time to between four and five hours a day.

It is to be collected that the tendency of your observation is to shorten school time?—Decidedly. In regard to the sanitary condition of the children, shorter time for sitting together on the school benches is desirable. In Holland, there is no compulsory schooling. It is a great mistake to assume that there is; and shorter school-hours would ensure more voluntary attendance. In summer-time, it would conciliate the school attendance with the demands for various out-door occupations; but, in winter-time, with us, the poorest classes of parents are well satisfied with long hours of school attendance for this reason alone—that their children are kept in warm rooms, the climate being very severe, and fuel dear.

By what years of age in your last organised neutral schools do you teach your children to read intelligently, to spell correctly, to write a plain hand, and get them through arithmetic, to decimal fractions inclusive?—Between eleven and twelve; including vulgar and decimal fractions, and the decimal system of weights and measures.

By what time, however, do parents of the lower classes take away their children?—They scarcely ever keep them beyond their twelfth year. In agricultural and in many manufacturing districts they take them away sometimes by the ninth, sometimes by the tenth year. A great deal very often depends on the influence of the local authorities on the mass of the

population. A good schoolmaster or a good burgomaster will sometimes induce parents to leave their children half a year or so more at school. Small rewards for regular school attendance I have found to be very efficacious.

Do you consider that you might, by school organisation, reduce the school-time in years?—Yes; I think this might be done, firstly by circumscribing as much as possible the instruction in history; and, in the second place, by abreviating other points of theoretical, and by no means practical, instruction.

Have you introduced physical training in your schools?—In the primary schools physical training is not compulsory by law, which is a serious defect; but it is generally encouraged, and is now becoming general. The schoolmaster who is duly qualified in gymnastic instruction, comprising the drill and the manual exercise, will obtain a higher rate of salary than another man. By the law of 1863, on secondary instruction, gymnastics and military exercises are now compulsory in all the public secondary schools. The beneficial effects are already visible in the improved physical condition of the pupils, and public opinion is entirely with the change.

Does not the improved teaching in the improved neutral schools furnish an improved basis on which to superinduce improved technical instruction?—Of course it does. The new law of 1863, for secondary (including technical) instruction is based on the improvement introduced into primary instruction by the law of 1857.

What amount of technical instruction are you now enabled to impart, up to the thirteenth or the fourteenth year?—The first technical instruction is given in the secondary schools of the lower class, called burgher day and evening schools. Algebra, geometry, common and linear drawing, and, at many schools, the elements of physics and mechanics.

What is the length of the course of study at these schools?—Generally two years. In the primary schools, however, there is some preparation for technical education, varying with the capacity and zeal of the teachers, who may do much in that way. In rural districts they introduce natural history; in manufacturing districts, physics to some extent. The whole turns upon developed special capacities and skill of teachers. We have frequently men who pass scholastic examinations very well, and utterly fail in practical skill and aptitude.

What is the present relative position of the new school teachers in Holland?—In large towns the masters are generally well paid—from £110 to £180 a-year, besides a house rent-free. The salaries vary very much in different parts of the kingdom; in some small villages they have no more than from £35 to £45, with a house and garden. If married, and with a family, their position is very sad. Every effort is being made throughout the country to raise the salaries, and much progress has been made in that respect in the last four or five years. Curates here are relatively just as badly off as the schoolmasters. Ushers very often change their profession if they can find an opportunity; the head-master very seldom.

May it be stated, then, that the progress of experience in Holland proves it to be necessary, for the advancement of national education, that it should be protected from the irresponsible rule of half-knowledge, or of positive ignorance or apathy—*i.e.*, the uncontrolled rule of the burgher (or the vestry, or the guardian class in England); that divided attention in supervision leads to inferior results; that progress can only be attained by undivided, competent, and responsible attention; that "as is the schoolmaster so is the school," and that every effort must be made to ensure the competency of the teachers, and to secure and advance their position; and that, to these ends, aggregations of pupils, for division of educational labour wherever practicable, is necessary; and that physical and mental training must go together?—Nothing can well be more prejudicial to national or any other education than the interference of unqualified persons, who worry the master, and cripple all his efforts. His superiors ought to devote themselves to their task quite as much as the schoolmaster himself. Another requisite is an influential social position. Parents, townsfolk, and authorities here in Holland, will (very often) not listen to the schoolmaster, but allow themselves to be advised and guided by the district or provincial inspector. "As is the schoolmaster so is the school" is so perfectly true, that the very first desideratum of a good educational law, in my opinion, is, that it should provide for the proper training of the teachers, and ensure them a comfortable livelihood. Aggregations of pupils for division of educational labour are requisite wherever practicable. Mental training, unless it go hand in hand with physical training, will only rear a race of wooden-legged, left-handed cripples.

What would be the effect in Holland of denominational inspection by three or four sets of denominational inspectors?—Denominational inspectors would be impossible in Holland. No dogmatic instruction is allowed to be given at the public schools, and the government inspectors take care that nothing is taught which could hurt anybody's religious feelings. (I refer to Art. 23 of the law, already mentioned.) Denominational inspectors would have nothing at all to do at the public schools; and at the denominational schools, the clergy of the sects they belong to give the tone they please to the religious instruction of the pupils.

What is found to be the intellectual and moral condition of children reared in the small denominational primary schools, when they are presented for admission into secondary or superior schools?—Very inferior indeed with regard to intellectual development, and morally they are certainly not a whit better than the others. The intellectual development is retarded—1st, by there being a great want of division of educational labour at the smaller schools; 2nd, by a great waste of time on dogmatical religious instruction greatly above the capacities of a child's brain.

Our difficulties in getting children into school in England will, it is expected, be met, as to artisans' children, by the application of the half-time principle; but compulsion will be needed in the case of the children of vagrants, or of abandoned orphans. It is expected to be necessary to force large numbers into institutions of the character of the district schools, where the failures now do not exceed three per cent. Is delinquency widely prevalent in Holland; and to the extent to which it is prevalent, how do you deal with the children of delinquents, or mendicants, or of the absolutely destitute—and with what results?—I should say not, to any great or abnormal extent. There are orphan asylums in all the towns, where great numbers of the destitute, who have lost their parents, are boarded and well educated. The children of mendicants and delinquents without means of subsistence, are sent to the two mendicant institutions (government establishments) at Ommerschans and Veenhuizen, where adult mendicants and vagrants are also provided for at the expense of the commune to which they belong (*i.e.*, of their birth-places). Both establishments are in course of improvement. The results obtained are by no means satisfactory.

Under the present voluntary system in Holland, what residuum is there of untaught children?

The last returns, published January 1st, 1868, give a residuum, for the province under my inspection, with a population of about 620,000 souls, of no less than 23 per cent. of boys between 6 and 8, and 29 per cent. of girls of the same age; of boys between 9 and 12 years of age, 18 per cent., and of girls, 24 per cent., who do not attend the day-schools. A small deduction from these figures must be made for those who are instructed at home, by private masters or governesses, perhaps 3 or 4 per cent.; but it is impossible to be quite accurate in this latter respect. About the same figures as the above form the average throughout the whole kingdom.

It must be taken into consideration that a very great number of the children who do not go to the primary school, between 9 and 12 years of age, have been to school before, and that a large number of the children between 6 and 8 have most likely been sent, between 3 and 7 years of age, to the infant schools. The education of all these is, of course, all but worthless.

The residuum is thus still terribly large, and a League has just been formed for promoting school attendance. The second meeting is to be held on the 27th inst.

The principal sources of the non-attendance at our schools are :—

(*a*). The ignorance of the parents, who are themselves incapable of appreciating the practical value of instruction. I have invariably found that parents who have had any instruction themselves, wish a higher rate of education for their children, and are generally willing to make sacrifices in order to obtain it.

(*b*). There is a great deal of poverty in the rural and manufacturing districts, besides a dearth of hands in agricultural pursuits. Child-labour is cheap, too, for manufacturing purposes, and there are but very few masters of large works who have established schools for the children's benefit. A law on child-labour in manufactories is a great desideratum here.

In rural districts one very great difficulty exists. In all seasons of the year, except the winter months, the children can earn a trifle, which their parents are too needy to give up. Some of the children referred to above as not visiting the day school, do attend the evening school, but in many cases very irregularly. A large number of villages are built along the dykes and canal banks. A population of perhaps 1,000 souls is spread over a straggling line of habitations three or four miles long. For some of the children the distance is too great on dark or wet evenings. Mud, snow, and wind, throw obstacles in the way of regular school attendance that are very difficult to overcome.

(*c*). Another cause of non-school attendance is sectarian intolerance. The Roman Catholic opposition to the public schools is no less violent here than in England. The priests very often exercise every opportunity of keeping the children from the public school; their influence on the lower classes is paramount. I know of cases in which, even where there was no Catholic school to which to send the children, many were entirely deprived of all schooling.

(*d*) Compulsory schooling in Holland is the only radical remedy I know of. There is no doubt of the efficacy of the compulsory system, and for some years it has worked with the best results in Prussia.

Is behaviour a topic of instruction in your infant schools in Holland?—Good behaviour and decent manners are inculcated in the infant schools.

To what extent has the principle of open competitive examinations, as a test for first appointments to the civil service, been applied in Holland; and what appears to be the probable effect of that principle on national education? — Competitive examinations have been introduced for most branches of the civil service, and with the best results. They are very generally approved, and will doubtless have excellent results on national education. The frequentation of the public schools is greatly encouraged by them; all mere favoritism is done away with; they encourage mental exertion and activity to a great extent. No man of sense can object to them. Competitive examinations precede appointments to military and naval cadetships, the diplomatic service, as government engineers (the civil service—the French *Ponts-et-Chaussées*), clerkships in the telegraph service, India civil service, Post-office, government accountants, &c., &c. The tendency is to introduce them into every branch of the service possible. The opposition made to them by the patrons of the denominational schools—and, of course, among these, in the very foremost ranks, by the Roman Catholics—is one of the best proofs to be given of the inferiority of their schools to the public establishments. The cry raised by them and the pietist Protestant sects is, substantially, "That the competitive examinations oblige parents to send their children to the public schools, and thus to act in opposition to their own religious convictions." This is called unfair on the part of the government, &c., &c. The only answer to be given is—"We want efficient public servants; competitive examinations enable us to get them. If you do not like our public schools, why not complete and perfect the course of instruction at your denominational establishments?" The examinations are perfectly fair and impartial, and no candidate is even asked to what creed he belongs.

EXTENT OF SCIENCE AND ART INSTRUCTION IMPARTED IN SECONDARY, HALF-TIME SCHOOLS IN HOLLAND.

Dr. Bosscha, Inspector of Secondary Education in Holland.

How much technical instruction can you impart in your best schools to pupils between $10\frac{1}{2}$ and 14, who have passed through the best elementary schools? (The same information is desired with regard to pupils between 12 and 14.)

The average age of pupils admitted to the burgher schools (artisans and tradespeople) is 12. The course of study is biennial, and is, on an average, completed on the pupil's attaining his 15th year. Thus my own experience only enables me to give a pertinent answer to the second part of the question, regarding pupils between 12 and 14. The programme of the instruction in these burgher schools is based on the supposition that pupils of 12 years of age can read and write well, and know the four rules of arithmetic, with decimals and common fractions. Instruction comprises :—

(*a.*) *Elements of planimitry and stereometry*, including the theorems respecting the volume of prisms, pyramids, the cone, cylinder, and sphere. Algebraic notation—sufficient for the comprehension of a simple formula.

(*b.*) *Mechanics.*—Simple machinery, theoretically explained, exclusive of calculation of friction, and illustrated by the principle of the conservation of energy. Laws of falling bodies. Relations between force, mass, and acceleration. Influence of friction on motion. Concussion of elastic and non-elastic bodies. Equilibrium of fluids. The law of Archimedes, and its application to specific gravity. Elementary notions of the gravity of air, the barometer, the law of Boyle, and air and water pumps.

(*c.*) *Physics.*—Elementary notions of dilatation by heat; thermometers; boiling and melting; electricity, lightning-conductors, electro-magnetism, telegraphs, mirrors, and optical glasses. It is considered essential to illustrate this instruction by experiments.

(*d*) *Chemistry.* — Composition of atmospheric air; combustion, water, distillation, chemistry in gasworks, ivory-black manufacturing. The principal chemical elements applied to industrial purposes, as, carbon, preparation of charcoal; sulphur, fabrication of sulphuric acid; chlorine, and bleaching substances; iodine, in its application to photography. Metals:—iron, copper, tin, lead, zinc, silver, and gold. The ores; metallurgy, the principal metallic salts, and the way of preparing them. Organic chemistry. Fibrous substances. Amylum,—sugar, alcohol, greases, some organic acids and basis; aniline colours.

(*e*) *Natural History.*—Anatomy of the human body (elementary). Characteristics of classes in the animal kingdom. More at length description of domestic animals.

(*f*) *Common and Linear Drawing* with pupils between twelve and fourteen is, of course, only elementary. At this age they have neither sufficient steadiness nor skill to accomplish a really good drawing. Most of the pupils,

after passing through the course of instruction at school, continue their frequentation of the drawing lessons for several years.

The lessons are given at these schools in the evening between six and nine, thus at most eighteen hours a-week. It is, however, to be remarked, that though the age fixed, as above stated, is between twelve and fourteen, most of the pupils are really older. This is the result of deficient preparatory instruction. They leave the elementary (primary) schools, in general, before their eleventh year, remain two or three years without any instruction at all, and then come to the burgher schools. They have, in many cases, forgotten most of what they had learnt at the elementary schools, and, in consequence of mental inactivity for so long a period, there is naturally a diminution of intellectual capacity. To remedy this, they are sent to a preparatory class, where they sometimes remain one or two years. There is, no doubt, however, that boys of twelve, properly prepared by elementary instructions, can master the above-mentioned subjects in two years' time. I can affirm this from my own experience. My opinion is, that technical instruction between ten and twelve years of age can be of little avail. This period is more adapted for the consolidation and extension of purely elementary or primary instruction, critical reading, theory of arithmetic, correct speaking, sound notions of history and geography.

Of what positions in life, chiefly, are the pupils who attend these evening schools; and in what sort of productive service are they engaged during the day?—This will be shown by the following summary of the pupils, trades and professions. On an average there are, of every 100 pupils, 47 apprentice-carpenters, joiners, cabinet makers, and coach builders; 17 smiths, instrument makers, and tinmen; 7 stone-cutters, masons, and plumbers; 5 statuaries, plasterers, silversmiths, engravers, and lithographers; 9 painters, glaziers, and workers of lacquered wares; 9 various trades; 6 pupil teachers, schoolmasters, merchants' and other clerks.

For what sort of service is the recited course of study found to qualify the pupils?—The plan of study is to impart general information, serviceable in all trades and professions. There is no preparing for any special trade or profession, but it forms clever and skilful men for whatever trade they follow. The object in view is to render the pupils capable of acquiring practical knowledge with judgment and intelligence.

Is the attendance increasing at these evening schools, or, as we should call them in England, half-time schools, &c.?—The attendance has been steadily on the increase—about thirty per cent., from 1868 to 1869.

What advanced result, in time, of imparting a given amount of knowledge to these classes of children, do you conceive might be obtained if the studies could be made to follow immediately upon the instruction of the primary schools?—In this case, according to my opinion, instruction at the primary school ought to be carried on till the twelfth year, as results from what has been stated above regarding schooling between ten and twelve. If this were carried into effect, pupils might be expected, in general, to have passed through the course of study above cited with their fourteenth year, which now happens but rarely.

THE FAVERSHAM SCHOOL UNION.

This is an example of the gain of teaching-power by union, which has been repeatedly visited and examined by members of the Council. Faversham has a population of from five to six thousand. The lower and middle-class children were at one time taught in the single-chambered schools of nine parishes, at from thirty to forty shillings per head for six or seven years of comparatively inferior teaching, to impart the three R's., which was only superficially applied as respects the wage-classes, who often required to have their children away before the teaching could be completed. By union (the formation of which is an instructive history), the whole of the children (about 900) were brought under one institution, comprising an infant-school; a primary school, or classes; a secondary school, or technical education classes; with the results—1st, of a reduction of the time of elementary teaching to one-half, or before the eleventh year, and the teaching of a superior order, including some instruction in elementary drawing and in music; and, 2nd, a gain of between two and three years of time for the technical instruction of the children of the middle classes, or for those who could afford to let their children remain longer. The commercial school, as it is called, gives "instruction in the Holy Scriptures, in general English literature, geography, navigation, land surveying, book-keeping, agricultural science, French, and such other branches of useful knowledge as to the trustees shall from time to time seem fit, so as to afford an opportunity of acquiring a sound religious, moral, and useful education." The cost of the teaching power, by which this was achieved by means of a subdivision of educational labour, is almost one pound per head per annum. The religious difficulty was overcome by providing that, if the parent of any child would send in a written request that the child should not be taught the church catechism, it should not be taught; but no such request was sent in. The governing body of the school union comprises the clergy of the several parishes, the ministers of the dissenting congregations (who are nearly one-third of the religious community), the mayor for the time being, and the trustees of a local charity the proceeds of which are applied for school buildings, &c. Provision is made for the promotion of advanced children of the wage-classes from the primary to the secondary school, and arrangements are in progress to combine the proceeds of the educational endowment for a grammar or superior classical school with the primary or the secondary school, so as to provide a superior education for the children of those professional persons, resident in the town, who can afford to let them remain beyond their thirteenth or their fourteenth year, and thus crown the local educational organisation.

The school union is open to the admission of children from the adjacent district, and gains by it. Some children come to it from a distance of between four and five miles. Farmers' sons, and agricultural labourers' sons, as well as shop-keepers' sons, come to it. The experience of the institution shows that an administrative area for education may be six miles in diameter, and families, including children for the infant school, go and return from distances of three miles daily. The elder children bring the younger to the infant school or lower classes, and themselves go to the higher classes, and, on their return, take home the younger children. The organisation admits of extension, and further reductions in time, and of needful improvement, by the addition of provision for physical training; but, as it is, the members of the Council who have visited and examined the school consider it to be a highly important typical example for study and wide imitation, providing educational advantages, not otherwise attainable at any moderate cost, for the adjacent rural population. The following gives the numbers and the social position of the pupils taught in the classes, and also of the cost of the teaching power per head when it was last visited:—

PRIMARY SCHOOL.

Sons or daughters of		Agricultural labourers......	244
,,	,,	Artisans..................	412
,,	,,	Dredgers, sailors, &c.	122
,,	,,	Operators in cement or gunpowder works	134
,,	,,	Brickmakers	113
		Total......	1,025

Secondary or Technical School.

Sons of Professional persons	21
,, Ship-owners	4
,, Farmers	12
,, Tradesmen	52
,, Artisans	12
,, Clerks	7
Total......	108

The cost per head was as follows:—

No. of Scholars.	Time of teaching.	School expenses.	Total cost per head.
1,025	About five years.	£ s. d. Masters & mistresses 351 5 0 Assistants .... 250 7 11 Pupil teachers ...... 220 0 0 Monitors .... 69 4 6 Expenses............... 172 10 0	About £5 3s., including the infant school.
		Annual cost per head 1 0 9	

The total cost of the separate teaching in the smaller schools would be more than double.

ADMINISTRATION OF EDUCATIONAL FUNDS.

Illustrative Tables by W. T. Imeson, B.A., Head Master of the City of London Central District School.

TABLE A.—Shewing the Distribution of Funds in Education, and the Diminution in Cost per head, for the Elementary Education of each Child, by the Superior Organization of Large Schools as Compared with Small, and the Consequent Lessening of the Time of Teaching by Years.

No. of boys in each school.	Graduated Payment of Masters in Large Schools.								Yearly salaries paid to Masters.	Yearly current expenses.	Yearly cost per head.	Time in Years.	Total cost per head for an elementary education.
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.					
									£		£ s. d.		£ s. d.
50	80	..	..	..	..	..	..	..	80	30	2 4 0	7	16 8 0
100	100	60	..	..	..	..	..	..	160	35	1 19 0	7	13 13 0
150	115	75	50	..	..	..	..	..	240	40	1 17 0	6	11 4 0
200	130	80	60	50	..	..	..	..	320	45	1 16 6	5	9 2 6
250	140	85	65	60	50	..	..	..	400	50	1 16 0	4	7 4 0
300	150	90	70	65	60	50	..	..	480	55	1 15 8	3	5 7 0
350	160	95	75	70	60	50	50	..	560	60	1 15 5	3	5 6 3
400	170	100	80	75	50	50	50	50	640	65	1 15 3	3	5 5 9
1,800	..	..	..	..	..	..	..	..	£2,880	..	..	..	..

TABLE B.—Distribution of Funds and Diminution of Cost, under an Improved and Effective System, in Large Schools as Compared with Small.

No. of boys in each school.	Graduated Payment of Masters.								Amounts paid to Teachers.	Expenses incurred.	Yearly cost per head.	Time in Years.	Total cost per head with large schools and improved system.
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.					
									£		£ s. d.		£ s. d.
50	80	..	..	..	..	..	..	..	80	30	2 4 0	7	16 8 0
100	100	60	..	..	..	..	..	..	160	35	1 19 0	7	13 13 0
150	115	75	50	..	..	..	..	..	240	40	1 17 4	6	11 4 0
200	130	80	60	25	..	..	..	..	295	45	1 14 0	5	8 10 0
250	140	85	65	50	25	..	..	..	365	50	1 13 2	4	6 12 8
300	150	90	70	55	50	25	..	..	440	55	1 13 1	3	4 19 3
350	160	95	75	60	55	50	25	..	520	60	1 13 1	3	4 19 3
400	170	100	80	65	60	55	25	25	580	65	1 12 3	3	4 16 9
1,800	..	..	..	..	..	..	..	..	£2,680	..	..	..	..

Explanation of the Tables.

Preliminary Remark.—It is necessary to have units of measurement in all comparative estimates of this kind. We assume, therefore, that 50 boys be a unit of work for one master, that £80 be a unit of pay for one master in a small school, and that £5 per annum be a unit of increase for the current annual expenses caused by every addition of a unit of work. Different units may be assumed, but they do not affect the final result.

Table A.

1. *No. of Boys in School.*—This column represents 8 schools, each increased by 50 boys. The total number is 1,800. This would give us 36 small schools, with one master to each, having altogether 1,800 boys.

2. *Graduated Payment of Masters.*—From the table, it appears that the sum total of the yearly salaries paid to the masters is £2,880. This is also the amount paid to 36 masters of small schools, each receiving £80. This comparison is made under the supposition that the whole of the masters are competent, and not pupil-teachers. The latter are introduced in Table B. The effect of this distribution of salaries, on education generally, has been elsewhere shown.

3. *The Yearly Current Expenses.*—In this column Mr. Allen's estimate has been graduated, so as to give £5, as additional expense, for every increase of 50 boys.

4. *The Yearly Cost per Head.*—This column shows the cost, after adding together salaries and current expenses, as seen in the two preceding columns. The decrease in cost is remarkable, for it comes out irrespective of time saved by organization and improved methods.

5. *Time in Years.*—The graduation of this column depends on the school results produced. It will be sufficient to state, from experience, that seven years' work in the schools may, by organization and improved methods, be reduced to three.

6. *The Total Cost of Elementary Education.*—This is the yearly cost, multiplied by the number of years at school. The improved organization and methods that would follow the formation of large schools, and the introduction of a better system of paying and rewarding the masters, would lessen the time of teaching, and, consequently, the cost per head, as seen in this column. Those taught in three years do not cost a third of those that spin out seven years in getting the same amount of knowledge imperfectly.

Table B.

This shows how Pupil-teachers may be introduced, so as to lessen the cost to a fourth, instead of a third, as in Table A. To what extent the Pupil-teacher system may be introduced, is a question that requires separate consideration.

The following is interesting, because it shows how nearly the same result may be obtained in very different ways. In one way the Pupil-teacher system is prominent, in the other that of Masters:—

	Boys.	Teachers, &c.	£ s. d.	Time in Years.	Total Cost. £ s. d.
Mr. Allen. (Vide Table published by Society of Arts, March 4, 1869.)	40	Master and Mistress	70 0 0	7	16 10 0
		Monitor	2 10 0		
		Expenses	30 0 0		
	400	Master	180 0 0	4	4 0 0
		One assistant	70 0 0		
		Six pupil-teachers	90 0 0		
		Expenses	55 0 0		
Mr. Imeson. (Vide Table B. above.)	50	One Master	80 0 0	7	16 8 0
		Expenses	30 0 0		
	400	Head Master	170 0 0	3	4 16 9
		Five Assistant Masters	360 0 0		
		Two Pupil-teachers	50 0 0		
		Expenses	55 0 0		

In the latter case, the well-paid effective staff can do their work in three years instead of four.

Application.

There is a school in a village of Middlesex where there is accommodation for 70 boys, *i.e.*, for 40, and, by an act of grace on the part of the trustees, for 30 more. This extension appears to be quite in accordance with the wishes of the founder, still many are excluded for want of room, although three-quarters of an acre is attached to the school, and there is a field near, of about four acres, belonging to it, more eligible for building. Taking a circuit of three miles from this school as a centre, there are many hamlets to be found, increasing in population, with only one or two national schools, the rest being merely infant schools. From this village, children, excluded from school for want of school accommodation, are to be seen going two or three miles to get the means of instruction, while at the same time the funds of this village school have accumulated to the amount of ten or twelve thousand pounds. With a good site, large funds, and a proper sphere, what hinders the community from enjoying to the full extent that boon which it was the evident purpose of the founder to bestow?

ADMINISTRATION OF FUNDS FOR EDUCATION.

TABLE ILLUSTRATIVE OF SCHOOL ORGANIZATIONS FOR THE AUGMENTATION OF EFFICIENCY WITH REDUCTION OF EXPENSE.

[In this Table—which has been prepared on request by Mr. T. P. Allen, an experienced and skilful teacher who had charge, under Earl Russell, of an Elementary School at Petersham—it is assumed that the pupils enter school at seven years of age. At the end of the several periods mentioned in the third column, they would write a clear hand, and would read intelligently, and would be capable of passing with credit the ordinary Examinations in Arithmetic approved by the Privy Council; they would have thoroughly mastered the usual rules, including Proportion, as far as Decimal Fractions inclusive.]

No. of Scholars.	Annual Cost per Head.	£	s.	d.	Time of Teaching.	Total Cost per Head.
40	Master and Mistress*	70	0	0	6 to 7 years	About £16 10 0
	Monitor	2	10	0		
	Expenses†	10	0	0		
	House Rent‡	20	0	0		
	Annual Cost per Head	£2	11	3		
70	Master and Mistress..	75	0	0	7 years§	About £12 10 0
	One Pupil Teacher	15	0	0		
	Expenses	15	0	0		
	House Rent	20	0	0		
	Annual Cost per Head	£1	15	6		
120	Master and Mistress..	105	0	0	6 years	About £9 0 0
	Two Pupil Teachers..	30	0	0		
	Expenses	25	0	0		
	House Rent	25	0	0		
	Annual Cost per Head	£1	10	10		
200	Master	135	0	0	5 years	About £6 0 0
	Four Pupil Teachers	60	0	0		
	Expenses	35	0	0		
	Annual Cost per Head	£1	3	0		
400	Master	185	0	0	4 years	About £4 0 0
	One Assistant	70	0	0		
	Six Pupil Teachers	90	0	0		
	Expenses	55	0	0		
	Annual Cost per Head	£1	0	0		
700	Master	240	0	0	3 to 4 years	Nearly £4 0 0
	First Assistant	110	0	0		
	Second Assistant	70	0	0		
	Twelve Pupil Teachers	180	0	0		
	Expenses	100	0	0		
	Annual Cost per Head	£1	0	0		

* It will be seen that no mistress is allowed when the number of scholars exceeds 120. In those cases separate establishments are maintained for boys and girls.

† By Expenses is meant disbursements for Stationery, Cleaning, Repairs, &c.

‡ Small Schools, especially in the case of the so-called National Schools, are usually provided with teachers' residences. In estimating cost, therefore, in the small schools, we must include a fair per-centage (£5) upon the capital employed in the construction of the residence, the teacher's income being affected to the full extent of the supposed rental.

§ A school of 70 is perhaps rather more obstructive to progress than one of 40. In the latter, though the organisation is necessarily very imperfect, the surveillance of the master can be more readily directed to every individual. In much larger collections this advantage in favour of a small number is much more than counterbalanced by the constant general supervision of the master, by the aptitude and intelligence of his subordinates, &c.

Society for the Encouragement of Arts, Manufactures, and Commerce.

EDUCATIONAL ORGANISATION.

In the instructions which the Council adopted for the delegates to the two educational congresses, it was suggested that examinations should be made of the state of education in different districts, and of the means of improving it. Instructions for that purpose have been prepared, and one specimen report, made in compliance with them, has been completed, and other reports are in progress. The special attention of members of Parliament, and others interested in the education question, is solicited to the documents appended hereto. In the preparation of the instructions, which would serve as an example of a direct official initiative of a local educational reform, the Council had the advantage of the official services of members of considerable experience in the initiation of local administrative reforms. The document displays what appears to be the most eligible mode of making those in question by responsible officers of special aptitudes, acting under a competent superior authority. The first district examined, Ealing and Brentford, Middlesex, was selected accidentally, without any special reason except that of immediate convenience. To some extent it may be exceptional, but it nevertheless presents important common characteristic elements requiring to be dealt with, and a mode of determining for the application of practical measures, their nature, and relative extent. It is common to represent that one-third, or even one-half of the children of the school ages attend no school. It may be so, but here the proportion appears to be about one-sixth. The importance of defining by such inquiry the proportion of the children to whom the question of compulsory powers—the means of cutting up hereditary mendicancy and delinquency by the roots—is applicable, will be very evident. But the examination of the quality of the education extensively given to the middle-class children, as well as the children of the wage-class, and the time and expense at which it is given, and the large need and means of improving it, is fraught with conclusions of the highest public interest. The report will serve to show, on the one hand, how imperfect the knowledge of itself and of its position the locality has got or is likely to get from within itself; how little better execution can reasonably be expected from any mandatory direction addressed to it, than appears to have been given to the provisions of Mr. Denison's or Mr. Adderley's Acts; and how unapt are proved to be the executive hands within it for the initiation or the unaided prosecution of efficient measures of reform; and, on the other side, the loss of money as well as time that must be expected to be incurred by additional grants of money, to be expended separately by school managers, under the existing fragmentary and unsystematised local arrangements. Nevertheless, the materials for the constitution of a good local supervisory authority, for the direction of a superior secondary education of the children of the middle classes, in common with the

advanced artisan, may be pointed out as of important promise derivable from the report.

The statement in the report, on the expenditure within the district of £15 per family for drink, as against 15s. per family for elementary education, may appear to be exceptional; but it is proper to state that the estimated expenditure on drinks and tobacco—of which tobacco makes about 11 per cent.—amounts to more than £13 for every adult male in the United Kingdom, or about one hundred millions per annum,* against which expenditure is to be set some three millions of additional expenditure needed for a national system of secondary as well as primary education.

The importance of similarly conducted inquiries in districts under varied conditions will be of evident service, as a means of guiding public opinion and legislation, and the Council invite the volunteer service of heads of training colleges and practical educationists for the purpose.

Special value is attached to the information obtained from Mr. Coghlan, the director of the Home and Colonial Training School, and to his statement of his observations on the results of infant school teaching, in elucidation of its position in national education.

* *Vide* article on "Self-imposed Taxation," by Mr. S. Smiles (Appendix to the "British Almanack" for 1870).

The Instructions for the Inquiry referred to above, and on which Mr. Allen's Report, p. xi., *is founded.*

Sir,—

The Council refer you to tables made from practical knowledge of school organization, to illustrate the principle that school teaching is, in time, in efficiency, and in economy, very much as the numbers taught, by means of a division of educational labour in simultaneous class teaching.

1. They would be glad if you would take some convenient district comprising an area of three miles radius (which, in various practical examples, is found to be a distance from which even infant school children are brought), and examine and report on the application of the principle, as the means of advancing the education of the population within it.

2. The special object of the Society is the advancement of art and science instruction, as extensively as possible, amongst the population. For this purpose, it is proved to be necessary to improve and to extend primary elementary education, together with secondary education, amongst all classes of the community.

3. You will, probably, not have much difficulty in obtaining, with sufficient correctness, the numbers of children who now attend the schools within the district, the time they generally stay at the school, and the average amount and quality, and expense of the instruction the teachers are enabled to impart to them within that time. It is especially desired that you should ascertain, as closely as may be, what science, art, or technical instruction is obtained before the end of the 14th year, by scholars of parents of the middle class; and what numbers of scholars there are, within the district, of the gentry or professional classes, who obtain suitable education within the district, or elsewhere, and at what cost.

4. In respect to the numbers of children within the district who are not at school, it may be assumed for the present purpose, that the numbers living at the several school ages, bear the same proportion to the population of the district that the children of the school ages were found to bear to the total population of the country at the time the last census was taken, viz.:—

Years of age.	Proportions per cent. to total population.
3	2·55
4	2·53
5	2·43
6	2·37
7	2·31
8	2·26
9	2·21
10	2·17
11	2·12
12	2·08
13	2·04
14	2·01
15	1·98
16	1·96
17	1·94
18	1·92
19	1·90

With respect to those children who are not at school, it will be desirable to get, with the aid of the police, an enumeration under the heads set forth in Appendix I.

5. Of those children who are not at any school, and who are not the children of mendicants or

vagrants, you are requested to ascertain, by house-to-house inquiry, from the parents of such a number as may appear to afford fair instances for general conclusions, as to why they do not send their children to school; whether on allegations of poverty, and whether the parents are in receipt of parochial relief, or whether from the need of the children's productive service, or for domestic service, or how otherwise. Missionaries accustomed to house-to-house inquiries, and relieving officers, may be asked to aid the inquiry, or to check the returns of the answers.

6. In the instances where the children's productive service, or domestic service, are the alleged causes of the absence of the children from school, you will try and ascertain—

(*a.*) To what extent voluntary attendance would be conciliated by a reduction of the school hours to within three hours a day on the half-time school principle.

(*b.*) To what extent the school attendance would be promoted, by making employment within the district conditional on three hours of daily attendance at school, on the principle of the Factory Act.

(*c.*) To what extent voluntary attendance would be conciliated in the primary schools, or up to the 11th year, if the teaching were free.

(*d,*) To what extent the application of some compulsory provision for school attendance would be necessary, to ensure the attainment of the condition that every child within the district shall be taught reading, writing, and arithmetic, and receive religious instruction.

You will at the same time ascertain how far the existing legislation for the education of destitute children has been attempted to be applied, or why it has failed to be applied? viz.:—

For children of in-door paupers, the Acts 7 and 8 Vict., c. 101, and 11 and 12 Vict., c. 83, empowering guardians to draft their workhouse children into district schools.

For children of out-door paupers, Mr. Evelyn Denison's Act of 18 and 19 Vict., c. 34, enabling guardians, if they think proper, to pay out of the rates for the education of children in ordinary day schools.

For vagrant children, Mr. Adderly's Industrial Schools Act (1857), the 21 Vict., c. 48, and 23 and 24 Vict., c. 108, allowing magistrates to commit vagrant children to such industrial schools as benevolent people might have founded, and got certified for the purpose of these Acts.

7 Having ascertained proximatively the numbers of children who do not attend any school, and the total numbers within the district for whom an improved education is now required, you are requested to consider—

(*a.*) How far the example of the Faversham School Union is available for the district.

(*b.*) How far the existing school buildings are available for classes of children; and what additional school room appears to be needed.

(*c.*) Also, what ground is needed and available for drill and physical exercises. What charitable endowments appear to be available for contribution to educational purposes within the district.

8. You will state proximately what may be the expense of teaching-power required for the district, to what extent the time of elementary teaching may be reduced, and what may be imparted, and at what annual, and at what total expense per head, as compared with the present system, before the end of the eleventh year; and what amount of art and science instruction, or preparation for it, may be imparted before the fourteenth year, and at what total expense per head. Assuming that the condition of the trained and certificated teachers within the district needs improvement, you will state how far their interest may be better conciliated to their duty, (1) by a capitation grant of an allowance per head on each child of the wage-class who gets into service and keeps it for more than a year, in respect to whom the employer gives a satisfactory certificate; (2) in respect to children who remain to their fourteenth year, a capitation grant per head of all who pass a satisfactory art and science examination.

9. You may ascertain whether the services of the Union chaplain might not be available for the religious instruction of the children of Church of England parents; or how otherwise religious instruction might be improved.

10. You will, in your estimate, include the service of some one of a position to make visits to the parents of children, and especially the parents of children of the poorest persons (*vide* Appendix II.); to visit the places of work where destitute children may be sent; and generally to visit the employers of labour, and keep the school teaching as much as possible in relation with the service in demand.

11. You will also estimate for teaching military drill, elementary drawing, and vocal and instrumental music, to the children.

12. You are requested to distinguish the gain in time, in result, and in money, derivable from a better arrangement of the existing buildings and educational means, for the existing numbers who are already under education within the district.

13. In case a school-rate should appear to be necessary to ensure the attainment of the condition that every child within the district shall receive primary instruction, you will state how much that rate would be, or what it would amount to as a capitation tax. You will learn at the same time to what extent excessive

drinking habits prevail amongst parents of the wage classes, and consume the means that would be applicable to the education and to the better care of their children.

14. In your estimate of the additional school room, you will take into account the eligibility of the half-time principle, as extending the use of the existing buildings for additional numbers, in double sets, as now experienced in America. (*Vide* account given by the Rev. Mr. Fraser of the introduction of the half-time system there. Appendix III.)

15. Assuming a local education Board for the supervision of the application of the educational fund, to be eligible on the principle of the Faversham School Union, and to comprise, as *ex-officio* members, the ministers of religion, and the managers of the existing schools, will you ascertain what members might be added to it from existing representative bodies, and state how many might be added, and with what qualifications, by direct election?

16. You are requested to state how far additional securities are needed, for obtaining educational results from the existing public expenditure upon the schools.

Where additional school room is required, it may in general be estimated at £3 per head.

You are requested to confine your conclusions to the exact relevant facts, so far as they may be ascertained, with relation to the one district examined and reported upon. Nevertheless, you may report any prevalent opinions you may meet with as to the need of compulsory provisions and as to an education rate, or other points under public discussion on the question.

In making your report, you are requested to give the data upon which you base your opinions and estimates.—I am, &c.,

P. LE NEVE FOSTER, *Secretary.*

APPENDIX I.

It is requested that the police of the district will ascertain by observation—

1. The numbers of children of the school ages, or between the apparent ages of three and fourteen years of age, or the age of puberty, who, during the school-hours are loitering about at their doors, or are found in the streets or in the fields.

(To check the returns, the numbers should be taken on two days in the week, not the days of half-holidays, Wednesday or Saturday).

Of those children not at school there should be distinguished (1) the number of the children who appear to be, or are known to be, engaged in any and what sort of service, or waiting for it, and to be the children of parents in honest courses.

2. The children above eleven years old, of poor but honest parents, but which children are doing nothing, and are idle from want of aptitude for service, or from other causes.

3. The children of parents who are in work, but who are habitual drunkards.

4. The children whose parents live in beggars' or common lodging-houses, or in brothels, or in low beershops, or in marine store dealers' or receiving houses; the children of tramps, children who beg, or are known to pilfer, or are suspected of pilfering, or are otherwise in bad courses of future delinquency.

5. The total number of children in the district in respect to whom, in the view of the police, the immediate application of special compulsory provisions for industrial training and education, fitting them for honest service, is expedient and necessary.

Note.—In respect to the children of the married men and officers of the police of the district, any observations are solicited as to the character of the schooling found available for them—what it is—whether satisfactory or not.

APPENDIX II.

Out-Door Service needed for the Promotion of Education.

1. It is a great mistake to speak of "primary education" in its widest generality as if it were all of a sort, and all successful. Of the accepted lower-class elementary education, a large proportion is unsuccessful; even denominational and religious education, even under trained masters, as in many of the Poor-law unions, where the children are often ill-trained, and few of them get into habits of self-supporting industry. A competent examination of what is taught, and the modes of teaching it, and of the general training of children in these places, under the auspices of the guardians, will leave little surprise at this.

2. One great cause of these educational failures appeared, under the Poor-law Inquiry Commission, to be, that the knowledge of many of the school managers and teachers was very much bounded by the four walls of the school, and that they paid little attention to the future necessities of the pupils, as to what service they were to be put after leaving the school. The first step for amendment appeared to be, to bring the school in good relation to the place of service. For this purpose, some years ago, circulars were issued to the employers of the children who had been brought up in some primary schools under the Poor-law Guardians, with an inquiry to this effect:—"You have had in your service a child who has been reared in school. Will you state from your experience any defects which may be preventible in the training of

other children?" One immediate result of these inquiries was to show the low state of education, and unfitness of a large proportion of the employers for the care of children, which was confirmed by visits made by the Poor-law chaplains of the district schools to the places where the children were put out, when it was made evident that many of the places to which they had been recklessly sent by the guardians were of a sort to ruin almost any children, however trained. The girls were much in demand as servants for low beershops, or for low lodging-houses, and were used for the lowest purposes.

3. These inquiries led to the adoption of a provision that the union or the district school chaplain should visit the abodes of persons applying for the service of the children, and ascertain, as well as he could, the fitness of the places for them. This provision served to put a stop to one large source of the ruin of the children previous to training, and to enable the chaplains to save numbers of girls from sin, by saving them from sinful places.

4. But extensive observation leads to the conclusion that the inquiry into the fitness of places for the employment of children should be carried much higher for the children of the artisan and the middle classes, and should be systematised into an inquiry under an interest to fit the training of the school to the most eligible places, and to increase the efficiency and practical success of that training. The first proceeding requisite, however, is to get together the whole of the raw material to be operated upon in the training school, and the larger the aggregation the better, all separation being loss to *the many* by thinning and weakening the classes; and it is still a greater loss to *the few* generally by the destruction of the power of proper simultaneous class teaching.

5. But in respect to a large proportion, most frequently the greater proportion of the nonpauper children of the wage-classes who do not attend school, it will be requisite to ascertain, by a previous house-to-house friendly inquiry, the causes of their absence. This should be made by some one having authority in relation to the school. It may be made by the school chaplain, or by the head-master, or the Rector, as he would be called in Scotland. It should be a person in authority, of a position and with power to give weight to his exhortations. The common answers to the inquiry—"Why do you not send your children to school?" will be the allegation of some domestic needs, or the needs of productive service to augment the income of the family. To obviate those difficulties, the parents may be told, "Your children are not required for the old long six hours, but only for a half-time class of three hours; and it may be arranged that one child shall be sent with the morning half-time set; and the other child with the afternoon half-time set, or to the alternate-day half-time set." To the objection in a rural district, that the boy is engaged by the farmer for bird tending, the answer may be that a double set will be proposed; and that an effort will be made to arrange with the farmer to take a second boy in the same day; or if at first that cannot be arranged, for one on alternate days; and this should be done by application to the farmer, who may be told that it is an arrangement which "my lord" or "my lady wishes" to be made; and, moreover, that an order is expected soon to be issued on the half-time principle, which his friends at the school board wish he would anticipate.

6. An active, zealous, competent, and influential inquiry, acting by arrangements on the out-door half-time principle, would in time usually so far conciliate voluntary school attendance as to leave little for any compulsory action, except with the absolutely vagrant, mendicant, or the delinquent class. In respect to this class, the chaplain or other officer having ascertained their number definitely, it would be for him to arrange with the poor-law authorities for the reception and care of children of this class, and with the police, for their removal, with the sanction of the magistrates, under the authority of the Acts already provided them.

7. Assuming the educational reorganisation of a school district to be completed, and the children to be all in school, the next consideration is as to how soon they may be prepared, by teaching and training, for leaving it for the best available productive service—it being previously ascertained, as closely as possible, what that service will be. The school chaplain, head master, or Rector, would soon become known in the district, as the head of a juvenile labour mart, to whom employers in need of service would apply. He would make himself acquainted with the aptitudes of the children, and it would be his duty to make friendly visits to the mothers or parents of the children, and inquire from them for what they destined that promising child of theirs, and, if they have no destination, to offer them advice, or tell them of any opening he knows of for it; and on ascertaining the destination of any class of children, he should, as nearly as might be practicable, direct the special instruction of the school to it.

One great advantage of the organisation of schools on a large scale is that they bring forward varieties of aptitudes for notice which are overlooked in small schools, where there are, and scarcely can be, any systematical development and observation of them. A genius for mechanics or for drawing is lost where neither are taught. The teaching in large classes in the

secondary schools might appear to be productive of a level uniformity of results; but it does not. Practically it evolves varieties of capacities, often to the surprise of the teachers. And these varieties of aptitudes would be brought forward and applied under the arrangement proposed.

8. The head master or school manager would also put himself in relation with the chief employers of labour, of secondary or superior as well as of primary service, whether manufacturing or commercial, and ascertain their wants, and, where the demand was sufficiently numerous to form classes, to take steps to provide for them and to obtain special art, science, or technical instruction, as it might be. For those destined to agriculture he would provide appropriate lessons, and so with those destined for the arts and manufactures.

9. He should regularly visit the places to which boys from the school have been sent, and inquire from employers how they answer expectations; and upon ascertaining defects of the outcome, take steps to have them remedied, and this in relation to the outcome of the secondary as well as the primary school teaching and training.

10. Actual inquiries at counting-houses as to the outcome of large endowed schools, as well as the results of competitive examinations, are demonstrative of the worse than waste of time in those schools, from ignorance or indifference as to the actual needs of service to be provided for in them. Supercilious objections are made to such a course, that the object of education is to do something more than to fit the pupils for the office or the shop. For whatever else they may be fitted, they must be fitted for these if they are not to be fitted for the insolvent court, or as family paupers in life-long vicious and painful dependence as "ne'er-do-weels," of which the affliction is so widely spread amongst the middle classes of this country. A clergyman, the son of a peer, stated to Dr. Temple, when head-master of Rugby, his intention to send his son in for a competitive examination for the Royal Engineers; on which Dr. Temple advised that the youth should be sent elsewhere for a special scientific training. Such is the advice needed by parents of higher as well as of lower condition. Being informed that a large machine-maker at Rochdale, who employed some four hundred workmen, had discontinued employing any other than "half-timers," inquiry was made of him by a member of the Council and also by a clergyman, as to the particular grounds of the employer's preference of the half-timers, when he stated that he could only state that he found their general aptitudes so decidedly superior that he said—"Now if each of you gentlemen were to bring me a son of yours with a premium (presuming that they were the same as the sons of gentlemen of your class), I would not take them, and would take half-timers for nothing in preference; for I well know the difficulty there is in dealing with young men of your class. It is almost necessary to stand over them and guide their pens for them." Similar accounts are received of the inaptitudes engendered or left by the teaching in superior schools, from the heads of manufactures requiring science and art in their processes, and so also from the heads of large commercial establishments. They complain that, from great classical schools, which have their annual recitals and displays of eminent scholarship, the scholars come to the counting-house with arithmetic that is worthless, and that they must re-teach themselves if they would get on; and that, although they may have been taught modern languages, they have been so ill-taught that they cannot write correctly a foreign letter, and that, though they may know good Latin, there are few of them who write good English. Hence they are frequently beaten by boys whose education has been in infant and in large national primary schools. This unfairness as towards the middle classes will be only prevented, at all events as to the greater proportion of them, by a common start, in large primary and secondary schools, which are kept in close relation with the art and science demands, the manufactory, or the counting-house, by constant communication with them from the school.

11. It is to be borne in mind that, the more closely the lessons of the school are brought in relation to direct practical and profitable application, the more interest is excited, and the teaching quickened, and the labour of the teacher lightened.

12. The distinguished success of the district schools is due to such cultivation, very much by Mr. E. Carleton Tufnell, who has been enabled to see, on a large scale, what was wanted, and to get provision made for it.

13. The influence of the school chaplain, or of the school teacher, and of the school with the lower classes as well as with the pupils, it is to be borne in mind, will be enhanced when it is perceived that he is a man who may find places for them.

14. In relation to the children of the classes who do not now attend school, it is very generally assumed that they can only be got to school by the apparently hostile agency of the policeman. The agency of what is called a "boys' beadle," of a retired policeman, has, it is stated, been used successfully for bringing into the schools gutter-children of the vagrant class. It may, however, be confidently anticipated that the friendly agency of a clergyman, or of a head master, would be the most efficient with

the wage-classes. At all events, the more benignant agency should be applied in the first instance. It would frequently occur that the services of the union chaplain would often be eligible for the purpose, with an addition to his stipend. The preference expressed for the services of clergymen is on administrative grounds mainly, and from observation of their success in the instances of their secular services in district schools. Where sectarian feelings happened to be widely spread, and a strong objection was entertained to a Church of England clergyman, a lay agent might be engaged to do the service. But with the position and feeling of a man of education, the service of the chaplain would, apparently, be the best that could be commonly found to be available in most districts.

15. It may be set down as a general conclusion, that, with the non-reading classes, no self-acting law will reach them, no authoritative printed declarations or notifications—nothing but direct personal intervention and oral explanation, exhortation, and individual aid will be of extensive avail.

16. The general administrative conclusion is, that for effectual educational reform, special means must be taken to put the school in regular, active, practical, and influential relation with the home and the field of service.

APPENDIX III.

The Half School-time System in Agriculture.

The opinion-evidence of manufacturers who had never tried it was, that the half school-time system would never do for manufacturers. But now, the opinion of those who have tried it is that it will do, and that it ought to be made of general application. The opinion-evidence of agriculturists and farmers who have not tried it is now generally that it will not do for agriculture; but a number of agriculturists have tried it, and their experience-evidence is that it will do, and that it will do particularly well. The opinion-evidence is, that agricultural labour is, "on the whole," healthy; but the mortuary returns show that farm labourers' lives form a fifth to a fourth lower than those of farmers, and farmers' lives are known to be improvable. Moreover, the rejections of farm labourers for bodily unfitness as recruits are not inconsiderable. That their bodily condition is improvable by the prevention of over bodily work in early life, is established by the fact that, in the instances where the half-time system has been tried, the bodily improvement of the young agricultural labourers, which was not at first thought of, but only their mental improvement, was remarkable. Amongst others, the following testimony of considerable employers of labour, and good observers, may be cited as respects the general question. Mr. J. Garth Marshall, of the firm of Messrs. Marshall, the flax manufacturers at Leeds, states that they have had the half-time system in operation since the passing of the first Act in 1834:—

"We have provided large schools, in which half-timers and full-timers are taught together. We at present employ 633 half-timers out of a total of 2,874 workpeople.

"We have repeatedly compared the progress of the half-timers with that of the children at school all day, and in our judgment, and that of our schoolmasters, the half-timers on the whole fully keep up with children in the same classes who are all day at school. The work in the mill makes the half-timers more intelligent and more alert than those who are wearied by six hours spent in the same occupation. Their attendance at school is more regular.

. . . . . .

"The children who have been brought up in our schools as half-timers are our best hands, more docile and teachable at their work than others; and as they grow up to work full time, they give a constant supply of good hands. Thus the school and the mill work in harmony—the mill attracts scholars to the schools, which are constantly full, and the school is a constant supply of hands to the mill. We employ no half-timers but those who have entered the school.

"To apply the half-time system to agriculture is confessedly a difficult undertaking; but I see no reason to despair of its accomplishment within a reasonable period of time.

. . . . . .

"Both experience and the almost unanimous opinion of teachers of all sorts show that two or three hours a day good teaching is as much as is really useful.

"I would suggest, therefore, that where schoolroom is deficient, the morning school hours should be from eight to twelve, the afternoon from 1.30 to 5.30 p.m., in each case having a clear half-hour in the middle of the time for play in the play-ground—and thus two distinct sets of children might be taught, one in the morning, and one in the afternoon.

"I have not time or space to examine Mr. Tufnell's objections. They appear to me to be generally of a similar nature to those originally made against the Factory Act, and more recently, to each extension of that Act, and have been found to give way to steady and judicious enforcement of the provisions of the respective Acts, ending in general acceptance of them.

Colonel Akroyd, M.P., states:—

Bank-field, Halifax, Jan. 17, 1870.

Sir,—I beg to enclose the answers to the questions, issued by your Society, relating to education, touching also upon its extension to the rural districts. I have no hesitation in saying that I believe the application of the half-time system perfectly possible in such districts; and even the evidence of the Agricultural Commission (particularly that of Mr. Stanhope, first Report, p. xix, cl. 81) shows that school attendance during the winter months, for not less than 100 whole days, can be rendered without much inconvenience to rural industry. I would, moreover, apply the principle of school certificates for full-timers, as Mr. Paget does for half-timers. He refuses to admit any half-timer unless a satisfactory examination in the first standard of the Revised Code has been passed. This preliminary examination will be much more easy in the agricultural than in the manufacturing districts, because, in the former, children are not sent to work before the age of 10 or 11, whereas

half-timers in the latter commence at eight. Hence, children at the age of 11 ought to be better educated than at the age of eight. The same principle of examinations I would apply as a passport to full time after the age of 13.

May I further venture to touch upon the wider question, raised by the National Education League and the National Education Union. As perhaps you are aware, I am a supporter—and yet not a prejudiced one—of the Union; but I have come to the conclusion that we must either extend the present system of voluntary education, supplemented by Government aid, or adopt in its entirety the other plan of school boards. Now, it must be borne in mind that, if we adopt the latter, it must apply to evening as well as day schools, and it would ultimately extinguish Mechanics' Institutes, and—if you will allow me frankly to express my own opinion—the Society of Arts too.

Hitherto your Society has done much for the development of the voluntary system; and I can speak most favourably of your examinations by certificates in our evening schools. But if the whole education of the country is to be put under a bureaucracy of local boards, directed by central organisation, there will be no room for voluntary agency, whether it be that of individuals, of denominations, of Mechanics' Institutes, of Working Men's Colleges, or of voluntary associations of any kind, like that of the Society of Arts.

Were Working Men's Colleges or evening classes like my own, to be superseded, the alteration could not stop there, but would extend to all other voluntary agencies. —I am, &c. EDW. AKROYD.

P. Le Neve Foster, Esq., M.A.

QUESTIONS.

1. What are the classes of children, and the total number taught in the school?

2. At what age do they enter, and at what age do they leave?

3. What is the teaching-power employed; how many trained teachers, mistresses, and how many pupil teachers?

4. What is the annual cost per head of the teaching-power employed?

5. By what age are they, on the average, taught to read intelligently, to write a clear hand, and enabled to pass with credit the ordinary examinations in arithmetic approved by the Privy Council; to have thoroughly mastered the usual rules, including proportion, as far as decimal fractions inclusive?

6. What are the total attainments imparted by the 11th year (*a*) to those children who have entered the infant-school stage (*b*) to those who have not, and what are the total attainments (including music and drawing, if taught,) usually imparted by the 14th year.

7. How long has the half-time principle been in operation? What is the experience of the half-time children in service, and what positions are they found to be qualified for after they have completed their school training, and as compared with children taught in the old and long time schools?

8. Any general observations on the half-time teaching?

Half-time Schools at Haley-hill, Halifax; and Copley, near Halifax; embracing also Departments for Infants, and Evening Classes for Adults.

1. The children are of the ordinary class attending half-time schools, mostly belonging to families whose parents are themselves employed in the mills, or engaged in other branches of industry.

HALEY-HILL SCHOOLS.

Number of boys on books	340
„ girls „	284
„ infants „	297
Total	921

COPLEY SCHOOLS.

Number of boys on books	262
„ girls „	242
Total	504
Grand total in day schools	1,425

2. Infants enter the schools at three years of age. Half-time children enter at eight, and continue till thirteen, when they become full-timers. Full-timers may attend the evening classes after thirteen, and are classified into junior division from thirteen to eighteen; senior, from eighteen upwards.

3. In the boys' day school are employed three trained certificated masters, and three assistant monitors. In the girls' day school three trained certificated mistresses, two apprenticed pupil teachers, and two paid monitors. In the infants' school, two trained certificated mistresses, and three apprenticed pupil teachers. In the evening classes, one additional trained certificated master, two science masters (certificated), and three other masters for special subjects; also the teachers of the day schools divide their work, and give assistance in the night school.

4. The annual cost of the teaching power in the day schools is about 20s. per child in average attendance.

5. Half-time children at the age of twelve years are, on the average, taught to read intelligently, to write a clear hand, and are enabled to pass with credit in the examinations in arithmetic of the Privy Council. Only in exceptional cases do half-timers in day schools thoroughly master decimal fractions. In the evening classes a large proportion advance to this stage, and much higher.

6. The total attainments imparted in the infant school to the children attending from the age of four or five to eight, would enable them to pass in the first standard of the Revised Code with ease. Half-timers at the age of thirteen pass with credit the fifth or sixth standard; and, besides, are taught elementary free-hand and geometrical drawing so as to pass with credit the examinations in the first grade of the Department of Science and Art. A knowledge of music can be easily gained by those having a desire to do so, by joining the Haley-hill Choral Society, or some kindred association.

7. The half-time system has been in operation in these schools since 1839 (the Act came into operation in 1834). Many of the boys, and some of the girls, after passing at 13 to full-time, leave the mills, and are apprenticed to handicraft trades, or become office-boys, clerks, &c., and are, in all respects, intellectually, very nearly equal to the children taught for the whole day; while, as regards activity and adroitness in work, they are decidedly superior to those children.

8. The half-time system has advanced the children engaged in factories to a much higher grade of education than has been attained by those outside its provisions; and, moreover, has afforded a very solid foundation on which evening classes, Mechanics' Institutes and Working Men's Colleges have rested. The attainment of a fair primary education before entering these evening classes has enabled them to advance to a good position as regards general knowledge, and qualified them for gaining higher branches of employment, where a knowledge of book-keeping and accounts, or the insight into the *rationale* of processes of manufacture, has been absolutely requisite. The results, moreover, as regards the intelligence and moral tone of the rising factory population are most satisfactory. Even their manners and appearance are wonderfully improved, and this improvement is manifest to even the most casual observer. A striking proof of the superior intelligence and higher moral tone was given by the conduct of the factory population in Lancashire during the cotton famine.

All that is wanted to make the factory education perfect is:—

(1). A satisfactory examination, to be passed under

the first standard of the Revised Code, of all children of 8 years of age as a passport to half-time work.

(2). A satisfactory examination, to be passed under the fifth standard of the Revised Code, of all children of 13 years of age or upwards as a passport to working full time.

The first condition would render it imperative for children to attend infant schools under the age of 8 before going to half-time schools; and it would be to the interest of both employers and parents to take care that infants receive this modicum of education before 8 years of age; otherwise the parents would lose the wages of their children as half-timers, and the employers would lack the attendance of these juvenile workers. Secondly, the examination of the full-timers would ensure the education of all children without exception up to the fifth standard, before setting to work as full-timers.

The extension of the half-time system to the rural districts, with such adaptations as are necessary for the different conditions of labour is further required; and this adaptation might, I think, be easily effected by sending all children above 8 or under 13 to school, during the winter months, for at least 100 days. A satisfactory examination under the fourth or fifth standard might be further required, as a condition of full employment for all above the age of 13.

Half-time Instruction in America.

The Rev. Mr. Fraser reports, in his account of the American schools, that, owing to the pressure for room in the primary schools, and the deficiencies of accommodation, a half-time system has been adopted for the last year or two; the results of which are thus reported by the superintendent:—"The working of the system during the past year has been highly satisfactory. Some of the finest primary classes I have ever seen in Detroit have been trained in these schools since the introduction of the system. I regard it as a well-established fact, that children in these schools, other things being equal, make as good progress in the course of study as in the whole-day schools. It was feared, at the outset, that the half-day's absence would render them wild and intractable in school during the remainder of the time. This fear has not been realised. The half-day schools are quite as orderly and easy of management as others. The system has proved a very great relief where the schools are overcrowded. I have lately heard few complaints against it, except on the part of the parents who are desirous that their children should be kept out of the way during a part of the day." In some of the English schools, this inconvenience is of course prevented by the occupation of the children with physical and industrial training, and, *vide* additional extract on military drill introduced in America—"I am aware that with the poor, in cases where the parents are sometimes out at labour during the day, this is almost a necessity; but it is evident nevertheless that the first duty of of the Board of Education is to provide proper instruction for the largest possible number of the children of the city. Relieving parents of the care of them may be important in many cases, but it is undoubtedly secondary to the grander aim above mentioned. I suppose there is no member of the Board who would not rejoice at being able to provide means for keeping those children under the care of teachers during a larger portion of the day, but under the present circumstances it is simply impossible."

Mr. Fraser further states, in his "Report on the American Schools," p. 143:—"Military drill has been introduced into the Boston boys' schools in consequence of a movement of public opinion in that direction in 1863. In the report of the School Committee, English precedents are quoted for its introduction; but the Americans have characteristically taken the matter up with an energy and completeness which almost give it the position of an original idea. The special committee that recommended its adoption did so on the ground that it would be both a means of physical training and national defence; and the belief of its supporters is, that it will be not only the best means of physical exercises for the schools, but at the same it will inculcate a more manly spirit in the boys, strengthen and extend their faculties, improve their intellects, make them more graceful and gentlemanly in their bearing, and render them competent at the age of 16 or 18 years to enter the field as privates and officers in regular military organisation." (Boston Report for 1864, p. 33).

"Nor is physical training neglected. The boys go through a regular drill, I think, twice a-week, under the orders of a United States officer, on Boston Common. I saw them put through their evolutions, which they executed, if not with the beautiful precision of the cadets at West-point, with very creditable steadiness and promptitude."

APPENDIX IV.

Superior Morality of Large Schools.

It should be made known that the question of the formation of large schools is one of moral as well as mental advancement, to which experienced witnesses bear testimony.

"Even the selfish," says an able writer, "are there forced into accommodating themselves to a public standard of generosity, and the effeminate into conforming to a rule of manliness. I was myself at two public schools, and I think with gratitude of the benefits I reaped from both. But the small private schools of which I had opportunities for gathering some brief experience—schools containing from thirty to forty boys—were models of ignoble manners, as regarded part of the juniors, and of favouritism as regarded the masters. Nowhere is the

sublimity of public justice so broadly exemplified as in an English public school on the old Edward VI. or Elizabeth foundation. There is not in the universe such an Areopagus of fair play, and an abhorrence of all crooked ways as an English mob, or one of the time-honoured English 'foundation schools.' (De Ouincey's Autobiography Sketches,' vol. i., 150.) Of late years, the age at which boys are mostly sent to the great public schools has advanced from ten or eleven, to thirteen or fourteen. I think this is a gain, where boys can be kept at home, but very much the reverse when they are sent as boarders to private schools. What we stand urgently in need of is good day schools, for the younger boys of all classes."

Mr. Hope, in his amusing "Book about Dominies," says, "that a school of from twenty to one hundred boys is too large to be altogether under the influence of one man, and too small for the development of a healthy condition of public opinion among the boys themselves. In a community of fifty boys, there will always be found so many bad ones who will be likely to carry things their own way. Vice is more unblushing in small societies than in large ones. Fifty boys will be more easily leavened by the wickedness of five than five hundred by that of fifty. It would be too dangerous an ordeal to send a boy to a school where sin appears fashionable, and where, if he would remain virtuous, he must shun his companions. There may be middle-sized schools which derive a good and healthy tone from the moral strength of their masters, or the good example of a certain set of boys, but I doubt if there are many. Boys are so easily led to do right or wrong, that we should be very careful at least to set the balance fairly." And, again, he says:—"The moral tone of a midle-sized school will be particularly liable to be at the mercy of a set of bold and bad boys."

The constant occupation, with interesting lessons under the eye of a master, in the simultaneous teaching in large schools, excludes the irritability and means of intercommunication and provocation which prevail whilst waiting for lessons in the small schools.

REPORT TO THE COUNCIL OF THE SOCIETY OF ARTS

ON

THE EXISTING STATE OF EDUCATION

IN

EALING AND BRENTFORD.

My Lords and Gentlemen,

Purpose of the Report.

1. In accordance with your instructions, issued on the 10th ult., directing me to inquire into the existing state of education in the parish of Ealing, and to report on the feasibility of an improved organisation, as a means, first, to promote efficiency and economy in primary education; and, secondly, to establish a scheme of advanced technical instruction, I have the honour to lay before you the results of my investigation, together with some facts bearing upon the special exigencies of the district, with which it appeared desirable your Council should be made acquainted, in order to facilitate the attainment of the objects in view.

Exceptional social conditions of the district selected.

2. I am desirous, at the outset, to guard against a supposition that the district selected for inquiry is, more than any other, favourable to the development of a general scheme, or that it was suggested by the Council on other ground than simply that of convenience to myself; indeed, the social elements and conditions are here so extremely diverse and exceptional as to surround the education problem with unusually perplexing difficulties, which are greatly aggravated, too, by the topographical distribution of the parish into sections differing widely in character, and so complicating every question of local administration and government. That this diversity may be appreciated, and its importance in all considerations affecting primary education the better understood, some of its leading features are particularised, and the rather as they prove the mental and social hindrances to the spread of art and science education among the dependent class to be so serious, that any attempts to promote this object must prove fruitless until these hindrances have been partially, at least, removed by a general diffusion of the common elements of knowledge.

Ealing.

3. The two main portions of the parish are Ealing proper and Old Brentford, the former situate seven miles west, the latter eight miles south-west of London, with which both have direct hourly communication by omnibus and rail. Ealing proper differs in no material respect from other first-class metropolitan suburbs that have sprung up within the last two decades, except, perhaps, in a greater preponderance of city, commercial, professional and independent classes over the lower middle, artisan, and wage classes, the relative numbers being fairly expressed by the ratio 3 : 2.

Old Brentford.

4. In the sister half of the parish this auspicious adjustment of society is reversed, the well-to-do being an insignificant minority. Poverty and destitution are here so wide-spread as to cease to excite the sympathy they deserve, and, accordingly, a worse than the actual condition is often simulated. An overwhelming wretchedness, unsurpassed even in the east of London, pervades the whole town, mainly attributable, it must be acknowledged, to an almost universal habit of intemperance.

Intemperance.

5. Nor has speculation been slow to take advantage of the prevailing weakness, for it has been calculated there are at present as many as 96 licensed and unlicensed drinking houses, and the number is increasing; on an average, this is one house to every 100 of the population. If we assume the receipts of each to be £300 annually (by far too moderate an estimate in the opinion of the police), the total value of the yearly consumption of beer and spirits amounts to £28,800, or for Old Brentford alone £21,220.

Table I.—Comparison between the Cost of Beer and Primary Education.

	Beer.			Primary Education.		
	Per the whole population.	Per family.	Per head.	Per the whole population.	Per family.	Per head.
	£	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.
Old Brentford.	21,320	15 3 1	3 0 7	1,095 6 10	15 7	3 1
Ealing	8,400	7 0 0	1 8 0	746 5 4	12 5	2 6

It is important to remark that the calculation in the table includes elementary education only, otherwise it might be erroneously inferred that, since in Brentford the rate per head of the cost of education is much higher than that in Ealing, excessive expenditure in drink has no influence upon educational supplies. In Brentford, the whole machinery of education is of an exclusively elementary kind; in Ealing, the superior social status of the people involves a proportionate outlay on education of an advanced character. There is this consideration, too, the schools of Brentford are almost as much indebted to Ealing and adjoining parishes as to the locality by which they are nominally supported.

Abundant evidence testifies that £15 falls very far

short of the sum actually expended in drink by the family of a Brentford labourer. I have it on the authority of the chief manager of the gas factory, who has the supervision of a hundred men, that the weekly beer bill of not a few, whose average wage is about 35s., amounts to 25s. It is often more; and, notwithstanding these men receive, in the winter season, at the rate of £150 per annum, they are not unfrequently without an article of furniture. The women abandon themselves to this vice even more than the men; everything goes for drink; the husband's tools do not escape being pledged. One woman, described as in a state of intoxication five days out of seven, has repeatedly pawned her husband's fishing nets. It will be easily imagined that a considerable number of the unlicensed houses (beer-houses) in which these wretched creatures waste their livelihood are of a disreputable type. Forty per cent. of all the cases which the magistrates have to decide are directly traceable to drunkenness,* and competent judges ascribe to the same cause nine-tenths of the people's poverty.

Lodging-houses. —Overcrowding.

6. Hence, too, arises the overcrowding in bare and filthy tenements, which exists to a frightful extent, and is fostered by a system of lodging-house keeping that sets decency at defiance. A lets a wretched dwelling to B for 3s. 6d. per week; B divides it into two or more compartments, and sublets each for the original rental of the whole; while there is such an utter disregard of all sanitary laws that it is amazing disease is not more often epidemic.

A specimen.

In company with an indefatigable missionary, well acquainted with the haunts and habits of the lowest poor, I visited some of the worst of these abodes, and will delineate one, not an extreme case, but typical of many. It consisted of one unfloored room, 9 ft. square and 7 ft. high, and possessed no article of furniture whatever, except we could so describe the remnants of a chair, a bundle of rags insufficient to cover one child, and three broken plates. On the naked mud walls there hung the tatters of what had been a print. This was the living and sleeping apartment of a man, his wife, a son upwards of 20, two daughters, respectively 16 and 12, and four younger children, in all nine occupants. The children were asked:—

"Why are you not at school?"—"We haven't any clothes to go in."

"What have you had to eat to-day?"—"Nothing."

"And will you not have any all day?"—"Yes, when mother comes home from the market-garden, we shall have a piece of bread."

"How much money does your mother earn?"—"A shilling a-day."

"Is that all you have to live upon?"—"Yes."

"How much rent do you pay?"—"Eighteen-pence a-week."

Crime.

7. The cases of illegitimacy brought under the cognizance of the magistrates, though numerous, are as nothing in comparison with the full extent of that social evil, as it reveals itself in these overcrowded cottages and alleys; and while professional prostitution numbers its 30 votaries, there is an aspect of this evil still worse, and a lower depth of moral delinquency.

The poor are amazingly improvident but striving. — The nature of their occupation.

8. It has been seen that the poor of Brentford are beyond measure improvident; nevertheless, a more striving people it would be difficult to find. The staple industry is the work of the market-garden, which offers employment to great numbers of women; only those, however, of a very robust constitution, and they are generally Irish, can take advantage of this labour, beyond a few weeks, when the fruits are gathered. For skilled artisans there is very little demand, the operations at the gas factory, the soap factory, the timber mills, and the brick yard being of a semi-automatic nature, requiring little knowledge or intelligence in any but the foremen and managers. For the rest, who know little of any handicraft (if not engaged in barge carting), little fixed employment can be found. Yet, even during the present depression or stagnation of trade, only 40 men are obliged to apply for work at the stone-yard of the Union.

Vagrancy.

The unsettled, dependent upon casual and precarious employment, and those who prefer the freedom of a nomad life, whether belonging to Middlesex or the surrounding counties, find Brentford a convenient rendezvous; hence rag collectors, hawkers of fish, fruit, and vegetables, professional vagrants and casuals of every description, are perhaps nowhere more numerous in proportion to the population than here. By application to the police all wanderers and wayfarers, if without money, are provided with free lodgings for the night; in the day, they travel over or prey upon the adjacent neighbourhood for many miles round. Thirty veteran depredators were recently apprehended within a few days at one police station alone. The ill repute of Brentford is such, that the mere prospect of the bridge spanning the Thames being freed from toll lately threw the quiet inhabitants of the opposite village (Kew) into a state of consternation, the halfpenny exacted from every passenger having hitherto operated as an effectual check to the inroads of their vagabond neighbours.

Children inhumanly neglected.

9. The demands of labour, particularly in the market gardens, and the roving and intemperate habits of the people, lead to hundreds of children being left, from early morning to almost midnight, without parental control. Young children, scarcely past the age of infancy themselves, crowd the streets at midnight with babies in their arms, while mother and father are spending the last penny in drink. Nothing more than this is wanting to explain the prevalence of infantine feebleness and deformity, the abundance of gutter children, or the rifeness of juvenile crime.

An instance.

The petty theft which has supported and filled to overflowing an itinerant theatre for fifty nights in succession, the ceaseless supply of young criminals for the reformatories, and the benighted ignorance of children who hesitate in answering to their own name, are all referable to parental neglect. It is the conviction of many well qualified to judge that among the inmates of our reformatories there are more natives of Brentford than any town in Middlesex. A gentleman of considerable local influence told me that, in visiting these institutions, as he is accustomed to do, he has often been struck with the whispers of recognition with which the young captives acknowledged his acquaintance as a townsman.

Hard craving for drink makes monsters of some parents, who turn their children adrift that they may have increased means for indulging their appetites. Here is the history of such a castaway. "He wandered from Brentford to Margate, where, by carrying parcels for visitors, he saved a little money, began hawking along the south coast, and was arrested at Tunbridge Wells, wanting a license. The authorities there returned the wanderer to Brentford, but he was soon off again to Oxford, thence to Scotland,

---

* At the election for a coroner for West Middlesex, men, who were called "free watermen," were advised by agents to take an oath that they possessed an estate, as also men who had relations buried and held a grave, that they had an estate; and, by virtue of their oaths that they possessed "estates," they were permitted to vote. Evidence has, it is stated, been given that "water-side people," and others of the wage classes, were brought up in large numbers to take these oaths, and vote under the influence of drink and money payments of five shillings and upwards. Brentford was distinguished by agency and drinking at this election, on which one of the candidates has publicly declared that he had been led to expend between five and six thousand pounds. Bad education, ignorance, drinking, and venality were conspicuous on the occasion, and closely associated.

where he committed himself, and was sentenced to five years in a reformatory, from which he escaped after eighteen months' stay, and walked from Edinburgh, *viâ* Liverpool, to Taunton, in Somersetshire, where, completely tired out, he gave himself up. He is now in another reformatory, learning shoemaking, and likely to earn by it a respectable livelihood."

Prevalent and appalling ignorance.

10. Of the prevailing and appalling ignorance no further evidence need be adduced than that afforded by a paragraph of last year's Report of the Central Ragged Schools. It says—"During the first week, Jan., 1867, 95 children, of ages varying from four to 16 years, presented themselves for instruction, all, without a single exception, of the strictly ragged class. The number continued to increase, until at the end of the ninth month 354 had been entered on the rolls. Of these not one in 20 could read the most easy print; 298 had had no means of instruction other than the very little they could get at their own homes, two only could write, and but few knew the alphabet correctly, although as many as 164 were from 11 to 16 years of age."

Ealing proper.—The comparative absence of crime.

11. If it is said that in Ealing proper cases of habitual drunkenness, of prostitution, of abandoning or totally neglecting a child, are of very rare occurrence, sufficient will have been stated as to the diverse character of the two sections of the parish. Only one case is reported in Ealing of a child being left entirely to its own resources, and the constable represents this poor girl as being "eaten up" with vermin. Not more than seven, or perhaps eight, are known to the police as constant "loungers."

Literary statistics of the district.

12. I have ascertained, through the General Post-office, that the weekly average of letters delivered at Ealing is 9,410, and at Brentford, 6,000; but a large deduction, more than proportionate to the number of its population, must be made in favour of New Brentford, leaving to Old Brentford probably not more than 4,000 for 7,000 people, *i.e.* ·57 per head per week, while for Ealing it is 1·57 per head per week. The amount of cheap salutary literature, including penny newspapers, &c., distributed every week is at least five times as great in Ealing as in Old Brentford.

Area, population, rateable value of property.

13. The area of this discordantly conditioned parish is 3,930 acres, and the population, corrected from the last census, about 13,000, divided between Old Brentford and Ealing in the proportion of 7 to 6. The rateable value, as ascertained from the valuation list, is £83,318 10s., and the number of assessments 3,306, distributed in about equal moieties, another fact strikingly illustrating the disparity of wealth in the two divisions of the parish, particularly as, of the 400 untenanted houses, the major part are in Ealing.

School population.

14. Assuming, as according to the returns of the last census we may, that 25 per cent. of the population are children under 14 years and of school ages, this district should be liable to account for 3,250 scholars. Deducting from this number 750 who are being instructed in higher and middle class establishments, or in dames' private seminaries, both within and beyond the district, there remain 2,500 whom we should find in attendance at the primary elementary schools actually in the district. In the following table (Table 2) a list of the elementary schools is given, exhibiting the present gross and average numbers of each. These numbers are strictly accurate, except in the case of the endowed schools, which are approximations only, as thoroughly reliable statistics could not be obtained.

Table II.—Elementary Schools.—No. of Scholars.

Ealing.

Name of School.	No. on Rolls.	Average Attendance.
Endowed (boys)	120	104
Endowed (girls)	80	65
Ealing (infants)	150	90
St. John's (infants)	122	80
British (mixed)	201	114
British (infants)	160	91
Totals	833	544

Old Brentford.

Name of School.	No. on Rolls.	Average Attendance.
National (girls)	85	66
National (infants)	112	67
Transferred to New Brentford Schools (mixed)	113	87
Ragged (mixed)	199	151
Ragged (infants)	184	148
British (boys)	300	258
British (girls and infants)	275	235
Totals	1,268	1,012

Grand Totals:—{ No. on Rolls 2,101
Average Attendance .. 1,556

It appears from this tabulated view, that 2,101 children are receiving some kind of instruction, but that only 1,556, the average attendance, can be supposed qualified to pass the very limited standard appointed by the Committee of Council. Unfortunately, we must be content to accept this conjecture as final, as the test of inspection is only applied in the case of seven out of 13 of the schools mentioned in the table, those being the unsectarian schools. Hence we infer from the foregoing, that there are in this district 545 (2,101 — 1,556) whose mental education is so imperfect as to be well-nigh worthless, and 400 (2,500 — 2,101) whom our present system leaves wholly untouched, who are growing up in the midst of vice and in the darkest ignorance, having, as I am informed by a magistrate, scarcely any perception of moral responsibility.

545 children whose education is practically worthless.

The instability and practical worthlessness of such schooling as that of the 545 who, we said, were but imperfectly educated, was plainly exemplified in an evening class of 40 young men and boys, all over 14 years, lately formed for technical instruction. Not less than 50 per cent. were the sons of tradesmen and small shopkeepers, and, with a single exception, all had been previously taught; yet 90 per cent. were inaccurate in very ordinary problems of simple division, and 20 per cent. (including four who were the sons of tradesmen, and carried their watches), were only just certain of the alphabet. With the one exception alluded to, all could write from a copy, which of itself was presumptive evidence that they had been instructed.

500 children totally uneducated.

15. Since there are admitted into the infant schools many children who are usually considered as too young to be within the school age, some being entered as early as 15 and 16 months, it follows that somewhat more than the 25 per cent. of population should be at school, and consequently from this cause it is probable we must add nearly, perhaps quite 100 more to the 400 already said to be beyond the reach of school influence. The house-to-house visitation, which your Council instructed me to make, and in which, by the courtesy of Colonel Henderson, I secured the energetic and valuable co-operation of the police, was intended to ascertain the causes which deter these 500 children from attending school, and, if possible, to discover means for their

removal. A simultaneous inquiry was instituted in the three densest and poorest parts of the district, viz., Old Brentford, and New-town and Steven's-town in Ealing proper, which has resulted in returns neither full nor quite satisfactory, but, allowance being made for the exceptionally unfavourable conditions under which they were collected, more complete than could have been looked for.

Arab, gutter, and vagrant children.

16. First, as to Old Brentford.—Its population is roughly estimated at 7,000, 25 per cent. of which would be 1,750, the total number of possible scholars; and, by Table 2, 1,268 is the total actual number, the difference, therefore (1,750—1,268=482), is neither greatly below or in excess of the number to be accounted for.

TABLE III. — OLD BRENTFORD. — RESULTS OF AN INQUIRY EXTENDED OVER THREE-FOURTHS OF ITS AREA :—

	Total No. of children visited.	Total No. attending school.	Above 11 and under 14 years.	No. employed or at school between 11 and 14.	Vagrants.
Boys	459	332	50	26	26
Girls	466	312	46	7	35
Total......	925	644	96	33	61

TABLE IV.—TABLE III. CORRECTED FOR THE REMAINING QUARTER OF OLD BRENTFORD.

	Total No. of children visited.	Total No. attending school.	Above 11 and under 14 years.	No. employed or at school between 11 and 14.	Vagrants.
Boys	612	442	66	34	34
Girls	621	416	61	9	46
Totals ...	1,233	858	127	43	80

Subtracting in Table 4 the number attending school from the total number visited (1,233—858), the difference, 375, plus 80, the number of vagrants, amounts to 455, representing the untaught, and corresponding almost exactly with 482, the number previously deduced from other data. Adopting the mean of these two numbers $(455+482)\div 2=468$. The residue of the 500 believed to be the total number of the untaught in the whole parish, is made up of about 12 (the precise number could not be obtained) in New-town, all infants, and 23 in Stevens-town, 7 of whom are over 11, and in occasional employ, and 16 are under 9, no valid reason being assigned why they should not attend school.

The respective numbers of educated and uneducated children.

17. Thus we have discovered that 1,556 are in the way to reach the national standard in the three principal elementary subjects, that 545 are likely to leave school with such an imperfect mental training that it will prove practically valueless to them, and that 500 more are altogether outside the pale of school influences. Is this gigantic failure due to the inherent defects of our present system, or are the obstacles to a general diffusion of the prime elements of learning insuperable?

Poverty alleged in excuse for non - attendance at school.

Pauper returns.

18. One of the commonest allegations in excuse for a child's absence in this district is poverty, which, undoubtedly, exists to an extent far beyond what is disclosed by the Pauper Returns. These returns are so ill-arranged, confused, and contradictory, that it is impossible to ascertain with precision the number of families at present in receipt of relief, but the results of a most careful examination of the last report, ordered to be printed by the Board of Guardians, are tabulated below :—

PAUPER RETURNS FOR THE HALF-YEAR ENDING LADY-DAY, 1869.

	Heads of families. relieved.	Married.	Children.	Total No. of individuals.
Ealing	120	52	140	312
	(48)	(23)	(71)	(142)
Old Brentford	331	139	370	840
	(124)	(60)	(180)	(364)
Total	451	191	510	1,152

Thus, five per cent. in Ealing, twelve per cent. in Brentford, and an average of nearly nine per cent. in the parish, or one-eleventh of the population, received assistance from the rates. The numbers in the tables enclosed in parentheses respectively represent like returns for the previous half-year, under names which do not again recur; they may, therefore, be considered as indicating the constant fluctuations in the tide of pauperism incidental to removals and the vicissitudes of labour.

Pauper children subject to compulsion.

19. It will be observed, that the number of pauper children for the whole year was 761, or 600 of school age; and, by virtue of Mr. Denison's Act of 1862, in this parish invested with an obligatory force, these would all be educated out of the local rates; at least, it must be so supposed, but no authentic list is kept. Voluntary aid unavailingly extended its hand in the shape of a virtually free school; it had no power to compel acceptance of its offer, but so soon as the narrow threshold of pauperism is passed, attendance at school is insisted upon, and no grievance raised or murmur extorted. But for being paupers, these children would have remained uneducated.

The inefficiency of voluntary effort.

20. In this parish, wherever voluntary effort has relied exclusively upon its own supplies, while offering what is tantamount to free instruction, it has most conspicuously failed in drawing larger numbers. Such schools are indeed being rapidly absorbed by others. The explanation is plain. There are many whom no inducement will influence, who remain passively indifferent to everything but force—who see no benefit in schooling commensurate with the restraints it imposes, while those who willingly attend soon discover that a reduction in fees means an inferior teacher, with an inefficient staff. Nor is it alone among the destitute, the depraved, and vagrant classes that voluntary attendance fails to be conciliated. A clergyman who has been most assiduous in his endeavours to promote education among the young of his congregation, recently deplored the fact, that of 350 children, the offspring of a moderately comfortable and industrious class of poor, dwelling in the cottages surrounding his school, only 80, on an average, were seen in their classes.

A compulsory Act thought necessary.

21. The opinion is here almost universal that some compulsory measure must be enacted, if we are to secure the condition that every child within the district shall be fully instructed in the primary element of learning. But there are three classes of objectors to a legislative enactment embodying this principle—those who would conciliate attendance by further inducements; those who regard an education rate as a

Objectors.

purely additional burden, not being convinced of the advantages they themselves will derive from it; and those who think the education of the poor has already advanced beyond its just limits. These objectors are not numerous, and will acquiesce without much opposition in a reasonable employment of force. More serious, however, is the very generally urged question, "How can a compulsory scheme be enforced here?"

Can a compulsory measure be enforced?

22. From personal observation, and the statements of the police, it appears probable that the interference of the magistrate would not be often called for; cases of pertinacious refusal to send children to school would be very rare, and had we to deal only with people of settled industry, a modified scheme which should not enforce attendance, but should insist upon every child under 14 years being qualified up to a certain standard of attainments, and duly certificated, before entering upon full employment, would in this district be adequate to the occasion. Fortunately the district supplies us with examples of how much may be accomplished by a persuasive policy, and the progress of this inquiry has afforded proof that a little pressure, while effective, would meet with no overt hostility. In the New Town, with a population of about 1,000, there are perhaps not a dozen uninstructed children, such is the salutary effect, it is said, of the unremitting zeal of district visitors. The frequent presence of the missionary acts in a similar beneficial direction in Brentford. Even, therefore, where no ulterior advantages are promised to the scholar, it suffices in many cases to importune the parents to secure attendance. But if, as has been suggested in an important appendix to my instructions, it became the established usage for a regularly appointed officer to visit parents for the purpose of urging upon them the imperative claims of the school, and afterwards to bring the school supply into reciprocal action with the demands of labour, so that an inducemant of future half-time employment might be held out as the certain reward of every scholar on completing his 11th year, the present difficulty about attendance would be in a great measure conquered, so far, at least, as it applies to those whose parents have settled occupation. A few days ago I interrupted the game of a group of half-a-dozen boys, who were in the fields, by the question—"How many of you go to school?" Without any direct reply to the interrogatory, the boldest among them began to lay informations against a younger companion (of eight years): "Because his father had beaten him, he had stayed out all night, and had been found the next morning in a ditch; the other day he had cut off a pig's ear, &c., &c."—"But," I said, "answer for yourself; do you go to school?" "No, sir, my mother thinks I am old enough to be at work." And this, as it afterwards appeared, was a view of their child's case common to all the mothers, who seemed to think no mart for labour was so sure as the street or the field. Yet, judging from what I saw and heard in the course of my domiciliary visits, and from the report of a constable in reference to these same boys, if they find work at all it will too probably be in a reformatory. I mention this conversation as showing that boys would, no doubt, be retained longer in school if reasonable ground existed for anticipating that the additional schooling would be a readier passport to employment.

An amusing incident which occurred in connection with this inquiry, gives colour to the belief that the mere investment of a magistrate with authority to coerce, in cases where persuasion and inducements have failed, would suffice, in most instances, without invoking positive interference. The day following that on which the police had been requested to assist me in making inquiries, I called at the Ragged School, and was told by the master that several parents had accompanied their children that morning, "fearing they would otherwise have fallen into the hands of the police."

Public meeting of working men. A compulsory law unanimously approved.

23. Still, it was important to have more tangible evidence of the real feeling and opinions of the poor as to education being made obligatory; accordingly, with the kind permission of the manager, I addressed the whole body of men at the gas factory, explaining in outline the education controversy, and some of the questions requiring solution, dwelling more particularly upon the special needs of Brentford, and the apparent impossibility of bringing all the children of the town under instruction without the aid of a compulsory Act. The meaning and probable operation of such an Act were, it is hoped, made tolerably clear, and at the conclusion of the address, a candid expression of individual opinion was invited. One of the foremen thought that "compulsion was not only expedient but just," and regretted a coercive law was not in force in his own school-days. His opinions were echoed all round by his comrades, except that two declined to speak for or against—they would remain neutral, on the ground of being unmarried. In truth, these men knew they had no valid excuse to allege for detaining their children at home; they have no domestic occupation for them, and the opportunities for hired service are very rare; even if they were abundant, the utter ignorance of both boys and girls would unfit them for the duties. The squalid poverty of their homes has prevented the acquisition of the most primitive notions of household economy, order, or cleanliness. One boy, 14 years old, on being well washed at school, did not remember that he had ever washed before.

The presence of the philanthropist, not of the magistrate, required.

24. Often, however, it is the want of necessary clothing, and not indifference to education, which keeps the child from school, and in such cases the operation of the law must be preceded by the benevolence of the philanthropist. The means are not lacking, if properly applied, to meet this want. Amongst other sources of supply, the report, just issued, of a local Sunday school very opportunely indicates one. It says:—"Besides the money collected, the children are in the habit of meeting once a month to make garments for the heathen, and the result of the exercise of their nimble little fingers has been, that a box of clothing was forwarded, in the month of May last, to the island of Jamaica." In face of the absolute starvation and nakedness of the Brentford heathen, one cannot resist the reflection that, though they may be less interesting, it would be more appropriate and charitable that they should have precedence of their kind in Jamaica.

The introduction of the half-time system must be gradual.

25. Supposing a compulsory law established, its operation here would possibly be attended with some unavoidable rigour. To reduce this to a minimum the half-time school system has been proposed. In this district its introduction would necessarily be very gradual, owing to the scanty means of productive employment. The success of the system depends upon a regular and general demand for youthful labour, and here the work of the market gardens, almost the only resource for boys, is inconstant, and, at its best, scarcely remunerative. What is called the "Season" is a period of about three weeks in the summer, when the fruits are gathered; even then the unpropitious weather or a scarcity of garden produce often entails much distress, enhanced by the great influx of surrounding villagers. The same causes deprive many families, dependent on their skill in the manufacture of small baskets to contain the fruit, of their one hope of a comfortable subsistence. A strong active girl of 14 can make a gross of these baskets in a day, the profits upon which are 1s.

Testimony in favour of the half-time plan.

26. Where practicable, the desirability of the half-time plan is undoubted. Three teachers of this district, who have had unusual opportunities for testing its merits, bear over-

whelming testimony to the greater aptitude, intelligence, and sprightliness of boys trained under it. One of these, whose scholars were employed on extensive machine works, attributes their improved mental power and acuteness to the habits of attentive observation and prompt action the operations of the yard engendered. Another of these gentlemen succeeded his father in the management of a large middle-class school, the outcome of an industrial experiment made by Lady Byron. He assures me that nearly every pupil trained in the original establishment, which was conducted on the half-time principle, has since gained a superior position in life. Mr. Thomas, the harpist, and Mr. Adams, the sculptor, were of the number; other distinguished names might be mentioned, but I am not authorised to give them publicity. These boys were taught gardening, it being permitted to each to obtain what price he could for the produce of his own allotment, purchasers in the village preferring to get their vegetables from the school, as they were fresher than those obtained at the shop. The industrial element is still prominent in this school, and the master states the advantage of his plan is, that the power of application is never exhausted, the school and the garden are the proper complement the one of the other, and his scholars are eager to enter on the work of each as a recreation or agreeable relief.

School accommodation.

27. It has been shown that of the 2,500 for whom provision has to be made in the elementary schools, there are already in attendance 2,101, including about 100 who would usually be considered under school age. There is actual accommodation for 2,260 (Ealing, 730, Brentford, 1,530), so that, making allowance for unavoidable detention at home from sickness and other accidental causes, it may be said convenient room would be found were the 500 at present uninstructed children compelled to attend to-morrow. This accommodation, however, is badly distributed, and enforced attendance would lead to plethora in some schools, while others starved.

Denominational development the cause of unequal distribution of space and imperfect organisation.

28. Unequal distribution of school space results here from the absence of combined action consequent on denominational development, a more serious fault of which is, that it is obstructive to economy and efficiency. It is now nowhere disputed that these qualities in education are in direct ratio to completeness of classification, and the improved division of labour thereby involved. But highly scientific classification is only possible with large numbers, and it may be stated as an incontrovertible doctrine in educational science, that efficiency and economy, both of time and expenditure, increases with the increase of numbers. Its truth is abundantly illustrated in the case of the large British School of this district. Comparing the results of the last inspection with those of the average of all the schools in England and Wales, the following Table will show the relative position occupied by these schools. Out of every 100 examined, in 1868-9, there passed in—

Efficiency and economy dependent on completeness of classification.

	Reading.	Writing.	Arithmetic.
Schools in England and Wales	90·03	88·16	76·49
Brentford Boys' School	95	98	91·5
,, Girls' ,,	92·3	89·51	84·61

The small national schools of the district are uninspected, and therefore afford no reliable data for comparing their results with those in the table. But it will be instructive to institute the comparison between the two British Schools, that of Ealing, with 200, and that of Brentford, with 300 scholars. The two schools are conducted on the same system, are under the same inspection, and managed by teachers who were trained at the same time, at the same institution; who are apparently of equal skill and popularity. There the parallel ends. The Ealing School is socially superior, and the year selected was its best, not its last, yet the comparison, as seen below, is in favour of the larger school:—

	Reading.	Writing.	Arithmetic.
Brentford	95	98	91·5
Ealing	96	97·3	90·6

These numbers, however, by no means indicate the full extent of the advantage gained by the more perfect organisation, as in the school of 300 many subjects are very thoroughly and exactly taught which are altogether excluded by the incapacities of the lesser school. The respective costs of education on the two scales cannot be determined and compared, as they are not kept distinct from those of subsidiary establishments; but it may be put to the credit of a faulty system, which insists on an extravagant multiplication of schools, that one of these equally hard-worked, competent, and successful teachers receives a salary just double that of the other.

Extravagant multiplication of schools for sectarian purposes.

29. If in future these large economic aggregates are not more common in this parish, that party in the Church must be held responsible who hold so strictly to the dictum of a right reverend prelate, that "every church should have its handmaid—the school." Notwithstanding, the existing school space, with a little re-adaptation and re-distribution, would amply suffice for all primary requirements, this year four new and elaborate buildings are to be commenced, at a probable cost of not less than £6,000. One of these, it was publicly declared by the projector, is to be constructed large enough for half the children in Ealing proper. Moreover, it will be erected on the spot where in the whole parish it is the least required. Three schools already crowd each other in the immediate vicinity, while careful inquiry has established the fact that there are not twenty children habituallly absenting themselves from school, and even this small deficiency is not due to sectarian jealousies.

Proselytism and waste of State funds.

30. The avowed purpose of this prodigal waste of means is to afford scope for proselytising, as was candidly acknowledged to me by the incumbent, for whose conscientious, though, as I conceive, mistaken zeal, one must entertain the utmost respect. His converts are to be drawn from the neighbouring "godless," because unsectarian school, admitted to have attained a position in secular things much beyond what its rival can ever hope to reach. And the scheme thus initiated, and with such an object, has the sanction of the State, and will be supported by grants from the consolidated fund, local representations being uncorrected by central personal investigation.

The Church of England clergy the hereditary instructors of the poor.

31. A second clergyman, who suggested a scheme of amalgamation, but had his overtures rejected, claims for himself and brethren an hereditary right to educate the poor, and considers the present denominational system, as it affects the Church of England, ought not to be disturbed, "because the personal sacrifices made by former priests purchased, as it were, a right of advowson in the education of the poor, which properly descends to their successors." A third and a fourth have no faith in what is called "practical religion;" it must be dogmatic to be of value, and direct religious denominational teaching must be interwoven with the whole conduct and economy of the school.

The Rev. Mr. Brookfield on religious teaching.

32. Yet a distinguished school inspector, the Rev. Mr. Brookfield, says:—"It is an undoubted fact that, in schools where Scripture only is taught, it is learned with almost no intelligence. The misconceptions as to time and place, and the relation of one event to another, in the minds, not of the children only, are amazing, and too ludicrous for me to record them on so grave a subject." He, however, gives an example of practical interpretation, such as results from good teaching of the sort called, in Holland, neutral religious teaching, that is, of undenominational teaching, on the basis of a common Christianity. "I cannot," says the rev. gentleman, "refrain from giving an instance of practical interpretation by a boy of 11 years, living on the banks of the Thames, which might be profitably adopted by many persons of riper years and more exalted station. 'Tell me of any state of life to which it may please God to call you?' 'A waterman.' 'Well, how would you do your duty in that state?' 'Take no more passengers than the license says.' 'Well, anything besides?' 'Behave civil to the passengers.' 'Anything else?' 'Land 'em dry on the other side.' 'Anything else?' 'Ask no more than the regular fare.' 'Anything else?' 'Keep some of the money for my father and mother.' 'Anything more?' 'Try to lead a good life.'" Mr. Brookfield continues:—"I have heard in my time some lengthy and less complete commentaries on your duty towards your neighbour, than undertaking no more than your boat will carry, claiming no more than your regular fare, and landing them dry on the other side."

Wesleyans complain of the injustice they suffer from the continuance of sectarian schools.

33. The non-conforming clergy are uniformly in favour of amalgamated, common schools. They are the supposed stewards of the religion of nearly two-thirds of all the children in primary schools; still, bitter complaint is made, especially by the Methodists, of the injustice they suffer by the continuance of sectarian schools and restrictions. Children religiously connected with them have often no option but to attend the national school, and, once there, the conscience clause is declared to be no protection to them. In large towns they can hold their own, but in rural parishes, where all their funds are absorbed in church extension, the grievance is so strongly felt that it formed the subject of certain resolutions at a recent Conference, at which, however, after lengthy discussion, it was resolved that the Wesleyans, as a body, should not stir in the matter of education until the government plan was known.

A possible solution of the religious difficulty.

34. The inquiry here tends to support the opinion that the only solution of the religious difficulty lies in the appointment of separate hours and separate schools for doctrinal and denominational teaching, but subject to this condition—the free use of the Bible in schools to be permitted as now. Having ascertained, by careful examination, that 95 per cent. of the children attending the day schools were present at the Sunday classes, I ventured a suggestion to the clergy individually, that on the supposition of a State scheme of common schools, the disengaged members of the Sunday-school staff, aided by tract distributors, district visitors, and others, should meet their respective classes at a certain hour on two non-consecutive days in the several schoolrooms, which, for the time, would become strictly denominational; each distinct sect, being separated from the rest, would have its own teachers, and its own minister or his *locum tenens* as president. Since the suggestion was offered, a letter from the Rev. G. R. Gleig, Chaplain-General to the Forces, addressed to the Scotch Commissioners on Education, in 1865, has been read, and from this it appears that a precisely analogous plan has been for some years in operation in the army, and with great success. (*Vide* Appendix.) By the adoption of this, or a similar plan, every child might have four hours of direct dogmatic teaching in the week, two hours on Sunday, and one on each of the days proposed, with these advantages, that religion would be withdrawn from the hands of youthful, inexperienced, and ill-qualified pupil and other teachers (to whom this lesson is often distasteful, and who certainly succeed in making it repulsive to their scholars), and transferred to persons who, by their wider knowledge, their fertility of illustration, impressive manner and dignity of position, make it the most attractive lesson of the week.

Slovenly manner in which religion is taught.

35. The gain to religion which such a change implies can hardly be estimated. Dogma and doctrine are still taught as if the sole object was to mystify and not to elucidate their meaning, and the result to the scholar is that attested by Dr. Benson thirty years ago. He says:—"I believe that I owe almost all the experience I have gained on the religious instruction of children to the following little incident. Walking home one afternoon through the Woodbine-lane, at about four o'clock, the hour when Dame Wilson's little school used to separate, I was enjoying the sight, which often pleased me, of the little chubby troop of children just escaped from their tasks, carrying home their baskets, stopping to gather wild flowers, and often carolling as they went. One very laughing, merry little boy arrested my attention, and I stopped to catch the words of his song. To my astonishment, I heard the following: 'Suffer-ed under Pontius Pilate, was crucified, dead, and buri-ed.' 'What words are you saying, my child?' said I. 'We have just said our Friday catechise; and so, sir, I was just singing a bit of him.' I questioned him, and found he had not the slightest idea of the sense of the solemn, awful words he had uttered."

Anticipations of a government plan.

36. It was admitted by those least anxious for a compromise, that it was reasonable to expect some arrangement of the kind referred to above would form a part of any government plan, and that in itself it was not objectionable, but a passive resistance would be offered to it, and ultimately a return to the present denominational arrangement was certain. Yet, judging from the superior quality of the instruction in the unsectarian schools here, their great preponderance in numbers, their financial prosperity, and the daily instances of the very poor asserting their self-respect in defiance of the menace that their soup, coals, and bread will be withheld, except they betake themselves to the sectarian Church and carry their child to its "handmaid," it is probable no great obstacle to amalgamation would be encountered were the government determined on a bold and comprehensive measure, favouring a common school system, and refusing to aid by grant from the national fund, or otherwise, all schools of an exclusively dogmatic character.

Proposed amalgamated scheme for the Ealing and Brentford district.

37. It is proposed that, in an amalgamated scheme for this district, schools should be either NURSERY, PRIMARY, or SECONDARY, corresponding to the three periods of a child's school age, viz., from five to eight years, from eight to eleven years, and from eleven to fourteen years. Children younger than five years would not be excluded any more than now, but it is supposed that at five learning really commences. Eight is chosen instead of seven, the usual limit of the infant stage, in consideration of the distance the child might have to walk to reach the "primary" school.

Nursery schools for Ealing.

For Ealing proper, two nursery schools only would be required, one at Ealing-dean, the other in New Town; the former with accommodation for 200, the latter for 300. The necessary enlargement of the Ealing-dean school, which at present affords space for not more than 80, would be paid out of the sum already in part raised

for the erection of a needlessly large building on the same site.

Nursery-school training.

38. The question remains, "What would be accomplished in these nursery schools by the end of the eighth year? Little positive knowledge is gained before a child enters his sixth year—beyond training its faculties of attention and observation, it would, in my view, be doubtful wisdom to attempt much. The next three years, however, if at the command of a skilful teacher, are perhaps more valuable than any other similar period of his subsequent school career. But it is to be feared the true province of an infant school is as yet too little understood by English teachers, and the result is that these three most precious years are almost worse than wasted. In illustration of this, I may cite a case which came under my notice in the course of this inquiry. A governess, in some qualities desirable in a teacher unequalled by any in the district, and highly commended by Her Majesty's Inspector, was giving a lesson on the geography of Europe to a class of 30 or 40 apparently very attentive listeners, averaging six years. So that before they had yet gained a clear perception of the length of a yard, or a foot, they must learn that the Volga was so many thousand miles long, the Alps so many thousand feet high, and St. Petersburgh or Rome so many hundred miles from London. The first simple notions of geometry could have been made infinitely more entertaining; they are incomparably more effective in developing the faculties, and require no effort of comprehension beyond a child's capacity, while they help an appreciation of form essential to correct taste.

Proposed primary school for Ealing. Its results.

39. One of the central schools on the Green would be best adapted for the primary school, but either would require enlargement to afford accommodation for all in Ealing, between 8 and 11 years inclusive, allowance being made for increase of population, from 400 to 450 scholars. Thus the total number on the rolls being in Ealing, 833, a number considerably in excess of that, 950, is the number here provided for in view of increments of population, and those who will be brought in by enforced attendance. On quitting the primary school, any ordinary scholar, who had had the advantages of good training in the nursery school, of a connected systematic course due to regularity of attendance, and of an improved classification consequent on aggregating large numbers, would be more than a match in scholastic attainments for another of 14 trained under the present, in every point defective system; particularly would his knowledge possess greater stability, owing to his increased opportunities for firmly rivetting every link in the chain on which it hung.

Proposed distribution of scholars at Brentford.

40. By precisely similar arrangements the 1,268 scholars of Brentford, *plus* the 455 of that town now in the streets, *plus* an addition of 200 representing increase of population, or a total of 1,923, would be distributed amongst existing schools—enlarged where necessary—the present British school becoming the primary school.

Proposed secondary school for the whole district.

41. Such a scheme as that just slightly sketched, or one not unlike it in principle, would, it is presumable, greatly facilitate the large objects your Council are endeavouring to promote, by setting free three years, now (through our defective classification, and inability to insist upon attendance) entirely wasted, for higher technical and scientific instruction, which would be the proper care of the secondary school. The pupils admitted to this school would be of both sexes, and between 11 and 14 years of age. The numbers of this age on all the school registers of the parish amount to between 250 and 300, about 200 belonging to Brentford. It would be necessary that this school should be made accessible to the whole parish, and it opportunely happens that the site best adapted for it will shortly be cleared for the erection of new school premises. This spot is about equidistant between the two extremes of the parish, and its distance from the most remote dwelling of the district is not so great as many boys travel daily to and from the British schools at Brentford.

Secondary school training.

42. As the main purpose of a technical school is to produce skilled artisans, there would necessarily here be less of simultaneous and more of individual teaching; as far as practicable, each pupil's course of instruction would be modified according to his intended pursuit or his inclinations, and the cost of his training would therefore be proportionately enhanced, a fact which leads us to consider how far we were justified in pronouncing the suggested alterations in our present scheme capable of an economy of money as well as of time.

View of the income and expenditure of existing schools.

43. The following table exhibits the main sources of income and the annual expenditure of the existing schools of the district:—

TABLE V.—INCOME AND EXPENDITURE OF EXISTING SCHOOLS.

	Name of School.	Voluntary Contributions.	School Pence.	Government Grant.	Gross Income.	Annual Expenditure.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Ealing.	Endowed Schools (boys)....	8 13 6	15 10 4	..	174 2 0½	198 7 8½
	" " (girls)....	..	19 6 6	..	152 8 10	126 9 10¾
	Ealing (infants)	52 8 0	19 9 0	31 14 8	111 9 4	102 8 11
	St. John's (infants)	54 13 6	19 6 4	..	80 1 4	72 15 5
	British (mixed and infants).	49 14 6	98 13 0	89 17 4	264 7 0½	249 18 0
Brentford.	National (girls)	12 10 0	12 4 10	..	100 7 9½	123 9 7
	" (infants)	20 11 0	14 10 4	..	46 1 4	72 7 3½
	" (mixed)..........	13 0 0	25 0 0	..	98 0 0	98 0 0
	Ragged (mixed and infants)	199 16 10	..	80 18 10	280 15 8	280 15 8
	British (mixed and infants)	97 19 0	256 9 11	251 14 4	675 8 5	665 4 6
	Totals..........	509 6 4	480 10 3	454 5 2	1,965 1 9½	1,989 17 9¾

The total educational expenditure of the district being taken at £1,987 17s. 9¾d., and the total average number in attendance at 1,556; the annual cost per head is £1 5s. 7d. The estimated average cost per scholar in England and Wales is £1 12s. 6d.; but the cost in State aid schools, taken separately, is £1 6s. 8d. It would be misleading to compare the costs of any two schools mentioned in the table, the conditions being too dissimilar

to obtain a fair criterion of their relative economy. For example, the Brentford British Schools are the only schools in the district with a teaching-staff at all adequate to the numbers, and here the head-master's salary alone almost equals in amount the united receipts of the whole staff, monitors included, at the British Schools of Ealing. The total salaries of principals, assistants, pupil-teachers, and monitors throughout the parish is £1,071 8s. 10d. Of this sum, £512 15s. 7d., nearly one-half, goes to the British Schools, Brentford. It is the smallness of the remaining incomes which gives to this parish such apparent priority in point of economy as compared with the average of villages in England and Wales.

Mistaken economy of the Board of Guardians.

44. While on the subject of teachers' salaries, it may be mentioned that the guardians of this union have, for some months, been vainly advertising for a schoolmaster, and, because they refuse to offer a salary of more than £30, they are driven to the necessity of retaining a master, who, as I understand, dislikes them as much as they disapprove him. Some of them appear to be as little conscious of the value of teaching power as they are regardless of the universal experience that the school is as the teacher.* What wonder that 30 per cent. of workhouse children go wrong!

The augmentation of teachers' incomes.

45. But one of the principal merits claimed for the suggested scheme of reorganisation is, that it will make the teacher's labour more remunerative, and offer such inducements as will prevent his abandoning his profession just at the moment when his matured experience has a double value. It is, besides, both reasonable and possible he should receive some recognition for the moral benefits conferred by his discipline, as well as for the mere mechanical results of his teaching. No very accurate moral guage can, perhaps, be discovered; yet it would not be difficult to increase a master's augmentation proportionately with his success in turning out boys whose character and deportment should continue unimpeachable during the first six months of their being employed. Still, home influences and associations have so much more to do with the formation of a boy's character than those of the school, that the mistake may often be made of attributing to the master a result to which he can lay no particle of claim, unless occasions be taken to note that his general moral power continues unbroken in the school, which would appear to be the proper object of an unannounced inspector.

Inadequacy of voluntary effort to the demands of education.

46. A glance at the foregoing table is sufficient to convince us of the inadequacy of voluntary effort in meeting the demands of education; only one-fourth of the income of existing schools arises from subscriptions, and several of these schools are considerably in debt to their respective treasurers. Of the £510 subscribed last year, two-fifths were due to the munificence of a single lady, the catholicity of whose benefactions is proverbial. The Baroness Rothschild assists the poor of this parish to the extent of £3,000 annually, without distinction of sect or creed. If we analyse the subscription lists still more minutely, we shall find that many whose opulence would point them out as the largest contributors of eduational means render no help whatever, and, on the other hand, that spontaneous aid often flows in channels where it could be dispensed with; in other cases it is paralysed by the magnitude of the evil to be remedied. What is undeniable is, that it has failed to give any instruction at all to 500 children who are growing up in the most deplorable ignorance.

* The same guardians have just appointed an under nurse of the union-house as schoolmistress.

The necessity for an education rate.

47. We conclude, therefore, that voluntary benevolence must be supplemented by taxation or rates. The rateable value of property in the parish is estimated at £83,318 10s. This would yield, at 4d. in the £, £1,388 12s. 10d. In the event of a rate being declared, all small annual subscriptions may be expected to be withheld, and only those of £5 and upwards continued; these latter amount to about £300. Charitable endowments, applicable to educational purposes, are equal to £400. The government grant for 2,500 children, supposing them all to pass (as it is believed they would under an improved organisation) as creditably, as the scholars of the British School (Brentford) last year, would amount to £1,086.

Tabulated, these sources of income stand thus:—

A 4d. rate would yield	1,388	12	10
Endowments	400	0	0
Voluntary subscriptions	300	0	0
Government grant	1,086	0	0
Total	£3,174	12	10

Average cost per head in schools on the old and on the reorganised plan.

48. The average cost per head in all state-aided schools was said to be £1 6s. 8d. But irrefragable evidence has been again and again produced in proof that by scientific classification on large scales, such as proposed for this district, the rate of cost for education in primary schools may be reduced to £1 per head. Since, however, this rate would be insufficient to maintain the secondary school, we will assume that, for an average of £1 5s. per head, the whole scheme of primary and secondary education may be kept in operation entirely free from indebtedness. On this assumption, £3,125 would be needed, a sum less by £49 12s. 10d. than the reliable income. This calculation omits all reference to the weekly payments by artisans and the more respectable of the dependent class, because the necessary statistics for forming an opinion upon the best means of levying these payments have not yet been obtained.

Economic results of re-organisation.

49. A comparison of the present outlay (£1 5s. 7d. per head) with that involved in the recommended alterations of the scheme (£1 5s. per head) appears at first view not to confirm the statement that a large economy would be effected by the change. But under the new administration of educational means a boy will have completed his first school course by his 11th year, while on the old plan he would not have been so well grounded, even in three elementary subjects, by his 14th year. If, therefore, we would measure the economic value of the two systems, it is important to consider the gain in productive labour the three years curtailed from the period of school attendance would permit. And further, as the effects of military drill and other systematic physical exercises, for which, it is assumed, provision would be made by the new plan, is to give to three the capacity of five for all ordinary purposes of labour, it follows that the advantages of five years' employment, now entirely lost, must be put down to the credit of a readjusted organisation, equivalent to an average money value of 6s. per week, or a total of £80 for every child thus trained. The gain in economy is equally striking if we simply compare the actual amounts of the school expenditure on the two plans. The respective factors are—

For the present plan, £1 5s. 7d.; 2,500 scholars; 9 years,
„ new „ £1 5s. 0d.; 2,500 „ 6 „

and the totals of expenditure are, £28,781 5s. and £18,750, representing a saving of upwards of £10,000 in a single parish, and in the whole country of above fifteen millions, by improved organisation and methods.

The advantage of secondary-school training.

50. The comparison may still be pursued when, instead of leaving school for the farm or the factory, a boy is advanced at his 11th year to the secondary or technical school. At present, except in schools of superior organisation, like Mr. Tate's, at Brentford (formerly under the skilful management of Mr. Crampton), there is no field for mental training beyond the three R's, while in the class of schools the urgency of which your Council have taken the initiative in making apparent, proficiency in any three of the following subjects could with certainty be obtained :— Drawing, mathematics (pure and mixed), physical science, chemistry, book-keeping, short-hand, French, advanced English, vocal and instrumental music. Specialities for boys would be military drill and the use of tools ; in all such exercises perhaps the precedence, which an almost superstitious conventionality gives to the right hand, should be ignored. Specialities for girls :—Dancing, sewing with machine, and skilled cutting. Instead of doing work carried from home, they might be required to make and re-adapt clothing intended for the poorer children at the free schools.

Military drill.

51. Military drill, as an important auxiliary in improving discipline, would form a necessary part of the training of the primary schools; but it would be serviceable to boys of the higher school, as well as of advantage to volunteers, were they occasionally brigaded with the local corps for field evolutions or ordinary tactical experiments. It is Mr. Tate's experience (his is the only primary school of the district where drill is practised) that a drill-sergeant should not be employed; the schoolmaster's better knowledge of the dispositions and characters of the boys, secures for him readier submission in the ranks. This habit of prompt obedience, he says, is carried into class with the happiest effect on the *morale* of the school. "Without boasting, in reference to discipline, he would challenge comparison with any school in the country."

Differences in the intellectual capacities of children of separate districts.

52. The children of Brentford are declared to be of slower capacity for learning than the children in London and other places. They require, therefore, to brighten them up, to have the extra stimulus that is imparted by good drill and physical training, and by first-rate teaching power, beginning first with the best appointed and systematised infant schools. Mr. Chadwick, who has paid special attention to the power of receptivity, as it may be called, of different races of children, states, on the testimony of teachers who have conducted schools in the northern and the southern counties, that the power of learning of the Lancashire children, for example, as compared with that of children in Hampshire or Berkshire, is as 3 to 2 ; and, as compared with that of others living in Norfolk, as 5 to 4. Mr. Tate, of Brentford, has taught in a school at Leeds, and he states that the Yorkshire children learn much quicker and retain much better. He rates the difference as 5 to 3. The earliest teaching, and on the most approved models, will be needed to bring this backward population up to the front. Only teachers of observation, who have had experience among children of different districts, tribes, or races, can be aware of these differences, and what is required to meet them. Their existence is not perceived even by the people themselves.

The constitution of a local board.

53. As to the constitution of the local board of control of the reorganised schools, there is the usual diversity of opinion. Fear is expressed that if the clergy are *ex-officio* members their differences will be a seriously disturbing element, but none wish their entire exclusion. Amongst the clergy themselves a disinclination is felt by those of the Church of England to sit with the Nonconformists, who at present, perhaps, are a little lukewarm about the honours of management. Influential ratepayers insist upon the right of their body to elect whom they please, yet deprecate in the strongest terms a reduplication of the Board of Guardians. Fortunately, there is here no lack of gentlemen of high standing in the esteem of the parishioners, who would willingly undertake this responsible duty, and who would be trusted. Provided, therefore, all elections are subject to revision by the central board, but little difficulty on this point need be apprehended.

Conclusions.

I may venture to submit, as the proximate results of the investigation made under the guidance of the important instructions with which I had the honour to be charged by your Council :—

First, as to the children of the most depressed of the wage-classes.

That, out of about 2,500, there are upwards of 500 of the school ages who do not attend any school whatsoever, who are growing up in ignorance, industrial inaptitude, and demoralisation ; and of these, 80 are the children of vagrants in direct training for crime.

Second, as to the children of the self-supporting wage-classes and the lower middle-classes of the district :—

That the elementary teaching and training they receive is very ill-qualified to prepare them for productive service.

That in the lowest part of the district, Brentford, whilst the expenditure for drink averages fifteen pounds per family, the expenditure on primary education amounts to little more than fifteen shillings.

That there is a large and increasing amount of pauperism in the district.

That the district furnishes a large contingent to the reformatories and prisons, and for the occupation of the police.

That the primary school-teaching is, on the average, inferior and excessively long, extending to the fourteenth year.

That elementary drawing is little taught within the district, although it is pronounced to be as valuable to artisans as handwriting.

That, except in one school, the British School at Brentford, there is no physical training by drill or systematised gymnastics.

That within the district there has been much waste in school buildings, and that manifest waste is now going on, due to want of local knowledge of school organisation, and want of central arrangements to secure a more economical and efficient application of the aids dispensed by the State.

That inspection is far too uncommon, and should become general ; inspected schools being invariably in advance of uninspected.

That the payments for teaching-power are insufficient.

That by an improved organisation, involving higher remuneration to teachers, an advanced secondary as well as primary scheme of education may be established and kept in successful working, instruction being imparted in many branches of art and science now wholly neglected, and at a cost of time and money greatly below that demanded by the existing defective system.

That, of the children of the school ages within this district who are in question, about one-sixth need some form of compulsion or of special conciliation to ensure proper school attendance, the mode or extent of the conciliation to be ascertained by an out-door agency, such as is described in the appendix No. 2 of the instructions for bringing the school in better relation with the home and the place of work, and acting upon powers of the modified application of the half-time principle or of the Factories Act, together with Mr. Denison's Act, whilst the children of vagrants, about one-sixth of the children attending no school, or about one-fortieth of

all the children of the school ages, may require the application of the principle of Mr. Adderley's Industrial School's Act, and the aid of the police.

That at a meeting of married men of the wage-classes, whose average expenditure on drink was at the highest, a unanimous resolution was passed in favour of a compulsory measure of education.

That it is declared that the voluntary power of contribution by school pence, and the beneficence of individuals directed to the support of primary education in the district is nearly exhausted; and that it is averred the extent of the rate-paying power in the highly pauperised portion of the district has been reached, and the additional fourpence in the pound could with difficulty be attained. That is to say, they could not bear a forced reduction to the extent of one-twentieth of their expenditure in drink, which, as a member of your Council has suggested, raises the question whether the readiest mode of getting a national scheme of education will not be for the State to advance what is required, by deducting from the revenue derived from intemperance the sum needed for the support of its proper corrective.

That the provision of *ex-officio* guardians on any school board for the district, might render eligible the Baron Rothschild; Sir Alexander Spearman; Mr. James Whigham, County Court Judge; Mr. Webster, a member of the Chancery Bar, who has bestowed much labour for the improvement of the district, and a number of other gentlemen of high social station and distinguished ability.

I have the honour to remain,
My lords and gentlemen,
Your most obedient servant,
T. Paynter Allen.

Appendix.

The Rev. G. R. Gleig, Chaplain-General to the Forces, in a letter to Colonel Maxwell, of July, 17, 1865, says:—

"I must first of all put you right in regard to the system of education which prevails in the army. It is not purely secular. So far as the schoolmaster and mistress are concerned, there is, indeed, a prohibition upon them to refrain from teaching, in regular school hours, *dogmatic religion*. But the work of every day begins with a collective Bible lesson. . . The Bible lesson is not, however, compulsory on those among the children whose parents object to it. These make their appearance in school after the half-hour devoted to instruction in Scripture has expired.

"We do not, however, in the army neglect dogmatic teaching. On two days in every week, and for one hour in each day, our chaplains take charge of our schools, which are divided according to the religious persuasions of the pupils. The Church of England chaplain has his disciples handed over to him, and he instructs them in the Church Catechism, the Collects, the Epistles and Gospels, in the Prayer-book generally, and in the constitution and doctrines of the Church. The same process is followed by the Presbyterian and Roman Catholic chaplains. Each has his own pupils in a room apart from the Church of England children, or in a distinct portion of the schoolroom . . . and each instructs his class in the principles and practices of his own church, which is also theirs.

"We have, besides, Sunday schools everywhere. This will show you that, in describing our system as purely secular, a certain amount of mistake is committed. We keep, indeed, our religious and our secular instruction separate, and we never use the Bible as a mere reading book. . . . I can testify to the working of the system of religious instruction, which is excellent. . . . Indeed, I don't find in any parochial schools, which, from time to time, I visit, anything like the same amount of intelligence and knowledge which I find in the schools of our regiments."—(*Vide Report on the State of Education in the Country Districts of Scotland.* Sellar and Maxwell, 1866, pp. 231-2).

ON INFANT SCHOOL TEACHING,

AS AUXILIARY TO SECONDARY SCHOOL TEACHING;

AND ON

MIXED-SCHOOL TEACHING AT THE HOME AND COLONIAL TRAINING-COLLEGE.

By Mr. E. COGHLAN, Superintendent of the Schools.

How long have you taught or superintended the teaching of children?—More than twenty-five years.

What are the numbers of children, and from what to what ages taught in this institution?—Between eight and nine hundred, and from two and a-half or three years of age to fifteen.

What is the general social position of the parents of the children?—In the middle-class school, small shop-keepers, clerks, superior artisans, and about 15 or 20 per cent. of the parents of larger means and better education, who send their children because they appreciate the education given in the school; in the other schools the great majority of the children are those of the labouring classes.

What amount of attainment do you impart on the average to children, say between the tenth and eleventh year, or ten and a-half?—Children who are regular in their attendance in our schools, from the age of seven or eight, or even earlier, become really intelligent boys and girls between eleven and twelve. They read well, write very fairly, work the simple and compound rules of arithmetic intelligently, know something of English grammar and geography, and have considerable knowledge of natural history and common things. They gain, at the same time, what is better than their attainments, a real love of learning, which disposes them in numerous instances, when they leave school, to take advantage of evening classes and other means of improvement. Frequently, also, they persuade their parents to allow them to remain at school for a longer period.

Do you ever receive children of these ages who have been taught previously at the small middle-class adventure schools, under single masters, in single chambered schools, say of 40 or 50?—A large proportion of the pupils of our middle-class school consists of children from such schools.

What extent and quality of school attainments do you generally find them to have gained by that age in such schools?—As a rule, the extent is very limited; the quality very poor. The reading, even when accurate, is without expression, or any intelligent apprehension of the sense. The writing of the boys frequently fair, of the girls usually an angular scrawl. Arithmetic very poor; it is the rarest thing to find a boy or girl who understands any of the principles of the rules they have worked. It is common to find girls, 11, 12, and even 13 years of age, who cannot write down correctly such numbers as 4,004, or 3,702, &c., who do not know the multiplication table, and who count on their fingers in adding. The worst feature in the case, both of boys and girls, is the absence of mental vigour—of the power of attention and application which they so frequently exhibit. This makes the task of teaching them, for a considerable time, both difficult and irksome.

By your additional teaching-power, and divisional labour, what attainments do you impart by the 13th or 14th years?—Assuming that the pupils have passed through our infant schools, and been in regular attendance till that age, they would be able to read with fluency and expression; write a good hand, and express themselves very fairly in writing; have a good and accurate knowledge of mercantile arithmetic, including vulgar and decimal fractions; they would be able to parse and analyse an ordinary paragraph; they would have some knowledge of general geography, a fuller knowledge of the geography of the British Empire, and a considerable amount of information on natural history and common things. The boys would know something of book-keeping, the first book of Euclid and algebra, perhaps as far as quadratic equations. They would also have some facility in elementary drawing and practical geometry. (I speak of the middle-class school.) But supposing the children have not passed through the infant school, 20 or 30 per cent. would, in most cases, have to be deducted from these attainments.

Of late times you have introduced military drill, and the Swedish system of gymnastics?—Yes; but before their introduction we always had some drilling and marching.

On your observation, what has been the result of that additional physical to the mental training, and what promise does it afford for its general introduction as a part of elementary training?—As far as my observation goes, I cannot speak too highly of its good effect. It is a healthful recreation; the children like it. It prevents rude and boisterous play, and the offences arising out of such play. The mind improves with the body, and the drilling is found greatly to promote order and regularity in all the movements to and from classes. The awkward and ungainly acquire some ease and grace of motion. Narrow chests are expanded. Many

children return to the school-room with increased vigour. The general introduction of some system of drill into all schools, boys and girls, I should consider a great gain, physical, mental, and moral.

What do you find to be the gain in quality as well as time by good infant school teaching?—The best answer I can give to this question is contained in the following extract from a paper of mine, on infant schools, in the last "Occasional Paper" of the Home and Colonial School Society, and drawn up by desire of its committee:—

"Shortly after the foundation of this society, a juvenile school was formed for children from seven years of age and upwards, and placed under my care. This school was supplied with children partly drafted from the previously existing infant school of the institution, and partly by children admitted from the neighbourhood. The contrast which the conduct and progress of these two sets of children presented, year after year, was strongly marked, affording a most striking illustration of the importance and value of infant schools. The labour of teaching and governing the children trained in the infant school was much less, whilst their progress was more certain, steady, and satisfactory. Children from eight to eleven years of age admitted from without, were constantly to be found in the same classes with those of seven, eight, and nine who had been drafted from the infant school. In the middle-class school, established a few years ago, the contrast is still greater. Every year a few of our infant school children pass into this school, and on their entrance are usually classed with children their seniors by two, often three, years.

"It is easy to explain the cause of this difference. The child of seven, or even six, who enters a juvenile school, after having spent three or four years in a well-conducted infant school, brings with him a considerable share of rudimentary, but at the same time accurate, knowledge of most of the subjects in which he is to be afterwards educated. But this knowledge, important as it is, is of far less value to him than the gentle yet efficient training he has received in acquiring it. He has begun with each subject at its first or simplest point, and learnt one fact after another connected with it, in its natural order, without break or gap, and in this way has laid a sound foundation for future work. He has been encouraged to put forth his infantile powers to acquire some knowledge for himself, helped where he needed help, guided where he needed guidance, and thus his mind has been developed without being in any way strained or forced. He has taken pleasure in the exercise of his faculties, and, above all, acquired some love for learning, not only because it has gratified his awakened curiosity, and saved him from idleness, but also because learning has never been made a burden and terror by tasks or punishments. Let me add, the advantage of the little scholar from the infant school does not stop here. He brings with him to the higher school habits of the greatest importance to his future progress, not only in the school, but, since "the child is the father of the man," through life. Habits of attention and obedience, of order, neatness, and exactitude, cultivated in him by watchful care from day to day, and only requiring further development and encouragement as he advances in age to become fixed and permanent. Nor is this all. He brings with him fingers made dexterous by the use of Kinder Garten tools, and of pen and pencil from the time that he was able to hold them; senses quickened by steady, though moderate, exercise; a ready sympathy with whatever he is taught; and a love of learning which makes teaching him a pleasure. I well remember Canon Cook, when one of Her Majesty's Inspectors, coming into our infant school one afternoon and seeing all the children at work—some on the gallery, others printing, and others at Kinder Garten work—and expressing himself to this effect:—'This is what an infant school ought indeed to be. Here is work for the hands and for the eyes; work requiring thought, but not too much. It is also work which they evidently like, for they are all intent upon it, and seem very happy in doing it.' Alas! this was before the Revised Code, and the invention of Standard II., which has done much to crush the old life and spirit out of our infant schools.

"It is a common mistake to suppose that children are happier and learn all the better for being left to themselves for the first five or six years of their lives. The real state of the case is the very reverse. A child is never so happy as when he is regularly and moderately occupied in congenial employment. The constant testimony of the parents is, that the children are much more easily managed at home, give far less trouble, require fewer toys, and are altogether happier.

"And as regards work, the child who enters school for the first time at the age of six or seven, has not only everything to learn that his fellow child in the infant school has already learnt, but in general he has many things to unlearn. As a rule, he is careless and inattentive, boisterous or mischievous, as an indulged natural disposition may determine, incapable of fixing his mind upon anything, or of using his hands or eyes to any good purpose. Even in his play, which is the thing he likes best and knows best, he is loud and clumsy, never having learnt how to run, march, or do anything in harmony with others. In point of health and bodily vigour, also, for which idleness is supposed to do so much, he is inferior to the infant school child whose alternations of play and pleasant occupation are favourable alike to the development of mind and body. Of course these statements must be considered as referring only to good modern infant schools; and it must be admitted there are infant school children who never come up to the general standard of the higher school, and there are likewise children who have never seen an infant school, for whom nature has done so much that they make wonderful progress after they have once begun. These are the exceptions. After an experience of twenty-five years, first in the juvenile school and afterwards in the middle-class school, affording the most ample opportunities for judging, I do not hesitate to say that regular attendance in a good infant school, from the age of two and a half to seven is, on an average, fully equal to eighteen months or two years additional school life. That is to say, other things being equal, a child trained in a good infant school would, at the age of ten, be as well educated as a child who had not been so trained at eleven and a-half, or even twelve.*

"Now, as it is a fact generally acknowledged and deplored that few children of the labouring classes remain in school after ten years of age, and it is doubted whether any legislation can ever materially alter this fact, is it not obvious that the proper way of meeting the difficulty is a general adoption of infant schools, and consequent addition of a year and a-half or two years to the school life as well as to the moral and religious training of the children of our working classes."

What has been your proximate experience on observation of teaching on a large scale, in an institution like this, as a manufactory, or as a mart for technical service?—If by "technical" is meant special preparation for some given employment, it is not attempted, and never has been. The aim of the Society is to give such a general education as will prepare the pupils for any occupation in which they may hereafter engage. With regard to the destination of the pupils after leaving school, I can only speak with any degree of certainty of the school immediately under my care. From 15 to 20 per cent. of the boys of this school become clerks in lawyers', city, or railway offices. The greater part of the remainder take to their fathers' trades or employments, or become assistants in retail shops; some, perhaps 10 per cent. of the whole,

* Further observation and reflection has satisfied me that two years' gain is not too great an estimate for good infant school training.

enter wholesale houses. Of the girls, about 10 to 15 per cent. become teachers (before the Revised Code came into operation a larger number entered this field of employment); 15 to 20 per cent. serve in shops; the remainder, as far as I am able to judge, assist at home in some capacity. Several obtain employment in telegraph offices; few, or none, become domestic servants.

May not the time saved by teaching upon a large scale be further improved for technical teaching, by the superintendent being brought more systematically in contact with the home, or with the manufactory?—If technical education, I repeat, mean preparation for some special employment, I very much doubt the wisdom of introducing it for pupils under 13 years of age. I am of opinion that a good general education, including, of course, such subjects as drawing and practical geometry, is the best preparation a boy can have for entering upon any special employment. Whilst I say this, I am of opinion that the more a teacher is brought in contact with the homes of his pupils, the greater will be his influence for good of every kind, and certainly he will be in a better position to stimulate them to exertion, and to give them hints in the direction of their future work; beyond this I should not think it profitable or desirable to go.

You school is a mixed school, and boys and girls are taught together in the same classes. How far does your experience coincide with that stated by Mr. Morrison, the master of the Free Church Training College, Glasgow?—We have for the last thirty-five years taught boys and girls together, and our experience coincides entirely with Mr. Morrison's. None of the boys remain after fifteen at the school; and we do not admit either boys or girls after twelve years of age.

The male and female children have separate playgrounds and offices, have they not?—Yes.

Are not the male and female children dismissed at separate times?—Yes. Great care is taken at the dismissal of the schools. The boys who take a much shorter time to dress than the girls, are dismissed first. They march in two columns, one going to the right and the other to the left, each under a captain, who is responsible for their conduct up to a certain distance from the school. The girls go in classes, the younger first. In connection with this subject, it may be observed, that nothing tends more to the right conduct of mixed schools than good order.

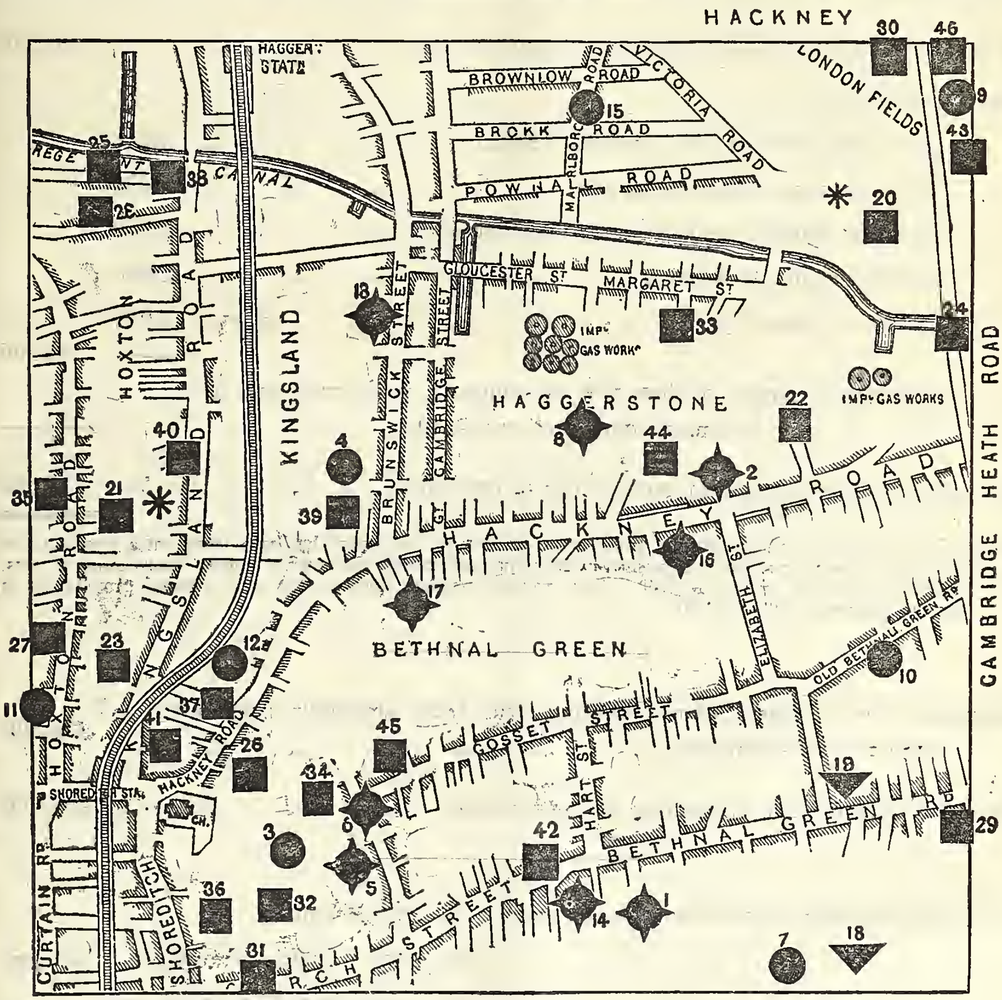
Up to what period, and to what ages, would you employ female teachers?—Where boys and girls are taught together, I think they may be left under a competent female teacher in our primary schools as long as they are likely to remain at school; but in a school consisting of boys only, 10 or 11 would be the limit. As far as my experience goes, a female would find it easier to govern boys in a mixed school than in a school from which the girls are excluded.

From what distances do children come to your school?—About 2-5ths from within a radius of a mile of the school, about 2-5ths more from between one and two miles, the remaining 1·5th from greater distances.

Supplement to the "Journal of the Society of Arts," March 25th, 1870.

Society for the Encouragement of Arts, Manufactures, and Commerce.

THE EDUCATIONAL CONDITION & REQUIREMENTS OF ONE SQUARE MILE IN THE EAST-END OF LONDON.



17 schools receiving government grants.

2 schools inspected by government, but receiving no grants.

27 schools not inspected by government.

8 schools proposed to be enlarged. (1 and 14 being alternate)

2 proposed new schools.

The numbers refer to Appendix I.

PREPARED AT THE REQUEST OF THE COUNCIL,
BY GEORGE C. T. BARTLEY.

LONDON: BELL AND DALDY, YORK-STREET, COVENT-GARDEN, W.C.

PRICE 1s.] 1870.

STATISTICS OF THE SQUARE MILE.

Estimated Population	130,000
Number of Houses...	17,589
Estimated Rateable Value	£250,000

Estimated Number of Children between 3 and 12 years		30,160
Number at School :—		
In Government inspected and aided schools	5,618	
In Government inspected schools	480	
In public schools paying a fee but not inspected	1,810	
In free schools not inspected	1,990	
In private dames' schools .. .. (about)	1,000	
		10,898
(Estimated number of these who are taught to read, write, and do arithmetic fairly well, say 4,000.)		
Estimated Number growing up more or less in ignorance		19,262

Note.—From a fear of overstating the educational destitution, the report has been based on a population of 130,000. The returns kindly furnished by the police authorities, and received shortly before going to press, prove the total to exceed 150,000. This would, therefore, increase the total number growing up in ignorance from 19,262 to 23,602.

Estimated Cost of New School Buildings and Land absolutely necessary if these are to be educated	£60,000
Estimated Annual Cost of keeping up these schools	£16,000

One Public-house or Beer-house exists for every	53	Private Houses.
,, ,,	453	Men, Women, and Children of all ages.
,, ,,	249	Adults over 20 years of age.

In this square mile there are 165 public-houses and 166 beer-houses, and the estimated amount annually spent in them by these very poor people is not less than £450,000. If one penny out of every eight now spent in drink were put by for one year, the amount raised would more than build the schools required, and one penny out of every twenty-eight would keep them up efficiently, without any government aid or assistance from charity.

THE EDUCATIONAL CONDITION AND REQUIREMENTS

OF

ONE SQUARE MILE

AT THE EAST END OF LONDON.

---

1. **Object of the Inquiry.**—The object of the inquiry in the present paper may be considered as fourfold, viz.:—First, to ascertain—the number of children provided for by the existing educational machinery within a certain district, the efficiency of such machinery, and the extent to which it is taken advantage of; secondly, the improvements that might be made without the addition of any great outlay, by the combination and organisation of the present schools; thirdly, the number of children educationally unprovided for; and fourthly, the general feeling in the district as to the advantages of education, and the practical working of any great educational measure among the poorest class of the community.

2. **The District, its Population, and Character.**—The district embraced in the inquiry is exactly one square mile, bounded on the east by the Cambridge-heath-road; on the west by High-street, Hoxton; on the south by Church-street, Shoreditch; and on the north by Shrubland-road, Dalston. It includes the worst portion of Bethnal-green, Shoreditch, and Hoxton, a part of Kingsland, Hackney, and the whole of Haggerstone. The population it is difficult to ascertain with certainty, but, after careful examination, it is estimated that the number amounts to at least 130,000. The northern portion is comparatively of a respectable character, but the southern half or three-quarters is inhabited by the poorest and most neglected part of the community. The houses are composed chiefly of four or five rooms, and usually contain the same number of families. An old inn which, some sixty years ago, was a sort of Sunday excursion house on the Cat-and-Mutton-fields, now called the London-fields, contains twenty-six rooms, and has no fewer than twenty-six families residing in it.

3. In the following statement it must not be supposed that a square mile, or the particular square mile which has been selected, has been taken with any idea to its being the most convenient area for future legislation. The scheme for its improvement, though necessarily drawn up without regard to the surrounding district, is not meant in any way to imply that, with a lengthened investigation, embracing the whole of the north-eastern district of about 14 square miles, a more economical and efficient arrangement might not be arrived at.

. **District Demoralised by False Charity.**—The nature of the district embraced is no doubt miserable even for the East of London, and for this reason chiefly it was chosen, but neglect is not now the evil which is affecting the inhabitants. For many years the inhabitants were totally neglected. Overgrown parishes with not very energetic clergy had sprung up in a state of hopeless poverty and ignorance. The children even of small tradesmen, within a few yards of Shoreditch Church, had seen some twenty summers without even having heard the name of our Saviour. (No. 120.) During the last two or three years, however, matters have changed, and the district is utterly demoralised by so-called charity. The very name of Bethnal-green is enough to bring money from many persons' pockets, rents have consequently gone up, and scarcely a tenement, however miserable, is unlet. The following examples will give some idea of the existing state of feeling. One of the leading guardians of Bethnal-green, having business with a publican, last winter was congratulating mine host on the open weather, saying what a blessing it was for the poor. The landlord agreed, and, after some little conversation of the same nature, a pause ensued, when a great able-bodied man, who was drinking at the counter, turned round and said, "You make a great mistake, sir; we don't want this weather; what we want is six inches of snow, and then the money will come into Bethnal-green, but people won't send it while the weather's open." On another occasion, when the wife of one of the vicars was remonstrating with a woman for applying for aid so frequently without attempting to get work, she received the following answer, "It is only your *duty* to give to me, mum." During this last winter, and that, too, in the intensely cold weather about the middle of February, it came to the knowledge of another vicar that the charity tickets distributed to the poor to enable them to receive articles, such as groceries, bread, coals, &c., of a certain value at particular shops, were used constantly to buy fresh butter at 1s. 10d. to 2s. a pound; the poor would have no other. Biscuits, the nice sweet ones, were also preferred, and consequently purchased with charity tickets, in many cases, instead of bread.

5. **Public-houses.**—The public-houses flourish. One small beerhouse in Bethnal-green, being purchased by an enterprising man, and embellished at a cost of £300, was sold in five months, at a clear profit of £700 over and above the outlay and takings during that time. In the summer months labourers and artizans make large wages, two and three pounds a week and even more are earned, and the extravagance at that time is remarkable. No provision is made for the winter, and the efforts of many well-meaning people are directed not so much in inculcating habits of economy and self-reliance, as in openly encouraging the reverse by wholesale and indiscriminate alms-giving in the winter. In some cases collections are commenced in the summer to enable large stocks of coals to be purchased cheap for the winter, the supplies standing, in fact, as warnings to all of the folly of providing for their own wants. In the opinion of many of the leading inhabitants, and of those who are well acquainted with the locality, the present administration of charity is a very serious evil. Could the money be devoted to improve the educational state of the unhappy children, it would undoubtedly be effecting a really charitable work.

6. **Mode of Conducting the Inquiry.**—This educational inquiry was conducted on the spot, by a house-to-house visitation, the writer residing in the district during eight days, and devoting the whole of each day to visiting the lodgings of all classes of persons in every part of the square mile. The details of the chief visits are given in Appendix II.

7. **The Inspection of Schools.**—An inspection has also been made of all the public schools,

which provide for the children of the poor, whether assisted by Government or not. A list of these will be found in Appendix I. and further information in Appendix III. No pains have been spared to render this list as accurate as possible, but the difficulty of finding out schools in such a neighbourhood is very great, particularly as they are often placed in the most out-of-the-way alleys and courts. Through the kind assistance of several teachers, the list may be considered practically complete.

8. **Dames' Schools.**—The so-called private, or "select" schools, usually kept by old women, have not been all visited; it would indeed be almost impossible to find many of them. The mistresses who keep them are most jealous of any inquiry, and consequently but little information can be obtained as to their working. As a rule, they are of little value, though, in the eyes of the poor, there is often a feeling that they are more "genteel;" and frequently higher fees are paid for instruction which is very inferior to that given at a British or National School. Evidence No. 93 gives a fair example of this popular delusion. The honest declaration made, a good many years ago, to Bishop Field by a dame in Salisbury, whose school he was inspecting, is equally true at the present time. "It is but little they pays me, and it is but little I teaches 'em." At a broad guess, and probably beyond the truth, the numbers under this kind of instruction, may be taken as 1,000. The greater number of the children are young, and are sent mainly to be got rid of during the day.

9. **Numbers of Children Taught and Untaught.**—Taking the population at the lowest estimate above given, viz., 130,000, it may be presumed that the number of children between the ages of three and fourteen, are as follows:—

Between the ages of	3 and 10	inclusive	24,700
" "	11 and 12	"	5,460
" "	13 and 14	"	5,200
			35,360

10. From the list of schools appended, it appears that only 9,898 children attend any regular school, and allowing that 1,000 are instructed in the dames' schools, it follows that 24,462 children within this one square mile are growing up in almost if not complete ignorance.

11. **Irregular Attendance.**—It must be borne in mind that, of those at school, no fewer than 1,680 attend free ragged schools, where the attendance is most irregular. In all establishments, whether or not a fee is charged, the short periods during which the children stay, although showing that a larger number of individual children than 9,898 enter the schools, also indicate that the number who are really educated must be much below this estimate.

12. This is borne out by the investigation. In speaking to boys who may be seen in dozens playing in the alleys, a stranger will find that most of them say they go to school. On further inquiry it usually turns out that they attend only once or twice a month at some ragged school —probably when a tea is likely to be given. In the case of No. 89, though all eight children were said to have been to school, not one could read, much less write, and one stared when asked what his name was, other than his usual street appellation.

3. From his observations, the writer has come to the conclusion that, of those in this square mile who go to school, not a third can read an ordinary book or newspaper, and fewer still can write an easy sentence. In one case, an intelligent lad of fifteen, who said he had been at school, could just read his letters, and write his own name. This, the boy said with pride, "was something," and he seemed rather to think himself a superior being in consequence of his acquirements.

14. Some Schools not Full.—From the table in Appendix I, it would appear that, while several of the schools are quite full, and in certain cases numbers are weekly turned back from want of accommodation, other places have not nearly their complement. In this way there is accommodation provided for 3,515 children which is not taken advantage of. The reasons for this it is difficult to fix with certainty. In the case of the Shoreditch National School the locality appears to be against it, and there can be no doubt but that fashion, has something to do with the success of certain schools. As a rule, however, those in which the instruction is good are best attended, the parents of the better class rightly judging of the quality of the schools by the children's advancement in reading and writing.

15. Attendance at Inspected and Uninspected Schools.—The attendance at the inspected schools where a fee is charged in all cases is better than that at the uninspected schools, many of which are free. The average attendance at the former is 321, and if full they would accommodate 398, whilst at the latter nine of which are free, the average attendance is but 140, whilst the accommodation provided is for 216. The larger and better schools, therefore, exceed in attendance the smaller and uninspected ones in spite of the supposed advantage of so many of the latter being free.

16. Difficulties of Getting Children to School.—Concerning the modes to be employed of getting those children to school who are at present totally ignorant, careful inquiry has been made, and two fundamental difficulties present themselves:—

First, the apathy and indifference of parents.
Second, the early age at which children are employed in assisting their parents.

17. The first difficulty is very serious, and one not easily coped with. In case No. 88, where, in a miserable court, 14 out of 19 children are at this moment doing nothing but running about the streets in search of mischief, it would seem easy to make some provision under an amended Industrial Schools Act, by which they should be taken to school during the day. Case No. 85 makes this, however, far from satisfactory, as it would be wrong to relieve this man, earning with his wife, £2 5s. a-week, of the expense of teaching his children, merely because he is so indifferent to their welfare. The irregular attendance of those who go to the schools is traced, by most teachers to the parents' indifference. In many cases parents would just as soon their children ran about the streets as went to school, and though most agree that school is a good thing, yet they make but little effort to send children regularly even to the free schools. In case No. 85, a woman with a young family of six, though believing that education was desirable, rather gave the pence to the children for sweets than for schooling, inasmuch, she said, as she had been a child herself, and wished her children to enjoy themselves, as she had done. This same mother stated that if the schools were free she would then send them; yet, in spite of there

being a free school within a hundred yards, it was too much trouble to apply for admission. Case No. 85, already referred to, shows the opinion of an intelligent and somewhat superior, though very poor, man. He considers that no amount of compulsion will get the children of this apathetic class to school except those, perhaps, who are in good work, and who, therefore, might be fined for neglecting their duty. The very poor, earning ten or twelve shillings a week, could, he thinks, only be reached by careful visitation. From the evidence of several teachers, however, and also from that of many of the poor themselves, it would seem that these are the very children to whom compulsion should be applied, inasmuch as they are fast learning to be thieves, and are not even attempting to earn anything, for their parents.

18. The second difficulty is, perhaps, even more serious than the first, in a district such as this for it affects, in thousands of cases, almost the existence of families. Children are required by their parents to work in aid of the general fund at a very tender age. Match-box makers, penny toy makers, weavers, &c., inhabit the district in large numbers, and children can in these trades assist their parents materially before they are ten years old. Case No. 71 shows how very young they thus begin to work. A fair specimen of this difficulty is given in No. 84, where a labouring man, with no education at all, and whose whole family was in the same state, remarked that it was not the school fee which had prevented him sending his family to school, but the loss of the 1s. a week which at 9, 8, or even 7 years of age, each child had by its work added to the family income. Case No. 69 the same. A general feeling seems to exist among many even of the poorest that some restriction might justly be put against the employment of very young children, up to the age of ten years. As long as employers are allowed to do pretty much as they like, it is impossible for parents, at times much pinched in circumstances, to resist the temptation of sending their children out to work as soon as they can earn even a shilling a week.

19. Advisability of Extension of the Workshops' Act.—In many cases there seems to be an opinion that some form of extension of the Workshops' Act would be beneficial, and for children at regular work there would not be much difficulty in enforcing it if slightly altered. At present, however, the universal neglect of this law has prevented those from carrying it out who are willing and anxious to do so, as shown in cases Nos. 100 and 111.

20. Children who help their Parents, &c., when very Young.—In this district, a large number of children, are helping their parents, brothers, or relations in a variety of ways, chiefly at home. These present greater difficulties, from the impossibility of getting at their employers. Though they really work, and often very hard too, yet they do not always receive wages. They increase the family fund, but the community cannot practically hold the employer responsible for their going to school; inasmuch as he being bound by law to feed them, his immediate interest is to keep them at home, where they can assist in maintaining themselves. Such a case is given in No. 71, already referred to, where a man stated that he began to work at filling his father's match-boxes at four years of age. For this he was paid 6d. a week and a lump of pudding on Sundays if good. Many families signify their willingness to agree to a law which would require their children to go to school during certain hours, or on alternate days. Judging from the state of many of the people here, it would be starvation to whole families to require that all the earnings made by children should be at once given up. Little short of a revolution would be the consequence.

21. Unanimous feeling for Education.—Among all the cottages and hovels visited during the inquiry, not a single case was found where parents objected to education. Large numbers, though totally ignorant themselves, and acting as if they cared nothing about any improvement to their offspring, dilate on the importance now-a-days of children being "scholars." The somewhat superior class at times make great efforts to provide the school pence, and not unfrequently send their children to the "ladies' select seminary," at 6d. a week, for what they imagine is a superior instruction. All seem to recognise the fact that some pressure should be put upon persons who neglect their children, but direct compulsion, though nominally acquiesced in by some, even of the lowest class, is violently opposed by others, as instanced by No. 83.

22. The Religious Difficulty.—The so-called religious difficulty has been also investigated, as will be seen from the Appendix. The feeling of all, among the hundreds consulted, with two exceptions (No. 83), is strongly in favour of some religion being taught in the schools. In one case, a person required secular instruction, but said it must be founded on the Bible and Dr. Watt's catechism. Many of the poor, though going to no place of worship themselves, and, in but too many cases, not having an idea of the rudiments of any religion, are particular about their children being taught religion at school, and say they consider it the "right thing." In No. 63, the woman of the house said she would keep her children at home and teach them herself, if religion were excluded from the school. The difficulty concerning sectarianism seems practically not to exist. In but one case (No. 73), it will be found that the parents objected to schools on account of their belonging to one or other denomination. This was a regular bigot, and though somewhat notorious for not attending church herself, would have it that all her children must go to a Church of England school or to none at all—her husband was not so particular. Many think, as one of the parents stated, with greater charity than a large number of her superiors, that all forms of religion are but different roads to the same place (No. 58, 78 and 82.)

23. The Conscience Clause.—In most of the schools the conscience clause is in force, though practically a dead letter. Cases Nos. 106 and 107 are somewhat peculiar. In one case a Jew objected to his boy being excluded from the religious teaching, on the ground that he lost part of the instruction for which he had paid. In the other, another Jew said concerning his child, "Teach him all the Christianity you can, I will make him a Jew all the same at home." In all schools it will be seen that children with parents of different religious persuasions attend without any difficulty, except in some cases where the Church catechism is enforced: parents, with good reason, objecting to their children stating that their god-fathers and god-mothers gave them their names, when they have not even been christened (99 and 123). On the other hand, the children of Jews, Roman Catholics, Dissenters of all sects, and Churchmen may be found in nearly every school

24. School Fees.—The question of the payment of school fees is one which will be seen in the Appendix to have been inquired into. Amongst the poorer classes, the natural answer to the question, "Would you prefer the schools to be free?" is in the affirmative. When children are at home, the parents say that they have been kept away on account of their being too poor to afford the fee. They usually, also, add that if the school was open for nothing, they would send them regularly. This is, however, forcibly contradicted by the fact that they do not send them

to the existing free schools, which are not full. The almost universal evidence of the teachers in the district, as well as of the better class of poor, is against free schools. The children whose attendance is most irregular, are brought as a favour on the part of the parents, and if subjected to any description of discipline, are often removed. Case No. 103 gives a good example of this. In order to remove any excuse for distressed persons not sending their children, some time ago a fund was collected which provides for fifty free scholars. These children are the most irregular and worst in the school.

25. Free Schools Abused.—It is found that this exemption from payment is much abused. Case No. 100 is remarkable. The school here referred to is situated in about as bad a neighbourhood as any in London, being on the site of the operations of Hare and Burke, who here made a trade of murdering persons by decoying them down the courts in order to sell their dead bodies for dissection. On looking over the names of children admitted this winter, it will be found that in spite of the fee being required a month in advance, a large number have come from the free ragged schools. Again, in cases 73 and 83, the free schools are encouraging men with permanent good wages to spend everything on themselves in drink or otherwise. No. 110 also is a case in point where well-to-do parents are withdrawing their children from paying-schools in order to send them where the instruction is gratis.

26. But few are too poor to pay some Fee.—There can be no question but that in this district some parents are really so poor that a school fee could not be expected. From the evidence of many of the poor themselves, this is, however, not often the case, they considering that 1d. or 2d. a week could in most cases be spared (65, 72, 73, 76, and 92). When it is borne in mind that in this square mile there are 165 publichouses and 165 beerhouses, taking, on a very moderate estimate, at least £450,000 a year from these same poor, it must be acknowledged that the difficulty of finding the penny or twopenny school fee is not so great as is sometimes supposed. Twopence from every child between three and twelve, for forty weeks in the year, would but amount to £10,053, or less than 2¼ per cent. on the drink account.

27. Publicans' Profits.—This computation of the publicans' takings is of course as to their gross earnings; but if no other trade flourishes in the East-end, that in drink certainly does. This may be judged of from the following authentic account, given by a respectable drayman :—While one day delivering a load of beer he began gossiping with the landlord, and the conversation, somewhat naturally, turning on their mutual trade, he asked him how he mixed the liquor before selling it. Without much bashfulness, the publican replied, pointing to a large three-gallon pail, "Well, you see, I put five of those in a puncheon (holding seventy-two gallons), but as everybody says mine is the best liquor in the neighbourhood, I am going to make it six." This is 25 per cent. profit, realised probably once a month at least. If this mixture were confined to water it would be comparatively harmless, but in the low beerhouses salt and other materials, some of an acrid character, are but too frequently added, in order to induce thirst. These mixtures, at the same time, excite the passions, and often lead to serious consequences.

28. Bribing Children to School.—Another evil which has grown up with the free schools, but which is not confined to them, is the system of bribing children to attend. This is much practised here, owing often to misguided charity; in fact, parents sometimes distribute their children

among several schools of different denominations, in order themselves to get the "loaves and fishes" attached to each. This causes even a greater evil, inasmuch as children go the rounds of the schools with a view to get the different treats. If a tea is given at a particular school at Christmas, they join at the beginning of December, and if a supper at Easter at another school, they leave the first in February, and go to this to secure the treat. Thus they travel the rounds of the schools, getting all the bribes, but little of the instruction. Again, the gifts of boots and clothes are much abused, children being kept at home in the hope that the school to which they belong may supply them with what they require. The evidence of most of the teachers is strongly against all these bribes and unnatural inducements to children to attend school, as lowering the importance of education in the eyes of both parents and children. The abuses are so great that they more than counterbalance the good such assistance would effect if applied merely to cases of real necessity.

29. Irregular Attendance.—The want of punctuality of pupils is another great source of difficulty. Children come in at all hours. As already stated, much of this is due to the apathy of parents in sending their children, or their want of thought in requiring them to go on errands during school hours which might be done at other times of the day. A considerable proportion of it, however, is due to the peculiar character of the class who inhabit the area embraced in the inquiry. The child is often sent with the parents' work to the warehouse, or the mother goes, and the eldest child, whether boy or girl, must mind the babies till she returns; or he is set to do odd jobs about the house, more particularly on those days set apart for washing. The attendance at the schools on Tuesdays is much reduced from this cause, many not coming at all on that day. In some places, as will be seen in the Appendix, a system of half-day instruction would much reduce this evil. As a general rule the afternoon instruction is somewhat of a continuation of the morning classes, and is not complete in itself. If afternoon classes were formed, where the education was systematic for reading, writing, and arithmetic, many, it is thought, would come who cannot attend all day, and therefore think they had better not attend at all.

30. Migratory Difficulty.—That which gives the teachers great trouble in this part of London is the migratory character of a large section of the population; they only live here during the summer or winter, and then go to the country. This prevents even those few who wish to get on at school from making much progress. It would seem to show the desirability of elementary schools acting on the same system and working together more than at present, so that the children might be drafted with a memorandum from the teacher from school to school, and so the disadvantage of frequent changes as far as is practicable would be lessened.

31. Evening Classes.—The evening class instruction in the neighbourhood is not as good as it might be. Several trials in different parts have completely failed, owing to a want of scholars. In the case of children working at ten or eleven years of age, whose parents care little for their improvement, so long as they bring something home on Saturday, it is not to be expected that they will voluntarily attend evening classes, particularly when they have up to this age, been completely neglected. Should they by any good fortune ever go to a school, they soon get discouraged by finding that the drudgery of learning to read and write has then but to be begun. Comparatively few of the schools have evening classes of importance.

32. Infant Schools.—The necessity for infant schools in such a district is great. This is shown forcibly by the fact that most of the existing schools are full (No. 109). In many cases it appeared that an increased number would come if they could be accommodated. One mother stated that she sent her children at one and a-half years of age, to get them out of the way. The importance of the infant school is shown, first, by the fact that a great deal of elementary instruction and discipline can be inculcated even at this age, if judiciously taught; and second, that it enables the elder children to attend school who would otherwise be obliged to stay at home and act as nurses. In a sanitary point of view, also, as long as the dwellings are so crowded, it is highly desirable to get infants as young as possible into airy and healthy rooms, if for nothing else. In any extensive educational movement in this neighbourhood, infant schools must of necessity form an important part.

33. Pauper Children.—Taking the population at 130,000, it may be allowed that at least 5 per cent. are in the receipt of parish relief—that is, 6,500. Of these, quite 2,000 are within the school ages, and might, under Denison's Act, be sent to school by the guardians. In addition, there are about 200 belonging to the square mile under consideration who are in the district schools in connection with the parishes of Shoreditch and Bethnal-green. As a matter of fact, none of the former do go to school, except in one or two cases which will be found in the Hackney part of the district, Nos. 113 and 115, Hackney being a bright exception to the general neglect of this Act. The cost of sending these 2,000 children, at 2d. a week, for forty weeks in the year, would be £666 per annum, or nearly $\frac{3}{4}$d. in the pound on £250,000, the estimated rateable value of the property comprised within the square mile. School No. 113, it will be seen, would take additional children receiving out-door relief. From the disproportion in the school accommodation to the numbers who attend, it would seem that there is ample provision for all these 2,000 children, and to a great extent, in inspected schools. Over 400 might be taken into the St. Leonards Shoreditch National School, which, though excellently conducted, is not popular in the district, and is consequently almost deserted. It is to be feared, however, that with the present poor-rate at 4s. 8d. in the pound, and local rates, altogether amounting to 8s., such an additional outlay can hardly be expected to be undertaken voluntarily. It might be remarked, however, that the rateable value is but two-thirds, or 67 per cent., of the estimated value ofthe property, a lower standard than exists in many other parts of the metropolis, where it sometimes amounts to 85 per cent.

34. The Industrial Schools Act.—The Industrial Schools Act is not carried out, except perhaps in one or two instances. Day industrial schools are much wanted in the neighbourhood where children wandering about the streets should be required to go by a magistrate's order, similarly as at present to an industrial school. They might return home at night to their parents, and a large number of cases would thus be beneficially provided for, without a heavy charge on the public purse.

35. The Workshops Act.—The Workshops Act is a dead letter. In one case, No. 111, a few children are at school in the evening under it, but where it has been attempted it gave the employers much extra trouble, and they, finding that no one was obliged to attend to it, somewhat naturally discontinued making themselves peculiar by obeying the law (No. 103).

36. The Organisation of the Schools.—Concerning one of the chief objects of this inquiry, viz., the organisation and better classification of schools, few districts can possibly afford a better

example. With such a population, greater than that of many a German State or English county, though confined to one square mile, the educational arrangements must be completely different to those of a spreading agricultural parish. A systematic arrangement of schools is consequently much more easily arranged, and can be carried out without any inconvenience on the score of distance from children's homes.

37.—At present there are 17 schools aided by Government grants; two inspected by Government without having any pecuniary assistance; and 27 entirely supported by fees or subscription. Within an area of about fifty acres behind Shoreditch Church, in the Bethnal-green parish. a district which cannot perhaps be surpassed in dirt and poverty, no fewer than three inspected and six uninspected schools exist. All the pupils they contain could be accommodated in four of them, proving what a large amount of teaching power and outlay is being wasted. These numerous schools involve another serious disadvantage, as above-mentioned, in that they encourage the children to wander from one to another. In Appendices, Nos. 67, 95*a*, 100, and 103, this evil is pointed out; children giving as a reason, if asked why they were going from school to school, " because they did not learn me much."

38. Competition among Schools.—Numerous cases have been known of one school competing with another for the same pupil. This is referred to at Nos. 99, 100, 102, 115, and 122, and is a serious evil. To a certain extent it is due to sectarian differences, but not always so. But from whatever cause arising, it prevents a teacher from having that influence over his pupils which in such a district as the one under consideration is so necessary If any unpleasant discipline is attempted, the pupils threaten to leave, naturally considering, when they are bribed to stay, that this step will be a punishment to the offending teacher.

39. Want of Union among Schools.—Another and a kindred difficulty, experienced by the best teachers, is the want of union among the different schools, as shown in Evidence No. 108. They are all independent of one another, and necessarily act as so many units. Children are taken in at one school who have been removed from another without much regard to their character, and often with no inquiry as to their previous conduct.

40. Want of Gradation in Schools.—Again, this system prohibits any attempt being made by different schools to teach more advanced subjects, which would serve as culminating points for the best pupils, as has been done at Faversham with so much success. See No. 100.

41. Uninspected Schools.—Concerning the schools not under government inspection, and which, unless they are ragged schools in connection with the Ragged School Union, are private speculations, nothing can be said, as it is hopeless to expect them to combine in any way. Inasmuch as 3,800 children attend them, it is a question whether they should not be required to be under some sort of inspection; but it seems probable that, were a general and efficient system established in the district, the larger number of these institutions would soon cease to exist.

42. Statistics of Scholars.—In order, not to paint the wants of the district in too dark colours, let it be supposed that the following children, all of whom attend some sort of school, are being educated, viz. :—

In government inspected and aided schools	5,618
In government inspected schools , ...	480
In public schools paying a fee but not inspected	1,810
In free schools not inspected	1,990
In private dames' schools (usually almost worthless) say	1,000
Total . .	10,898

43. Number Totally Unprovided For.—Deducting this number from the 30,160 who are within the ages of 3 and 12, and, practically, all who are of such a class as to prohibit the idea of their going to boarding schools out of the district, we obtain the total of 19,262 who are receiving no sort of education whatever. Of these the 2,000 children estimated to be receiving out-door relief might almost all be accommodated in the existing inspected schools at a charge of ¾d. in the pound. There yet remains the total number of over 17,000, for whom the only accommodation provided is 2,050 vacant seats in uninspected schools, into which it would be impossible, and unjust indeed, to force them.

44. Provision Required.—In some way, therefore, before any attempt can be made to compel attendance at school, provision is required in buildings for 17,000 children under 12 years of age. Inasmuch as it would be unreasonable to require these children to go to any great distance to their school, the whole number must be provided for within the district embraced, which has been taken for convenience, but not, as has been before stated, with any idea of its possessing special merits of itself.

45. Classes of Children to be Provided For.—The 17,000 children at once divide themselves into two classes: first, those who earn nothing, but are running about the streets; and, second, those who are at work.

46. It is clear that the first category should be at school all day, if only to keep them out of mischief; for it must be remembered that, in such a crowded neighbourhood, the children have no other play-ground than the dirty alleys and streets. Their time would probably be devoted to both physical and mental training. This number might fairly include all under ten years of age, and would amount to at least 14,000. As regards the second category, it would seem from the evidence of many, that if they were to attend regularly half the day, under the Workshops Act, it is all that could be expected or even desired. By a little management, and by making the education of each half-day complete in itself, half of these might attend in the morning and half in the afternoon, and thus accommodation for 1,500 would be sufficient. This would make, with that required for the whole-timers, premises for 15,500 children.

47. Cost of Buildings.—The cost of building schools for these 15,500, taken, as is usually estimated, at £3 per head, would not amount to less than £46,500; but it would seem advisable, as much as possible, to increase the efficiency and accommodation of existing good schools, rather than establish new ones; such a step being not only more economical, but likely to elicit the interest of teachers already doing good work. The sight of large new schools placed in strangers' hands, their own being placed somewhat in the background, might prove a source of irritation and serious discouragement. In addition to the buildings, £1

a head must be allowed for the cost of the land, making a total outlay of not less than £60,000 for school premises and play-grounds. Were it proposed to raise this on the rates, at 4½ per cent., and a sinking fund of 1½ per cent., it would amount to 3½d. in the pound until paid off.

48. Scheme of Organisation.—The following scheme would, it is thought, to a great extent meet the difficulty, and at the same time create day schools having immense advantages over the small ones now existing, giving scope for better organisation, more rapid instruction, and the introduction of drill, physical and other means of training, impossible at present.

49. South-west District.—The Friars Mount and the St. Thomas', Charles-street, Schools might each be enlarged and made model elementary schools each to contain 2,500 children more than they at present provide for. Perhaps it might be desirable to limit them to teaching, say the first three standards of the Education Department. Include in each of them large infant schools, taking children from two years of age, or even younger. Convert the Gascoyne-place School into one for 1,000 children more than at present, and perhaps limit the teaching to the higher standards, for which the teacher is fully qualified. Introduce elementary science in the higher classes, particularly for those few who remain till 14. This would well provide for the teeming population behind Shoreditch Church, being the south-west portion of the mile.

50. North-east District.—In the north-eastern portion, St. Mary's Haggerstone Schools might be enlarged to hold 1,000 additional children, and be confined to the advanced standards. A new school would have to be erected not far from the King's-road, between Hoxton and the Kingsland-road, for 2,000 children in the first three stages. The existing buildings of St. Columba would, if enlarged, be admirably suited for this, but they have been built by private funds, and there is a strong feeling against government inspection and interference.

51. South-east District.—In the south-east corner, including a large part of Bethnal-green, the accommodation is better than the rest of the district, though not at all equal to the requirements, several schools sending away pupils weekly. The schools in St. Peter's-square, and those in connection with St. Jude's, might be enlarged each to accommodate 1,000 more children, without the purchase of additional ground. These might be confined to instruction in the lower standards. Either the Abbey-street British, or the parish National School might also be enlarged for 1,000 children, the question to be decided by which ever of them would think it the more desirable to confine its attention to the upper standards and to elementary science teaching.

52. North-east District.—The north-east division remains, and it may be remarked that several of the local clergy have already considered the subject of amalgamation of their schools with a view to their being made more efficient and more economical, but the subject has dropped until the intentions of the Government on the education question are known. The Boston-street School might be enlarged to accommodate 1,500 children more without very great cost, by throwing it open to Boston-street, an improvement much needed; and a new school not far from Dunton-place might be erected for 1,500 children, the Adelphi British School being at the same time enlarged to provide for the remaining 500 in the advanced standards.

53. Annual Cost.—The annual cost for such an organised system would be as low as that of any efficient course of instruction could be, but it would amount to at least £16,000 a year, taken at the rate of a little over £1 per scholar. This, on the rates, would be more than 1s. 3d. in the £,

al of which it is needless to say it would be impossible to raise in the district, however desirable it might be to expend it in a project which would eventually prove in reducing poverty and distress.

54. How it could be raised in the district without rates.—This amount seems so great for such a poor district, that few would probably object to its being paid mainly by the taxation of the country; but the startling fact should be known that, if the inhabitants of this square mile, who are thought to be so very poor and helpless, were for one year to invest one penny out of every eight they now spend in drink, the £60,000 required for the school buildings would be raised by themselves. Not more than a third of this amount, or a penny in every twenty-eight, would amply keep the schools in order without any State aid or assistance from charity.

55. Conclusion.—In conclusion, it may be remarked that it is hardly possible for any district to give a better example of the inefficiency of existing schools for educating the poorer classes, nor could a locality be found giving a better opportunity for creating a really efficient and organised plan of schools, all working together under one management and having one aim. So many children, it has been shown, are totally unprovided for, that existing institutions, though in many cases excellent, are vastly disproportionate to the requirements of the age, and must be remodelled or fresh ones created before any general system of education can be adopted.

56. The writer would wish it to be known that in eliciting these facts and this information he is largely indebted to several gentlemen for assistance, more particularly to his friend the Rev. G. Hervey, the vicar of St. Augustine's, Haggerstone, without whose aid he could hardly have performed the task. Such an inquiry, embracing so many schools of all descriptions, can only be efficiently pursued by the most careful personal investigation on the spot.

From the foregoing pages, it may be thought that the subject of the quality of the instruction given at the various schools has been somewhat overlooked. This most important branch of such an inquiry, some might say, should form a leading feature of investigation. No doubt this is the case, but the writer, acting as a member of a private Society, and not having due authority of examination, has refrained from giving his opinion on any individual school. In fact, in all points, he has endeavoured to state facts, and leave the necessary inferences to be drawn from them, rather than state his own conclusions.

Without unfairly breaking through this rule, he would wish to place on record the conclusion he has come to, that inspected schools are vastly superior to uninspected ones. In fact, he is convinced that inspection is absolutely necessary for successful working and efficiency.

The private teachers are inferior in status to those in the inspected schools; and though the instruction given in many of these is not, in many cases, so good as it should be, yet they are all greatly in advance of the private or charity schools.

APPENDIX I.—LIST OF SCHOOLS ALREADY EXISTING IN THE SQUARE MILE UNDER CONSIDERATION.

SCHOOLS RECEIVING GOVERNMENT GRANTS.

	Average attendance.				Fees.	School has accommodation for				EVENING CLASSES. (Usually for persons above 12.)
	Boys.	Girls.	Infants.	Mixed.		Boys.	Girls.	Infants.	Mixed.	
1.—Abbey-street British School, Bethnal-green-road	450	140	200	..	2d. to 6d.	450	140	200	..	Say 50. Fees 3s. to 6s. per quarter.
2.—Adelphi-street British School, Hackney-road	260	240	..	..	4d. to 9d.	260	240	..	..	
3.—Club-row Infant School, Bethnal-green, behind Shoreditch Church	..	..	90	..	1d. to 2d.	..	..	130	..	
4.—Fellow-street Wesleyan School, Haggerstone	250	250	200	..	3d. to 4d.	250	250	200	..	
5.—Friar's-mount National School, Mount-street, Bethnal-green	80	70	70	..	2d. to 4d.	100	80	70	..	
6.—Gascoyne-place British School, near Columbia-market	114	100	45	..	3d. to 6d.	150	150	80	..	
7.—Good Shepherd's School, Mape-street, Bethnal-green-road	..	..	..	170	2d. to 3d.	..	..	..	250	
8.—St. Augustine's National School, Haggerstone	59	39	110	..	2d.	59	39	110	..	
9.—St. John's Roman Catholic School, The Triangle, Hackney	50	..	..	..	2d.	80	..	..	..	
10.—St. Jude's National School, Old Bethnal-green-road	130	70	180	..	2d.	160	90	180	..	80 girls and boys. Fee ½d. a lesson.
11.—St. Leonard's National School, Hoxton-square	120	70	..	..	2d., 3d., & 4d.	300	300	..	..	
12.—St. Leonard's Infant School, Union-walk, Kingsland-road	..	..	170	..	2d.	..	..	170	..	
13.—St. Mary's National School, Haggerstone	147	125	70	..	4d. and 2d.	230	200	70	..	
14.—St. Matthew's National School, Bethnal-green-road	300	200	..	..	3d.	300	200	..	..	120. Fees 3d. per week.
15.—St. Paul's National School, Brook-road, north of Canal	60	74	230	..	2d. to 1s.	80	80	230	..	
16.—St. Peter's National School, St. Peter's-square, Hackney-road	110	45	100	..	2d. to 6d.	150	75	120	..	
17.—St. Thomas' National School, Charles-street, Hackney-road	90	90	250	..	2d. to 3d.	300	120	250	..	
SCHOOLS INSPECTED BY GOVERNMENT, BUT RECEIVING NO GRANTS										
18.—St. Andrew's National School, Viaduct-street, Bethnal-green-road	120	..	..	200*	2d. to 3d.	120	..	..	200*	
19.—St. James'-the-Great (the Red Church) National School, Bethnal-green-road	70	..	..	90*	2d.	150	..	..	200*	40 scholars. Fees 2d. and 4d.
Total	2,410	1,513	1,715	460		3,139	1,964	1,810	650	
Grand total of Inspected Scholars	6,098				..	7,563				

* Girls and infants.

SCHOOLS NOT UNDER GOVERNMENT INSPECTION, AND RECEIVING NO GRANTS.

	Average attendance.				Fees.	School has accommodation for				EVENING CLASSES. (Usually for persons above 12.)
	Boys.	Girls.	Infants.	Mixed.		Boys.	Girls.	Infants.	Mixed.	
20.—Ada-street National School, Duncan-place, north of Canal	70	70	..	..	2d.	70	70	..	..	
21.—Albert-mews School, High Hoxton	20	40	..	..	3d. and 4d.	..	..	..	120	
22.—Ann's-place School, Hackney-road	..	..	..	130	2d., 3d., & 4d.	..	..	..	200	
23.—Basing-place School, Kingsland-road	40	..	..	70*	2d. and 3d.	40	..	..	70*	
24.—Cambridge-heath Mission School, Cambridge-heath-road, by Canal	..	..	..	110	2d.	..	..	..	300	
25.—Canal-road Mission School, west of Kingsland-road	..	..	..	40	2d. and 3d.	..	..	..	40	
26.—Commercial and Mathematical School, Hackney-road, by Shoreditch Church	120	..	..	..	6d. and 1s.	250	..	..	..	
27.—Hoxton Academy, close to Hoxton-square, High-street, Hoxton	..	..	..	90	3d.	20	..	..	130*	
28.—Mill-row School, Canal-road, west of Kingsland-road	60	..	..	..	2d. and 3d.	60	..	..	..	7 scholars 6d. a-week.
29.—Pott-street School, east end of Bethnal-green-road	..	..	..	140	2d.	..	..	..	400	
30.—Primitive Methodist School, London-fields	70	..	..	..	6d. and 1s.	300	..	..	..	
31.—*Ragged School*—Anchor-street, behind Shoreditch Church	..	..	100	..	Free.	..	..	100	..	48 scholars.
32.— " Collingwood-street, " "	80	90	..	..	"	80	90	..	..	40 "
33.— " Dove-row, Haggerstone	138	112	..	..	"	150	120	..	..	57 "
34.— " Gospel Hall, Virginia-row	120	160	..	..	"	120	160	..	..	
35.— " Hoxton	200	..	..	160*	"	200	..	..	160*	70 boys and girls.
36.— " Nichol-street, north of Church-street	..	..	100	250†	"	400	..	..	200*	350 scholars.
37.— " Union-street, east of Kingsland-road	..	..	..	170	"	..	..	..	170	40 "
38.—St. Andrew's Church School, Canal-road, west of Kingsland-road	45	45	..	..	2d. and 3d.	..	..	..	150	85 "
39.—St. Chad's National School, Haggerstone	30	..	..	20*	1d. and 2d.	30	30	40	..	
40.—St. Columba's National School, Kingsland-road	20	20	10	..	4d. and 3d.	200	200	200	..	
41.—St. Leonard's, Shoreditch, Parochial School, Kingsland-road	100	60	..	..	Free.	100	60	..	..	30, paying 4d.
42.—St. Matthew's Parochial School, Bethnal-green-road	80	70	..	..	"	80	70	..	..	
43.—St. John's Roman Catholic Girls' and Infants' School, Triangle, Hackney	..	40	80	..	1d. and 2d.	..	60	100	..	
44.—St. Stephen's National School, Haggerstone	..	20	70	..	2d.	..	80	40	..	
45.—Virginia-row National School, Bethnal-green	40	60	100	..	1d.	40	60	150	..	
46.—Working Men's Club School, The Triangle, Hackney	..	..	40	100†	2d.	..	..	40	100†	
Total	1,233	787	500	1,280		2,140	1,000	670	2,040	
Grand total of Uninspected Scholars	3,800				..	5,850				
Total in Inspected and Uninspected Schools	9,898				..	13,413				

* Girls and infants. † Boys and girls

APPENDIX II.

Notes made on the Spot of some of the Visits to the various Cottages and Courts in the District.

57. A fairly respectable home, with five children, all of whom went to school. The parents would not wish to have the education free, but prefer to pay. At present, they pay 2d., 4d., and 6d. a week, according to the age of each child. They would not like to send their children where religion was not taught, but would rather send them to a school where a different doctrine was inculcated to that which they believed, than to one where religion did not enter into the daily teaching. They thought it would be a good thing for all to be compelled to go to school. The eldest boy, aged 15, was at work in the city with his father They would "like him to attend evening school," but there is not a good one near for boys. They have one girl, very useful to mind the baby and help in the house, but would willingly send her to an evening school.

58. A small coal-shop, near Cambridge-heath-road. The owner, an old woman, who during part of the conversation was weighing out 14lb. of small coal for her boy to take out to a customer. She said he had been to school in the morning. The old woman would prefer a school belonging to a different sect to the one to which she herself was attached, rather than have religion omitted altogether. Preferred paying a fee.

59. House near new Museum. Very poor; two children; the parents would rather the schools were free; found 1d. for the younger and 2d. for the elder child, too much sometimes; in fact, this week they had not gone, partly because they "had colds," but really because of the expense; they thought the schools ought to be better; required religion of some sort to be taught, though not particular in what form; if it were left out altogether, they thought the education would be worthless.

60. A respectable family, though extremely poor. The mother very rarely goes to any place of worship, but would object to her children going to any school where religion was not taught. Four children; two go to national school, one is at home. The fee of 2d. is at times found to be rather high, and that was why the third did not go to school. Would rather the schools were free, as although the money for the fee can be had for asking of the vicar, the mother prefers to keep the child at home rather than go and ask for the money. One boy at work, earns 4s. a-week; would not object to his going to an evening school; indeed he is somewhat anxious to attend, but he does not come home till seven or eight in the evening. Children had all had the small-pox at Christmas, and that had reduced the finances of the family considerably.

61. A family of father, mother, daughter, and grand-children, as ragged, dirty, and miserable as could well be found, The parents had had 13 children; four living; occupation, street hawkers of mats, &c.; extremely poor. All the children had nominally been sent to school, and the parents professed to quite appreciate the importance of their children being scholars. Had lived in the same house a number of years. Had not the least objection to their children going to schools where some form of religion different to their own was taught, but would object to send them where religion was not taught; thought if all were obliged to send their chilldren to schools, it would be a good thing. The daughter, who lived a good deal in the same house with her parents, was married to a potman, who came home once a week from the public-house where he was employed. He allowed her 5s. a-week which, as she expressed it, was "not much for herself and five children." As he was boarded at the public-house, his wages were, however, but little more than that sum. Only one of her children went to school, the fees keeping them away, sometimes for months together, as she "really could not afford it," and she said she would "rather see them run in the street than receive the school pence as a charity; would send them all if the school were free," though she never attempted to place them at the free ragged school. She added to her allowance by binding shoes and felt slippers. The payment for making up three pairs of uppers and finding her own thread, was 2½d.; by hard work all day she could earn 6d. An adopted child in the family attended school when strong, but was too delicate to do anything, or profit much by the instruction.

62. A very dirty, almost a filthy room, serving as bed-room, parlour and all; six children, one sent to school; but the parents cannot afford to send the others, and there is some little difficulty in getting children into the ragged school. This trouble is really quite nominal, amounting to little more than an application. The eldest boy can read, and is at work; sleeps away, and so cannot attend evening school. None of the others can read. The second boy helps to mind the children, but could be sent to school half the day, if the school arrangements permitted it. The mother would strongly object to no religion being taught in the schools; would rather send her children to a school under a dissenting sect to which they did not belong than to one where religion was not taught.

63. A nice, tidy, and pleasant family, but the father was not very steady; occupied two rooms; were staunch "Church of England." Six children, four at school, paying 2d. each, and one attends on Friday at a sewing class, fee 1d. making 9d. altogether. The parents "would send the fifth, but could not well afford the extra 2d.," making 11d.; sometimes find it very hard to supply the funds. Would rather not let them go to school at all than to a place where religion was not taught; would prefer to teach them, in that case, "as best they could at home." When the children go to work they will be required to go to the evening class. Would not object to a compulsory law.

64. A tidy cobbler and shoemaker. Thinks that some dissenters might prefer schools having no form of religion at all rather than run the risk of having to send their children to a denominational school of a sect to which they did not belong, but had "never heard any one say this in so many words." All his children had gone to school; one was now a sergeant in the Fusiliers.

65. A shoemaker; had eleven children, and seven had grown up. All his children had gone to school, and his grand-children followed in the same way. He was strongly in favour of compelling those parents who neglected their duty to their children to send them to some school. He did not think they should be free, as even the very poorest he knew "expended much more than the school fee in sweetmeats and other useless things for their children," to say nothing of the amount expended on "drink;" "certainly, nearly all might pay 1d. or 2d. if they really chose to do so." Had lived in his present house twenty-five years, and in the former one about fifteen. Was strongly against schools where religion was not taught; would much rather send them to a school conducted by a different sect to his own than to one where there was no religious teaching.

66. The following story will give some idea of the ignorance of many of the inhabitants of this street:—A few months back, the numbers ran 1, 2, 3, 9, 5, 6, the *nine* being a beautifully-polished brass number. For some time this was a puzzle; but it appeared that the resident had removed from another house, and thinking that the bright brass number was an ornament, and seeing no reason why his landlord should have it, had taken it down, and put it on a conspicuous part of the door of his new home.

67. An untidy and miserable household with five children. Parents had tried all the schools in the place, but thought them not very good, though it appeared that each of these trials had only been for a few weeks; did not consider what sect provided the school to which the children were sent, as long as the instruction given was good; considered that in some of the schools nothing is taught but music and nonsense, and the more important subjects are not attended to. The husband is a French polisher, and the trade is generally bad in the winter. The fee is often at these times a great drawback, and prevents the children being sent regularly; three children are at home in consequence. Would much "prefer the schools to be free;" would strongly object to a school with no religious teaching; in fact, would prefer sending their children to a Roman Catholic school rather than to one of that sort. When better off (as most of this class of poor appear, on their own showing, to have been) they used to send their children to a private school, and pay 4d., 6d., and 8d., but really considered that the education was not so good as at the national school. Would like to see the evening schools increased, though they had never made any inquiries concerning them.

68. A nice, tidy family, with three or four children; one was at school. The parents would strongly object to compulsion, as they think persuasion would be sufficient, except in a few extreme cases, when perhaps it might be allowed; from the tone of the conversation, it was evident that if compulsion affected themselves it would be resisted; would not allow children to go to a school where religion was not taught, but would not mind them going to a school teaching a different doctrine to their own.

69. Another house, the abode of two widows, one with five young children and very poor the other with a large family, all of whom were grown up and had been to school. Three of the five children were at school; but the first-mentioned having lost her husband, and being next door to starvation, found it impossible to pay the school fee, which was defrayed by the vicar; she would consequently prefer a free system. The other woman thought she

"would not like all schools to be free;" she had paid 1s. a-week to a private school for some of her children when in better circumstances. Neither would, on any conditions, send her children to a school where religion was not taught, but did not object to schools managed by a sect to which they did not belong. The eldest child, a girl of thirteen, went to work as servant and helper in a shop; she had to be on the premises from 7 a.m. to 10 p.m., and was paid 1s. a-week; if she came home earlier, she had to bring home work to do, it was impossible, therefore, for her to attend evening school; the child is kept in food during the week, but dress and Sunday maintenance has to come out of the shilling; this, the mother remarked, "did not leave her much to help the others."

70. A very poor place, the whole family living entirely in one small room, which was dreadfully dirty. The parents approved of the children being taught, but found the fee prevented their being sent to school sometimes; one was at school now. Strongly object to no religion being taught, but did not know the difference between one sect and another.

71. A match-box maker in a small street out of the Bethnal-green-road. Had began to work at filling boxes with matches when in petticoats, about four years of age, and received 6d. a week and a piece of pudding on Sundays if good. He consequently never learnt anything, and can now barely tell the difference between one match-box label and another. Considered that the children worked too long, and would himself assist in carrying out a law which required them to go to school a certain time during each day. For making match-boxes, the present price is 6½d. a gross, all materials except the label being found out of that sum. The man said that the trade was ruined now; formerly they got 8d. a gross, but at 6½d. it was hard to make a living. Women and children are employed, and for the labour 2½d. a gross is paid, out of which paste has to be found. At this rate a hard-working woman will make 10s. a-week. This maker, though residing in but a small tenement, employs persons who make about 450 gross, or 64,800 boxes each week.

72. A respectable family, though wretchedly dirty and untidy. The parents had had thirteen children, of whom nine were living. All had been to school, but at times the payment was found very heavy, particularly when the number at school at once was five or six; in fact, it often prevented them all going, as had been wished. The house was dirty and miserably untidy, and the general style of the place was very bad; at 3 p.m. bed unmade, and room not arranged. The father, a bootmaker, considered that nearly all the poor, "even the worst, could pay 1d. a-week," as most of them could "spend a great deal more than that in sweets and rubbish on their children." Sent his children to school at four years of age, and all had left between nine and ten. Would not like a "school without any religion," though "not particular as to the sect to which it belonged, provided it were Christianity." Would have no objection to a compulsory education, particularly if schools were free, or free to those who could not pay. All the children who are at work are sent to the evening schools.

73. A very respectable woman; her children grown up, and she has a number of grand-children. Her husband also discussed the subject, and they would not object to compulsory education, but thought "it might do good." They considered, however, that most persons were able to pay at least something. Several instances were given of people employed in the gas-works, and making 24s. to 35s. a-week, who never sent their children to any school, though they certainly could afford it, and those who did only sent them to the free ragged school. Would strongly object to a school in which religion was not taught, but the mother would not, on any account, send her child where any form of religion but her own was taught. The father was somewhat less strict, but the woman had the most decided opinions in favour of the "Church of England." On further inquiry, however, it was found that her own attendances at church were not very numerous.

74. A conversation with a number of children in the street. Most went to the ragged schools, and they could all spell small words, a few being indignant when asked to spell "cat," particularly one boy, about the most ragged and saucy, who was evidently a clever fellow. One of them said, "O yes," he "went to school, and had lots of books." On being asked questions in arithmetic —twice four, ten times six, twice ten—many answered fairly, but were puzzled at last after one had said correctly what twice twenty was, by being asked what twenty times two amounted to. On the whole, however, they were more intelligent than might have been expected. It is probable, from the hour in the afternoon, they were on the way from school, and only stopped for a slide in the gutter.

75. A poverty-stricken and miserable home of a clay-pipe maker, with six children, none of whom go to school, except two sometimes for evenings' instruction at ½d. a night. Did not go to the ragged school, as there was some slight trouble to get in, an order having to be applied for. The mother said they could not afford it, but acknowledged they usually spent during the winter more than the fee in waste on the children. The father sometimes objected

to this waste, and said the children should go to school, but the mother would not have it, saying she had been a child herself, and wished her children to have the little pleasures she had enjoyed, such as buying sweets, &c., and so "could not help about the schooling;" said she would not object to a compulsory law, but that the schools must then be free; in fact, thought that such an arrangement would be good, as then her children must go. This the mother said almost as if someone but herself was now preventing them. None could read or write.

76. A highly respectable family with five children; one of the aristocracy of the district. All the children sent to school, each paying 2d.; the parents would like to see compulsion enforced on all, at the same time believe that most could pay something if they really wished to. As regards the form of religion taught in schools, would not hear of sending their children to a school where religion was not taught; but as regards schools of different sects, the mother stated that she had once refused to send her child to a school managed by a sect to which she did not belong, but should not do so again, though the family has now become very "High Church." Was convinced that parents never thought about the religious teaching of a school, but sent their children generally where they got the most in the way of bribes, treats, &c. For this purpose many sent one child to the Church of England school, another to the Wesleyan, an another, if they have one, to the Baptist, in order to be in favour with all these persuasions, and so get the good things often given away by each. Strongly opposed to the idea that religion should be taught by the parents, as the mother stated she knew nothing about it until a year or two back, when she began attending the Church, but left it all to the school-mistress, which quite satisfied her; in fact, the children knew more than she did.

77. A room in one of the smallest houses in one of the worst streets in Bethnal-green. A woman in the house had six children, only one went to school, the others not sent, as it was too expensive. Four were under six years, one boy at work, but did not go to school; the mother had been to school, and seemed to have been fairly brought up. The place very dirty and miserable, the father having been out of work 10 months during last year. Did not object to the children going to any school of whatever denomination except the Roman Catholic; "would send," she said, "all of them if the school was free." In spite of this, she had never made use of any of the four free schools which are within two or three hundred yards of her tenement.

78. A penny toy maker, behind Shoreditch Church, which is, perhaps, as bad a neighbourhood as any in London. Said he thought all children ought to be sent to school, and he himself had hot the least objection to send his children to any school, "whatever religion it might be, if they taught them well." He could not afford to pay a fee, it being as much as he could do to live, particulorly now that trade was bad, the abolition of Greenwich and other fairs having much damaged the sale of the scratch-rattle toy, which was his speciality.

79. A match-box maker's family. One child was very ill, and could not live; the other went sometimes to school. There appeared to be no father, and the mother earned but 2½d. a gross by making the boxes, less the paste, which she had to find. From this she was unable to afford anything for schooling, as she could only, with the help of a girl, make four or five gross in the day; some others, who were quicker, made 12 or 14.

80. Another small penny-toy maker, in a fair way of business, three men working together. Knew that many of his neighbours could net afford to pay a school fee, though "some might." A large part of the family was engaged in completing the toys, glueing heads to horses, painting the same, &c.; in this way children were very useful. Never heard of any one of his friends objecting to a school on account of its "religion;" in fact, did not think they considered it much.

81. A miserable cottage of four rooms, and a small place at the back, four families living in it, having altogether eight children; of these, three go to school occasionally. Some are too young to attend, being under three years of age, but, from the appearance, it looked much as if the attendance of the three is but nominal. A large number of children, if asked whether they go to school, will say "yes," but on closer inquiry it often turns out that their attendance is but once or twice a month in the winter, when they can pick up nothing in the streets, and the school is warm, or a tea or other treat is in prospect.

82. Another very wretched house near the last. Ten children belonging to several families; two of these go to a day-school, five (including the above two) to a Sunday-school, and two are grown up. The two who attend the day-school go to one on the opposite side of the way. According to the mother's account, this is an excellent school, the children getting on rapidly, &c.; a "wonderful many" went there. On being asked whether it was a Wesleyan school, a Baptist school, or a Church of England school, or what form of religion was taught, she replied "I don't know nothing about that," in a tone as if she had been asked to solve an obscure mathe-

matical problem. The character of this part of London may be judged of from the opinion of one of the inhabitants who, on being asked by the writer the way to the "Ragged School," replied, "The Ragged School? I don't know; we are all ragged here."

83. A conversation with several members of a working men's institute, composed of respectable, though very poor, labourers and others. Two of them were strongly in favour of "secular schools." One had attended Professor Huxley's lecture on Sunday, and consequently was full of what he had heard. Another, who had attended to his own children well, was quite of a different opinion, and would send his children to no school without some religion being taught; said that were the law to compel the attendance of children, he for one would at once resist it, and take his children away; he would not stand any compulsion. It appeared that he was personally acquainted with ten or more men employed at the gas factory, each earning 33s. a week, many of whom did not send their children to school at all, and those who did only sent one or two to the Ragged-school. He considered these should be made to "pay something for their education," and objected to free schools, except in extreme cases.

84. Another working man, who had had about 10 children, several of whom had died, said they had all grown up without schooling—not one could read. He felt they ought to be taught, and said that on that very morning he himself could have got work at 5s. a day, carrying out coals, if he had been able to read. The real difficulty with him had been, not the 2d. or 3d. for the school fee, but the loss of wages, consequent on children going to school: having a good deal of illness and a large family, as soon as a child was old enough to earn a shilling a week, he had been obliged to send him out to work, to help to keep the home together. He said he would send them to an evening school if such existed, but he did not know of any. As regards the religious question, he said he had never thought about it, and "did not fancy his mates ever had either." A school was considered to be a good one when the children "got on;" they "never inquired" what religion was taught there—"in fact he did not know the difference."

85. A most miserable court, turning out of Hoxton-road, with no thoroughfare. One of the inhabitants had seen rather better days, and all his children had been fairly brought up. He was convinced that no amount of compulsion would drive the children of that court to school, not that the parents objected, but because they did not care at all about anything but their own gratification in drink or otherwise. He thought if people visited them, and so induced them, they might be moved to attend to their duties; but even if all the schools were free, he was convinced it would make no difference whatever. He gave instances of parents sending their children for one week to the ragged-school, and then not troubling themselves to send them again. In the court there are fifteen children, and three of these go regularly to school, being the children of a man who was regarded as being well off, because he was a street hawker. Some of the parents make as much as £2 a week, but don't send their children to school, or only by fits and starts to some ragged-school. In one family the father makes £1 10s. a-week, and the mother, instead of attending to her children at home, leaves them all day, and earns 15s. more, and not one of them goes to school. The question of the religious instruction given in the schools was never considered by the parents, who are completely apathetic. The only effective means, in this man's opinion, to get parents to send their children to school, would be careful visitation, coupled with indirect compulsion, by requiring all who earned wages to attend school a certain time each day. By this they would feel that the quickest way of getting them off their hands would be to teach them. Compulsion he thought perhaps might be used against those above-mentioned who were in good work, and who might be fined for neglect, but for those earning but little it was impossible to carry it out.

86. The next house is one of the most miserable and dirty places possible. The father, mother, and two sons, respectively twenty-three and twenty-one years of age, live in one room, a married daughter, with five children, occupying another room in the same house, and none of the children go to school. The grandfather can read and write, and is in good work, but none of his children or grandchildren ever went to school, and he is completely indifferent about it, the only care of all the adults being to supply their own wants. This is a case which unfortunately shows that the fact of a man possessing an education himself does not always make him anxious to give the same to his children.

87. Cottage behind Shoreditch Church; four children; one goes to school, two make match-boxes. The mother would not object to these two being obliged to go to school for a certain time during the day; said she "taught them at home," but, judging from the filthy, neglected, and miserable look of the parent and children, the teaching could not have amounted to very much.

88. An alley up a narrow archway, with no thoroughfare, and terminating in a *cul de sac*. This is one of the courts where, it is said, people used to be decoyed and then murdered, in order

to sell their bodies to the hospitals, some twenty or thirty years ago. Saw several parents, and had a long talk in one of the houses of a somewhat respectable man, who had lost both legs. His own grandchildren went to school, but in the court there were 19 children; 14 of whom were of an age to be at school, and, though doing no work, only five ever entered a school. He thought the neglect arose from complete indifference on the part of the parents as to their education, as was shown by the fact that, though there were free schools within 100 yards, and though the children were earning nothing, yet the parents did not send them. Two families were Roman Catholics, and would not send their children anywhere unless that religion was taught, not even to a secular school.

89. A family of eight children; three grown up, but none can read or write, though they all say they have been to school. The younger ones do nothing but run about the streets, and are the most ragged children in the parish. The father was a drunkard, and died. The mother does a little washing, and has some parish relief, and so manages to exist. She is at the mercy of her children, who rule the dirty hovel in which they live. She said she would not mind if all her "children were taken away" from her and "put to school;" she wants them to go, but they refuse; though she sends them, they often run away, even when taken to the door of the school-house. The vicar pays the school fee, but this does not induce them to go. No law of compulsion could touch this case; it would only, if carried out, involve the mother being sent to gaol for what she, through her own weakness, no doubt, could not help.

90. A man with three children; thought that if compulsion was made the law, it would be "very hard" if they had to pay the school fee at all times. He would not mind when in work, but when slack he thought "they should go free." Would like to see the Workshops' Act really carried out.

91. A very miserable, dirty place. The mother said she would like her children to go to school, but seemed almost as if she thought the looking after it in no way depended on herself, and had never thought much about the free schools in the neighbourhood.

92. A little house near the former. The father, a respectable man, said he could only just pay his way. Although he was well dressed, he stated that that was no index of his position as to his finances; he was obliged to dress well, or he could not get any employment in his business—namely, that of a singer in a music-hall. He said if good schools existed at 1d. or 2d. a week he would send his children. Those that were near were "only nurseries," taking care of the children of those parents who were from home, and of others who merely wished to get their offspring out of the way. He and his wife could look after their own, and "therefore did not care for such places." The rooms and children were beautifully kept.

93. A family of children in Shoreditch. The mother stated they were to be sent to a more "select establishment" than a National School. It had been arranged for them to go to a "young lady" a few doors down, but the said young lady had just given up teaching and taken to "machine work." The grandmother, who said she had "been connected with schools all her life," considered the children "remarkably clever," and likely to do great credit to any teacher. However that might be, a practical lesson in the use of soap and water all round would have done good. These so-called private schools are often a great evil, charging high fees and giving inferior instruction; they conclusively prove that the poor measure the character of the education by what it costs them.

94. Another house near. The parents stated that a good many of the children in the neighbourhood went sometimes to a school, but they fancied they did not get much good from it, as their homes were so bad, nearly every house in the place having as many families lodging in it as it contained rooms.

95. Cottage with a family of two children, in one of the poorest parts. The parents cannot sometimes send them to school because they have not the pence, but if schools were free they say they would do so. Would not object to all those earning wages attending sometime each day. The two children here looked very clean. Although the mother said they often could not afford to pay the schooling, yet they were just returning from buying some sweets, the money having been supplied by an uncle.

95*a*. In spite of immense disadvantages in early education, by some extraordinary means a few rise to a good position. The following account of a man thirty years of age, already in exceptionally good employment, may be mentioned, in his own words. Though not residing in the exact square mile under consideration, yet the case is so typical of the habits of many of the children there, that it may be looked upon as belonging to this report:—

"1st. Of my first school I have but an indistinct idea. It was a room up some steps, where, at the age of four, a man taught me and a few others to read.

"2nd. My next school was in a two-roomed cottage. The teacher was a stout, infirm, elderly man, a pensioner or something of the kind. He lived and slept in the upper room. My most vivid recollections concerning him are, of his velveteen sleeved waistcoat, with mother-o'-pearl buttons, and his spectacles,

usually worn on his forehead. The school fee was 2d. per week. I was about five years old at this time. I also attended the Primitive Methodist school on Sundays.

"3rd. I was removed from here to a National school, at the age of six, where I remained but a few months. The fee paid was 2d. per week, and the instruction given the best in the district.

"4th. In consequence of a change of home, I next found myself at another National school, where the fee was the same as at the last, though the instruction given was much inferior. The clergyman was at chronic variance with the master, who was changed three times during my attendance of six months.

"5th. My next was again a National school, but I remained there so short a time that I scarcely remember anything about it.

"6th. From here I went for a few months to a Congregational school.

"7th. I was after this removed to a private seminary, kept by one of the dismissed masters of my fourth school. The teacher, though a man of considerable ability, was of most intemperate habits. This failing had brought him down in social position, and eventually caused his premature death. He was often absent for days together, and, when present, was frequently intoxicated. I remained here for a month or two, but do not remember the exact period. The fee was either 2d. or 3d. per week.

"I should state that, at intervals during these years, I was kept at home, occasionally for weeks at a time. I then received a little instruction from my grandfather. I also continued to attend the Primitive Methodist Sunday-school.

"8th. In my ninth year I began to attend the Roman Catholic day-school, and also the Sunday-school of the same denomination. I remained here for a little over a year. The fee was 3d. per week. I never, however, considered myself a Roman Catholic. On leaving this, I remained at home, acting as nurse and housekeeper during the absence of my parents at work. On Sundays I attended the Primitive Methodist school.

"9th. At about ten and a-half, for some two months, I was sent to a private Baptist school. The fee here was 6d. per week, as I was reckoned a first-class boy. After leaving, I was kept at home for about a year as a general servant, to assist in looking after the younger children.

"For many months, during my supposed attendance at the last two schools, I must own to having spent the weekly fee on 'Reynolds' Miscellany' and other such publications. When I did this, I tramped about during the day, returning home at the usual hour to prevent suspicion. This was the more easy, as my parents were both at work, and but seldom made any inquiries as to my progress. Up to the present day they are ignorant of this misconduct on my part.

"As far as my school education was concerned, it was now considered complete, and at about 12 I was sent out to work, at which I have remained ever since.

"10th. At 16, I entered the classes of a mechanics' institution, where I remained, first as a pupil, and afterwards as a teacher, for some ten years.

"I attribute my success in life, under God's blessing, first, to having been taught at an early age to read, which enabled me to gratify an insatiable thirst for reading everything that came in my way, from the 'London Journal' to Shakspeare and Milton; and, secondly, to the instruction I received and the associates I formed at the mechanics' institution. When I look back, I cannot but wonder at the escape I have had from the worst course, which is the more remarkable from the fact that my father, who was of very intemperate habits, so ill-treated me that, in my 17th year, I left home, and started on my own account."

APPENDIX III.

Notes on the Existing Schools, and the Opinions of Teachers and others in the District.

96. *Abbey-street School, Bethnal-green-road.*—This is one of the largest British Schools, and a most efficient one. 450 boys attend, and there are 500 on the books; 200 girls attend, and there are 250 on the books; over 200 infants attend, being almost more than can be properly accommodated. The fees charged vary from 1s. to 2s. 6d. a month. All religious sects are in the school, and the Scriptures are read and religious instruction given, though any parent may withdraw his child from this instruction if he wishes to do so. This has not been done by any parent for the last two years. In the experience of the teacher, the parents do not object to religious teaching from the Bible. The school is under government inspection, and receives grants. The upper classes are taught geography, history, vocal music, and drawing; occasionally a little science, as the teacher is competent, The age on leaving is usually 10 to 11, some few remaining till 14. Many applicants for admission are sent away owing to want of room. There is a strong feeling here against a local educational rate.

97. *The Adelphi British Schools, Hackney-road.*—260 boys and 240 girls; the school is quite full; a third pay 4d., more than a third 6d., and the rest 9d.; the school is supported by these fees and the government grants. The opinion here is in favour of direct compulsion, as the only way of really getting a large proportion of the children in the neighbourhood to school. Those at this institution are somewhat of a superior class. History, geography, and drawing are taught to the upper division. They have never had any difficulty about the religious question, whilst children of all sects come to the school.

98. *Fellow-street Wesleyan School*, in connection with the British and Foreign School Society.—Average attendance, 205 boys and 166 girls, aged from 7 to 11; also 183 infants, aged from 3 to 7 years, fee 3d. to 4d., the latter for the highest classes. The school is quite full; some of the pupils leave about 11 to 12, some few remain till 14. Religion is taught, the Bible being read and explained for about a quarter of an hour each morning. All sects attend the school, and no difficulty has ever been experienced on that account. During the last twenty-five years, in all three schools, on one occasion only has a parent objected to the religious instruction, and the child was accordingly withdrawn from that class. Inquiries have often been made to commence evening classes for those who have left school and gone to work. The teachers have no doubt that they would be successful if established. It was thought that if a system were adopted for certain classes to be formed for enabling children to come to school in the morning, or only for the afternoon, it might enable many to attend who now cannot. This would of course involve, that teaching on these half-days should be complete in itself, and not a continuation, as it generally now is, of the instruction given during the other half-day. Strong feeling exists against schools being free, it being considered that a large number of the parents would object, though in some cases it might be desirable at times to make the school payment more easy. Mr. Burroughs, the teacher, also considered that, though he himself was in favour of compulsion for those who would not send their children, yet, from his experience in the poorer districts, he was convinced that it could not be carried out. The only way would be by indirect compulsion, as by preventing them working up to a certain age unless they attend school, coupled with persuasion. The irregular attendance is the great impediment to more rapid teaching. Of the 400 attendances in the year, the average of each child is but 200; if each had attended regularly he would, by 11 years of age, learn what it now takes those who remain till 13 to acquire. In other words, were the attendance what it should be, practically, all by the age of 10 or 11 would be able to read, write, and do a fair amount of arithmetic. History, geography, and drawing, are taught in the higher classes of this school. The teacher has not observed a feeling in the district against rates for educational purposes.

99. *Friar's Mount National School* (under Government inspection.)—Boys 82, could accommodate 100; girls 70, could accommodate 80; infants 70, could accommodate 70; fee 2d., 3d., and 4d. It is found that the free schools compete with this school, particularly by the dinners and other good things given

away. Miss Burdett Coutts pays the fees of some of these children. All sects in the schools; and during 4½ years only one person objected to the catechism being taught, and the child was accordingly withdrawn from the religious instruction. The teacher thought an arrangement on the half-day attendance system would enable many more to come who are now absolutely prevented by the requirements of their homes.

100. *Gascoyne-place British Schools,* (under Government inspection).—Girls, 100, could accommodate 150; boys, 114, could accommodate 150; infants, 45, could accommodate 80. Fees for infants 2d., for the others 3d., 4d., 5d., and 6d., paid in all cases on entering, a month in advance. Several children now attending this school have come from the ragged schools in the district, there being five within a few hundred yards, and as a month's fee in advance is in all cases required on entering this school, it proves how much the ragged schools are abused by parents who can well afford to pay. One boy was here for some time under the Workshops' Act, but the certificates and other forms required gave his employer so much trouble that he got rid of the boy altogether, who at once left the school. All sects, including Jews and Roman Catholics, are in the school, and the conscience clause is allowed, but very rarely required. Drawing is taught here, but no science, though the teacher is qualified. In some cases parents send their children to schools of different religious persuasions, because, if two brothers go to the same place, they are apt to quarrel.

The habit of children wandering from school to school is a great evil. In a class of 15 at this school—

14 had been	at	one school	before
6	,,	two	,,
5	,,	three	,,
1	,,	four	,,
1	,,	five	,,

The one who had been at five schools was nine years old, and in a somewhat superior position to most of the other pupils. His attendance, which was unusually long at each school, had been as follows:—One year and six months at present school; one year and six months before that; six months before that; one year before that; three months before that; three months before that; total, five years. Another had been three months at this school; two years before that; six months before that; one year before that; total, three years nine months. He was 11 years old. It must be remembered, however, that during these periods the attendance is frequently broken by weeks or even months of absence. This changing from one school to another, and the competition among schools for the same pupils, is found to be one of the most serious drawbacks to rapid teaching. It is not uncommon, at the approach of a treat or distribution of charitable gifts, such as clothes, &c., at one school, for children of neighbouring schools to leave for a time, and go to this one, so as to get the treat, after which they return. The plan of combining schools in this district, and confining certain ones to more elementary teaching (say to the first three standards), is urgently wanted. The teacher finds much of his time taken up with the very rudiments of reading, writing, and arithmetic, while he is qualified to give instruction to the elder children in more advanced subjects, but is thus prevented. Nothing could be easier, in such a populous neighbourhood, than to organise and economise the teaching power.

101. *Mape-street, or the "Good Shepherd's" British School.*—This is under government inspection and receives grants. Nearly all the 170 children are infants of both sexes, paying 2d. and 3d. a week. The school might accommodate 250. In cases of distress or want of work the fee is occasionally remitted. Considerable difficulty occurs on account of the migratory habits of the poor, those who live here in winter rarely staying during the summer, and *vice versa.* Though a very poor district, the experience of this school is decidedly in favour of school fees.

102. *St. John's Roman Catholic School, Hackney.*—50 boys attend on an average, accommodation for 80; 40 girls attend on an average, accommodation for 60; 80 infants attend on an average, accommodation for 100. The boys' school is under government inspection, but not the girls' and infants'. A fee of 2d. is charged for each child, and 1d. for infants. One of the great difficulties found here arises from the irregular habits of the pupils, and the manner in which the children move from school to school, often three or four times a year. They generally stay the longest time at the worst school, as any strict discipline induces them to leave the better school. Children belonging to several sects are said to be in the school. The conscience clause is allowed if any parent objects to the religious instruction. Many cases have been known here and elsewhere of schools competing one with another for the same children.

103. *St. Jude's National School, Old Bethnal-green-road.* — Under government inspection, and receives grants. 130 boys attend, accommodation for 160; 70 girls attend, accommodation for 90; 180 infants attend, accommodation for 180. Fee for all classes, 2d. Evening school, with 80 girls and boys; a fee of one half-penny for each of the two nights per week is charged. The teacher considered that compulsion in some shape will be necessary, in order to bring the children in to school from certain classes of the community.

He found that, with good instruction and sufficient teaching power, the schools were always well attended He attributed to indiscriminate charity much of the present unsatisfactory state of the district, as many parents expected to get something offered to him even for sending his children to school. Christmas dinners and clothes are in many instances held out as bribes, though not at this school. The mode of administration of charity in the district he considered an evil in many ways. Owing to the distress, a fund has been originated to send fifty children to school free. These are the most irregular of the pupils, particularly the boys, and the teacher is convinced that nothing would improve the school more than to send away a dozen children every week for a month or so for irregularity. This, in his opinion, would make the parents think much better of the school, they often reckoning that the greater the difficulty of admission, the better the school must be. The irregular attendance of large numbers, and the casual way they come and go, is one of the greatest difficulties, as already pointed out concerning the Gascoyne-place school. Out of a class of 24, 23 had been to another school; 14 had been to two other schools ; and 9 had been to three other schools ; and out of a class of 31 of the better children, 22 had been to another school; 17 had been to two other schools; 10 had been to three other schools; and 5 had been to four other schools. One boy, of 9 years of age, had been two monhs at a former school, three weeks at another, and stated he was going to stay three months at this. Several other boys gave the same experience, the usual reason given by the children for leaving being, "Because they didn't learn me much." The teacher thinks that an educational rate would be very unpopular, and urges strongly the extension, or rather the compulsory working, of the Workshops Act.

104. *St. Leonard's, Shoreditch, National School.*—This school is under government inspection, and receives grants. The attendance is very poor, considering the accommodation; it has always been so, and is accounted for partly from the bad situation of the premises, which are in a narrow lane, close to large factories. Boys, 120; accommodation for 300. Girls, 70; accommodation for 300. Fee, 2d., 3d., and 4d.

105. *St. Mary's Haggerstone, National School.*—Average attendance of girls, 125; accommodation for 200. Average attendance of boys, 147; accommodation for 230. Average attendance of infants, 70; accommodation for 70. A fee of 4d. is charged, and 2d. for a second member of the same family; most, indeed, pay but 2d., as when the first member leaves, the second continues at the old charge, unless the elder brother or sister leaves to go to another school. All sorts of religious persuasions are in the school, half being dissenters, and no difficulty presents itself on this account; parents do not consider it a ground of objection. One child is the daughter of a dissenting minister, and he does not in any way object to the religious teaching of the school, which includes the Creed of the Church of England.

106. *Bethnal-green National School.*—This is a successful school, and accommodates 300 boys and 200 girls; it is quite full, in fact, many more could be admitted if there were room. Fee 3d. for one of a family, 5d. for two, and 6d. for three, after that 2d., each is charged, but few families send more than three at a time. A building for an infant school is in existence, but owing to some legal difficulty it is not used. The children in the school belong to all sects, and the conscience clause is in force; for more than 12 years no parent has requested that his child should take advantage of it. Several Jews attend, and though the master is quite willing to withdraw them from the religious teaching, most of them prefer to attend the ordinary scripture lessons; and in one instance the parent even objected to his child not receiving instruction in the Church Catechism, on the ground that he was losing part of the instruction for which payment had been made, and he felt, consequently, somewhat injured. He had been master of a large school at Leeds, with 500 boys of all sects, and never met with the religious difficulty; also at Northampton, with 300 boys, and at this latter place all had to go to the church Sunday school. As strong a proof of the absence of any feeling in the matter as could be adduced is found in the fact that, although children are repeatedly coming from and going to the Abbey-street British School, which is close by, yet in 12 years no change of this kind has ever taken place on account of the difference in religious teaching. The fee is here always required, and never relaxed, as any liberty of this sort would probably be largely taken advantage of. Sometimes credit is given for as many as six or seven weeks in (cases of distress), and only once in twelve years has a parent neglected to make good the debt. Mr. Simpson, the teacher, does not think compulsion is required except in a few cases, most parents of the respectable though very poor class being anxious and even willing to pay to have their children taught. He thinks they would object to free schools. Parents who have lost all sense of self-respect, and are sullenly indifferent—of which class there are many in this neighbourhood—he thinks must be compelled to send their children. The somewhat better class do not believe in the free schools, many cases happening of parents bringing their children to his school, and saying that as they did not seem to get on at the free school, they wished to try his, and

would pay the fee. He thought an extension of Denison's Act, and the Industrial Schools' Act, with an increased number of schools, would meet the present difficulty, and if strictly carried out, would rid our streets of a great number of the ignorant children who now infest them. Geography, drawing, history, are taught in the upper, and science in the evening schools, which are attended chiefly by adults, and some who have left the school for employment. The teacher has had several cases of children who could only attend half the day, particularly weavers' children, who at certain times are required by their parents. The afternoon instruction has been made complete; it is so arranged that a child attending only one-half the day would be taught reading, writing, and arithmetic, and have an oral lesson in some subject of general knowledge. Mr. Simpson thought if this system were somewhat increased, and half-day classes formed regularly, they might be beneficial, and draw in a large number who would not otherwise attend. Elementary evening classes are attended by over 100. The girls and young women are all taught sewing, cutting out, &c. The teacher's opinion is that any attempt at a local rate for a school would cause great dissatisfaction, and retard rather than advance education, unless the whole metropolis were thrown into one large rating area.

107. *Brock-road National Schools.* — Girls, average attendance 74, accommodation for 80; boys, average attendance 60, accommodation for 80; infants, average attendance 230, accommodation for 230. The fee varies from 2d. to 1s., the infants paying 2d. In the girls' and boys' school, when children get into the higher classes, if the parents are too poor to pay the full fee, they are assisted. The teacher, who has had great experience in the poor districts, considers that compulsion might be applied with advantage, and that all, even the very poor, could, if they thought proper, find a penny or halfpenny for the school fee. As regards the religious question, no difficulty had ever been found. Children belonging to all sects, including Jews and Roman Catholics, are at the school, and the conscience clause is in force, but rarely used. On one occasion a Jew's child came, and his father, on being asked if he would prefer his child not to attend the religious instruction, said, "Oh no; you may teach him any amount of Christianity you like, and I will make him a Jew all the same."

108. *St. Peter's National Schools, St. Peter-street.*—Boys, 110 average attendance; the premises could accommodate 150. Girls, 45 average attendance; the premises could accommodate 75. Infants, 100 average attendance; the premises could accommodate 120. Fees, 3d. and 4d. for girls; 3d., 4d., and 6d. for boys, and 2d. for infants. The teacher does not consider direct compulsion possible or advisable among the persons in this district, but thinks it necessary to create a class of schools which should be in some way free to the poorest class. The fees at other schools should be maintained, and the attendance ensured by forbidding any to work for wages up to a certain age, say thirteen, unless they had passed a required examination, or were attending school a certain time in the week, and this, he thinks, would meet a great part of the present educational want. The teacher also considers that the irregular attendance of the children is attributable partly to the want of mutual action among the schools. It is useless to complain to a boy of his being irregular, or to threaten to punish him for being so, as it is in most cases the fault of his parents, and they would immediately send him to another school, where the rules were less stringent. This might be prevented by mutual arrangement, based on a friendly and combined action among all the schools in the neighbourhood. The teacher remarked on the advantage of large schools well organised, particularly in a district where the material to teach is so plentiful, and is included in so small a radius. He stated that a school with a hundred children would, in his opinion, require one master and an assistant; a school with three hundred could be managed as well or better by one master and three assistants and pupil teachers, thus producing better results with less cost. At this school no difficulty had ever been expressed about religious teaching; the Church Catechism is taught, and Jews, Roman Catholics, and all sects have been in the school. Any child objecting to the instruction would be withdrawn from the religious lesson, but this has only happened once in several years.

109. *St. Thomas's Schools, Thomas-street, Bethnal-green.*—250 infants in the school, quite full, 80 under two years; 90 girls, accommodation for 120; 90 boys, accommodation for 300. The fee 2d. to 4d., but few exceed 3d. The teacher cannot account for the boys' school not being attended. This is one of the very poorest parts, the premises being contiguous to the Columbia-market and Miss Burdett Coutts's lodging-houses. A dinner is given to the chidren once every three weeks, and without this it is thought that the school would not get on at all; when it was given every week more children attended the schools. The teacher was convinced that they would not come if the school was free, as the experiment had to a certain extent been tried. The main difficulty in getting boys was their being at work in a variety of ways, though not under regular employers, but assisting their elder brothers to hawk about the streets, to push barrows, and so on. This tends, he considered, to show that compulsion to employers would not always be effectual. The

dinner, he believed, in many cases, was the only way of reaching the children. Very many stay away on certain days, Tuesday and Friday, either to help themselves or to mind the children while their mothers washed. In all weathers the infant school is full, it being thought that, had they accommodation, double the number might be taken in, the mothers being thus relieved of them while they attend to their work.

110. *St. Andrew's, Viaduct-street, Bethnal-green-road.*—A national school, but receives no government aid, though occasionally inspected. Average attendance of boys 90; could accommodate 120; girls and infants, 200; and both schools are full. A fee of 2d. and 3d. is charged. It is considered that the greater number of the parents prefer paying some fee. There is a ragged school near, though outside the square mile under consideration: it has been remarked that the free education there is often abused, well-to-do persons, often removing their children from this, and sending them to the ragged-school, in order to avoid the small fee, which they could well afford to pay. Want of clothing is thought to be the chief reason why the children dont come to school. There is a feeling against an educational rate.

111. *St. James-the-Great, Bethnal-green-road.*—Under government inspection, but does not receive any grants. Boys, 70; accommodation for 150. Girls and infants, 90; accommodation for 200. Each pays 2d. An evening school is in operation, with 40 pupils, the younger ones paying 2d., the adults 4d. Five children are sent here, under the Workshops' Act, in the evening. Formerly nineteen attended every afternoon under this Act; but the employer who sent them, finding it a good deal of trouble, and seeing his neighbours were not required to comply with the law, withdrew them. He would have been willing to keep them at school if others had been required to do the same. Several children of nine in this school wrote excellent hands, read very well, and did a fair amount of arithmetic. They had attended regularly for three years, after having been at the infant-school, showing what might be done, even at that age, by regular habits, and without in any way depriving the parent of his child's earnings. The teacher considered that direct compulsion would be no good. Greater facility for the children who are at work, or are required to do things at home for their parents, for attending half the day, might induce many to come who do not now. An increase in the number of evening schools is much wanted. He considered that religion formed no difficulty, as, though this was a national school, yet the religious instruction was not sectarian, and he found that 29 out of every 30 of the parents preferred to have religious instruction of some sort, though they did not mind what, or really understand the difference between one form and another.

112. *Albert-mews School.*—This is in connection with a dissenting place of worship, but is not under government inspection, and consequently receives no grants. It is situated up a narrow passage in a very poor neighbourhood. Average attendance, 60; the school would accommodate 120; fee charged, 3d. or 4d. Both sexes are mixed, and are in the proportion of two girls to one boy. The teacher has remarked that even the costermonger class prefers to pay some fee, and often rank the schools in order of merit according to the price charged for admission. He remarked that the parents rarely inquire on the subject of the religious teaching in the school, but that they select a school for their children on account of one of two reasons, according to their dispositions—either from the repute it has for enabling children to read and write quickly, or for the gifts and treats granted to the children and their parents by the managers. The Bible, without any sectarian teaching, is used here. The children are taken in from 3 and remain till 10 or 11. There is a feeling against rates for education, particularly as so many can afford to pay.

113. *Ann's-place Baptist School.*—145 girls and infants, could accommodate 200; charge, 2d., 3d., and 4d. This school is not under government inspection, but is supported by the school fees and private subscriptions. Until lately, six children were under instruction, their fees being paid by the parish under Denison's Act; the number is now reduced to three, but more could be received if the guardians would send them. The parents, as a rule, prefer to pay something. One great difficulty of sending children to school is the necessity of the eldest being at home to mind the babies; if infant-schools, or rather babies' schools or nurseries, were always attached to day-schools, a good many might attend who must "either bring baby or stay at home." Also, if a regular course of study, complete in itself, were given for half the day, a good many would come who now cannot. The school has never found any difficulty with the religious question, though children of all sects attend. The impression is against an educational rate.

114. *Basing-place Schools, Kingsland-road.*—Not under government inspection, entirely carried on as a private undertaking by the schoolmistress. A fee of 2d. and 3d. is charged. 40 boys and 70 girls and infants. The school is connected with an Independent Chapel, but all sects, including Jews and Roman Catholics, attend, who do not object to the religious teaching, though they could be withdrawn from it if the

parents wished. The opinion here is against compulsion and an educational rate, as likely to produce irritation, without affecting the totally indifferent class for whom it would be specially framed. The girls remain till about 12, the boys till about 10.

115. *Cambridge-heath Mission School.*—In connection with a Dissenting body; not under government inspection. A mixed school of girls, boys, and infants, with an average attendance of 110; the premises would hold 300. Fee charged of 2d. each, or three for 5d. in one family. Seven of the children are sent by the Hackney parish, under Denison's Act, the parents being in the receipt of out-door relief, and the fees are paid out of the rates. This parish has the rare virtue of being remarkable for strenuously enforcing this Act. The experience here is opposed to a free school, as the parents think they are doing a favour in sending their children. The pupils have a dinner every week. Many cases are known of children having been induced, by offers of clothes, &c., to leave one school and go to another. All sects are at the school, and the Bible is taught, but no particular doctrines are enforced. The attendance is fairly regular.

116. *Primitive Methodist School, London-fields.* For boys only. It is not under government inspection. The average attendance is 70, but the premises would accommodate 300. Fee of 6d. and 1s. each child. The attendance is very regular. The teacher, who has had large experience in ragged school teaching, considers that the cause of the irregularity in schools, particularly in ragged schools, is frequently the system of keeping the door open all day. He made a rule, in a large ragged school, to lock the door ten minutes after the hour of assembly, morning and afternoon, and no one was admitted after that time. The effect of this was that the children made an effort to get in in time, and were annoyed if they missed. The attendance was, during the years he was teacher, as good as could be desired. All sects are in this school, Jews and Roman Catholics, and no difficulty is experienced, though the Scriptures are taught, and unsectarian education is given. It is considered that if children at work for wages and in helping their families at home had to attend school every afternoon, it would, to a considerable extent, meet the growing evil of their being so very early over-worked and allowed to grow up in ignorance.

117. *Collingwood-street Ragged School.*—Free and quite full; 160 children, 90 girls, 80 boys, and 40 evening scholars. It is considered that most of the children really could not pay, for sometimes they come to school without having had even a piece of bread, which is occasionally given to them when really in need. Children of all sects, including Roman Catholics, attend the school, and their parents do not object to the Bible being taught. They are thus often reminded of things they heard in their childhood by the remarks of their children, and frequently send to the school and ask for the exact chapter and verse, in order to have passages read to them which they have not heard for years. In one case this led to the regular reading of the Scriptures in a neglected home. The feeling here thought to be against a local rate for education.

118. *Gospel-hall Free Ragged School.*—280 average attendance; about 160 girls and 120 boys; but the premises are about to be enlarged. A difficulty in securing regular attendance and rapid improvement is caused by the migratory habits of many of the population; they settle in the district for the winter and go away in the summer. No difficulty has been made about religion, as all sects are in the school, including Jews and Roman Catholics, who attend the instruction given in the Bible, though they are not required to do so, the parents not caring at all about it either way.

119. *Old Nichol-street Ragged School.*—Free, and not under government inspection. Each child is supplied with a dinner once a week, consisting of a good basin of soup and bread. Girls and boys, 250; the premises would hold 400; infants, 100; the premises would hold 200; evening classes, 350. The attendance is very irregular, but the teacher considers it cannot be helped in this very poor district, owing to the parents often requring their children at home or for errands. A further difficulty is the migratory habits of these people, who often stay in the district a few months only. A tea was given at Christmas, and attended by 2,400 children, all of whom (or nearly so) had been some time at the school during the year. These feasts naturally attract many, who often qualify for them by coming a few days to school, but the instruction given is necessarily of little good to them.

120. *St. Andrew's, Canal-road, Church School.*—Average attendance, 90; about equal number of boys and girls; accommodation for 150. Fee, 2d. and 3d. No government aid, the fees being the only source of income. An evening school of about 85, instructed by voluntary teachers, is in existence. There seemed a feeling that other schools in the neighbourhood compete one with another, and attempt at times to draw the scholars from schools of different religious opinions instead of trying to bring in children from the street, who attend no place of instruction. The Bible is taught and unsectarian religious instruction is given, but no difficulty is experienced concerning the religious question.

121. *Shoreditch Parochial British School.*—This is one of the old schools, endowed, and dependent partly on subscriptions. The boys' school was founded in 1705, the girls' in 1709, and possesses £4,000 invested in the funds, with the rent of a lease amounting to £80 per annum. It is over full with 100 boys and 65 girls. The school is free, and all the children are supplied with clothes and necessary books. They are elected by the managers, and are required to produce their parents' marriage certificate, and a proof that they are under nine years of age, and can read; this latter condition is usually taken to mean reading the New Testament. Those who remain till fourteen are allowed one suit of clothes, and £3 is given as part of an apprentice fee. The attendance is consequently regular, as, if not, they are liable to be sent away; and the advantages of clothes, &c., are much valued by the parents. Evening classes have been established for eight years, and more than 1,300 persons have attended them; of these, over 300 remained but a week, as they got discouraged by finding the work too tedious at their age, owing to their complete ignorance. The evening classes are open four times a-week, and work with great success. In many instances this evening school has been beneficial, by inducing the children, after they leave the day-school, to continue their studies. The ignorance displayed by some is extraordinary; one example of many may be given. Two girls, the daughters of a small but tolerably well-to-do tradesman near; very fairly dressed, in fact quite of a superior class, once came to this evening class. They were so much above the others that the master was almost inclined to persuade them not to come. On reading the Testament the first evening, our Saviour's name occurred, and they were noticed to smile. It occurred a second time, and they giggled outright. The master, however, took no notice, as they did not exactly seem to mean to be profane; but after the lesson he took advantage of their being alone, and asked them why they had laughed. This set them off again; but one of them, after some persuasion, said quite innocently, "Why, that's her chap." The teacher was naturally amazed, and made further inquiry, when it turned out that one of them was engaged to a young man at a butter shop, of the name of Jim Crist; and they both, never having so much as heard our Saviour's name, positively connected it with this young man's when it occurred in reading the Testament.

The teacher considered that compulsion would be of no use in this neighbourhood. He thought that free schools, where all the material for teaching was good, would be sufficient, and induce the parents to send their children. This school embraced all sects, and he had never had any difficulty in this respect, though religion was taught according to the doctrines of the Church of England, without being very dogmatic. Attached to this school there is a valuable school-library, numbering 400 books, which is established upon a novel principle. It was first commenced by the teacher giving twenty books to the school; these books are let out at one half-penny per book, and as soon as there is money enough to purchase a new book one is bought; sometimes as many as three in a week are added. Thus a continual stream of new books is being added to the library, which always keeps it fresh. The teacher stated that up to Christmas last he had changed 14,425 books since he established it seven years ago. The average number of books changed during the last year per week was 48. The teacher says that his object was to counteract the vast amount of abominable trash that was continually falling into the hands of the children. "I find this library," says the teacher, "of great use; the children take out the books to read, and they do read them. While they are reading them they are practising the art of reading. It shows the parents that they are able to read when they see them sit quietly for the hour together quietly conning over these books page by page. My opinion of the subject is that they make the children more thoughtful, better behaved, and much more intelligent than they otherwise would be without the library." With regard to the local educational rate, the teacher states that the general impression is that there would be a hostile feeling on the part of the ratepayers, simply because they do not know how the money is to be expended, or what kind of education they are going to get for their money. As to the great question of religion, the teacher states, "I have been a teacher twenty years, and the question has never been put to me, 'What religion do you teach?' I have had children from parents of nearly every denomination, and I have many times put the question to them—You would not like me to teach your child the Church Catechism? The answer has always been, "Oh, it does not matter; it will do no harm I suppose. Do as you like; he can believe it or not when he is old enough to understand it." I never yet, in the whole of my career as a teacher, had a parent interfere in any way with religious instruction. On one occasion a good old minister, of Methodist persuasion, brought his boy to me. I asked him if he would like the boy to learn the Church catechism. His reply was, "Yes, I should, unless you can find a purer doctrine; if so, teach him that.'"

122. *St. Matthew's Parochial Schools.*—This is an old endowed school for 70 girls and 80 boys, where the children are clothed, and the instruction is free. It is supported by endowment and subscriptions. None are admitted unless they have been baptized, and are between eight and

eleven years of age. The children are elected from the parishioners by the subscribers. The parents belong to all sects. In fact, the baptising rule but too often induces persons to have the ceremony performed just to get the children into the school. Half of them are Dissenters, but the children all walk to the parish church twice on Sundays, assembling at the schools for that purpose morning and evening. Parents are glad to send their children for the extra advantages of dress, and the outfit secured to those who remain till fourteen. Some are from the poorest homes, and the children wear their school clothes all day, but in forty years no case has occurred of a parent pawning or selling any part of them. All go home to dinner, no food is given except a loaf on Sunday to each child. No government inspection; the boys are managed by one master and his assistant, the girls by one mistress and a monitor. All must be able to read when they enter, but this, as in the St. Leonard's, Shoreditch, School, is really limited almost to knowing the letters. They must be from eight to eleven years of age, and are required to stay till fourteen, otherwise they lose the outfit; a great proportion do stay till that age. The attendance is very regular, the least carelessness being visited with punishment, and if continued leads to dismissal, which, being dreaded by the parents, is quite effective in preventing disorder. The boys learn history, geography, and a little geology; the girls do a great deal of needle-work, making the aprons, shirts, &c., for the boys, in addition to their own clothes.

123. *Virginia-row National School.*—A very bad neighbourhood, No government aid. Fee of 1d. charged to the infants; 100 infants, accommodation for 150; 60 girls and 40 boys. The girls' and boys' school is mixed and free, but about to be changed, and a fee of 2d. charged, as it is found that even here practically all can afford to pay, and the instruction, it is considered, will be more appreciated when paid for. The attendance is not very regular; but the mistress stated that a plan of giving marks for regular attendance, and prizes at the end of the year, varying in value according to the number of good marks obtained above a certain minimum, had worked well in other schools in which she had taught, and some such arrangement was about to be adopted here. The school was supported by fees and subscriptions. Instances are known in the district in which children had been bribed by the offer of presents in order to prevent them leaving one school to go to another. The mistress thought that compulsion would do but little good; the only thing likely to draw in the very poor was an occasional dinner and soup-ticket.

124. *Working Men's Club The Triangle, Hackney.*—A very similar school to the mission in the Cambridge-heath-road. No government inspection. Fee 2d. each, and three children from the same family are taken for 5d. The school is quite full, with 100 girls and boys, and 40 infants. All sects attend (the religious question causing no difficulty), including several Jews and Roman Catholics. Some cases have happened in which parents have removed their children from other schools to this one because they were required to say the Church Catechism; the children not having been baptised, they considered that forcing them to say their godfathers and godmothers had given them their names, when they really had no godparents, was tantamount to teaching them to tell an untruth. The attendance is pretty regular; in cases of absence, the parents are visited; in too many instances the parents do not seem to mind whether their children go to school or play in the streets, and the teaching influence is consequently much diminished by such bad home influence.

125. *A Ladies' Seminary.*—This is one of the numerous private schools, kept by a person of little superior education to her neighbours. They are met with in the narrow lanes and courts of this district, and often a higher fee is charged than at a national school, though they are little better than nurseries with from ten to twenty children. They are considered by many of the poor, as "more genteel" than national schools. The greater number are kept by broken-down dressmakers, widows, and such persons who, having failed in everything else, take to "keeping school," like the Irishman who was put to teach the children when too old to look after the pigs. One of these visited had about twenty-five children, paying 2d. each. The extra respectability is shown in some cases by the children being fetched from school by an elder sister or relation. Reading, writing, and arithmetic, are supposed to be taught, though little beyond the first two is attempted. The mistress thought that compulsion should be applied when parents failed to do their duty, but that the schools should be secular. On further inquiry, it appeared that by secular she meant only those in which the Bible is read, and a short catechism, such as Dr. Watts', the one used by her own persuasion. No religion at all would not be approved of by those in the neighbourhood with whom she was acquainted. Her gentility almost prevented her from acknowledging that she was acquainted with anybody in so inferior a position. She did not approve of evening classes, as they tended to shorten the time during which children were kept at the day-school, and after their work they were too tried to attend with any advantage.

LONDON: PRINTED BY W. TROUNCE, 9, CURSITOR-STREET, CHANCERY-LANE.

INQUIRY INTO THE

EXISTING STATE OF EDUCATION

IN

RICHMOND, TWICKENHAM, MORTLAKE,

AND NEIGHBOURHOOD.

My Lords and Gentlemen—

1. In pursuance of the instructions of the Council that I should carry my investigation into a district subject to fewer abnormal conditions adverse to the initiation of a scheme of technical instruction than those existing at Brentford, I had the honour to be charged with the duty of reporting on the educational facilities and the means of their development, of Richmond, Twickenham, Mortlake, and surrounding parishes.

Character of the District.

2. The district comprising these semi-rural villages is occupied in the centre by Richmond, and has a varying radius of from two to three miles. It is unequally divided by the course of the Thames, which, here more than ordinarily tortuous, visits in turn every village included in the inquiry. Waterside industries are therefore common, and among the people engaged in them there is the same degree of ignorance and reckless improvidence which characterise the class elsewhere. Viewed as a whole, however, the district offers, in its social aspect, the widest possible contrast to the main portion of that previously examined. Owing to its unrivalled natural beauties, it has been distinguished, as is well known, for many centuries as a favourite resort of royalty and fashion; and, although the progress of modern innovation has stripped it of much of its picturesqueness, and driven some of its ducal residents to places affording more seclusion, it is still studded with the seats of a greater number of families of social eminence than any other extra-mural area of similar extent. Princes of England, most of the members of the ex-royal family of France, men distinguished in literature, science and art, a large number of the aristocracy, and persons conspicuous for their wealth, many being liberal contributors to all educational and general local charities, are resident here. But having subscribed to its benevolent institutions, the further interest of these gentlemen in their neighbourhood is a purely residential one. They have seldom to perform any administrative functions; and no means being furnished them, by the publication of sanitary and moral statistics, for judging of the true condition of their parish, it is not surprising they should often be ignorant of the educational poverty that surrounds them. The imposing array of well-appointed schools, and the zeal of collectors for their support, who appear ubiquitous because disorganised, create the impression that the youthful population must be at least moderately well-educated. Great astonishment would no doubt be felt were it publicly stated that, in the 1st Royal Surrey Militia, whose head-quarters are at Richmond, whose strength consists of 887 young men for the most part drawn from the district, who had much the same facilities afforded

them for getting an education as those now in existence, there are 332 quite unable to write their own names. Indeed, though your delegate, from his former position of head-master for many years of a school in the district, under the auspices of Earl Russell, had peculiar opportunities of knowing the population, and particularly that of school ages, the examination made under the instructions of your Council has revealed a mass of ignorance and juvenile preparation for vice and crime which has surprised him. As an illustration of this wide-spread unconsciousness that masses of the young and poor are absolutely ignorant, their ignorance fostering bad habits, crime, and pauperism, I may refer to the storm of indignant protests against the statement in my former report of the disproportion between the expenditure on beer and that on education. Many resent what they consider to be an unfounded slander upon their neighbours, while to many others those statistics appeared so startling that they have been quoted and discussed at public meetings as of a sensational character, of which they would at once have been deprived by a general familiarity with the facts brought to light. There is not wanting the strongest testimony in proof that the gravamen of the figures was under-stated by probably one-third. The absence of knowledge of its condition and needs sufficiently explains the otherwise remarkable lack in this neighbourhood of agitation or initiative in respect of educational reform.

Population.

3. The inquiry instituted here embraces an estimated population of 31,510, distributed as follows :—

Richmond	12,500
Twickenham	12,000
Mortlake	4,200
Kew	1,180
Ham	1,000
Petersham	630

The three last-mentioned, being subject to restrictive manorial rights are, it is believed, slightly declining; the growth of the remaining villages is progressive and rapid.

The number and ages of scholars in the whole district. One - third uninstructed; one - half in average attendance; one-fifth obstruct proficiency.

4. Adopting twenty-five per cent as the recognised ratio between the school and total population, the number of children in the district in a condition of actual pupilage will be 7,880. Deduct one-third (assuredly much in excess of the real proportion) as representing those who belong to families of moderate or superior means, of those, therefore, who are not instructed in the national elementary schools, and the result will show 5,520 of the class for which State-aided schools were intended. This is clearly not an exaggerated estimate of the number of eligible scholars; however, it is alarmingly greater than the registered attendance, as will appear from Table I. of the Appendix, in which are the number and age of all the scholars in the thirty-two schools included in the survey. Considerations of the most grave importance are suggested by this tabulated summary, in truth, such as should convince the boldest sceptic that to continue in the *antiquæ viæ* of educational routine is not consistent with national prudence. For, on the supposition that 5,250 does not misrepresent the number of school ages, nearly one-third of the children of this district are wholly uninstructed; scarcely one-half are in average attendance; about one-fifth are constantly oscillating between the school and other irregular duties in a manner so unsystematic that their presence in class is very prejudicial to the general proficiency; to themselves, also, their school training is practically worthless, while they are subject to influences from without which are likely to perpetuate evil and vicious habits. One-sixth of those nominally under tuition are above the limit of age at which the experience of intelligent teachers who have had fair scope for elaborating their methods proves a sound rudimentary instruction may be imparted, and yet, as will be afterwards shown, their attainments in the prime requisites of learning are mostly very insufficient. Considerably more than one-half of the nominal attendance consists of children under eight years of age, yet our infant methods are so crude that the child's mental growth is stunted by an over-burdening of the memory at a time when education, in its strictest sense, needs most of all to be insisted on. Notwithstanding, too, the general superiority of the infant-school teachers in this district, they seem to have but very imperfect conceptions of their true functions. But the system is more to blame than they—it leaves them most inadequately supported by teaching power, and insists upon treating them rather as nurses than as occupying the most delicate, and perhaps most difficult and responsible, office in their profession. Moreover, while it appears from the table that the existing accommodation corresponds very accu-

rately to the recognised wants, this district, like the previous one, exemplifies the faet that there may be even a superabundance of structural means, and yet, by a perverse distribution, the aim of education be subverted quite as much as by a deficiency.

5. In reference to the first deduction from the table, that one-third of those of fitting ages never seek admission into any school, returns have been obtained through the Superintendent and Inspector of Police of the district (for whose intelligent and valuable aid I have again to acknowledge the courtesy of Colonel Henderson), showing that in the lowest parts of the three most populous parishes alone there were, at the beginning of the present month (February), 597 boys and 455 girls, or a total of 1,052 children, between three and fourteen years, habitual absentees, loitering about their doors, in the streets, or in the fields, without acknowledged occupation or intention of seeking any; that other 115 boys and 85 girls, between eleven and fourteen, were growing up in enforced idleness, from want of aptitude for service or other causes; while 108 boys and 82 girls appeared to be engaged in some kind of productive labour, yet without the means of mental improvement. These particulars are summarised in the following table :—

Police returns of children between 3 and 14 not receiving any education.

CLASSIFICATION OF CHILDREN NOT ATTENDING ANY SCHOOL.

Description of Child.	Richmond.		Twickenham.		Mortlake.		Totals.	
	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.
No. of children, between 3 and 14, loitering in the streets, fields, &c.	224	168	185	205	188	82	597	455
No. between 11 and 14 idle from want of aptitude for service of any kind	43	37	62	42	10	6	115	85
No. between 11 and 14 who appeared to be occupied, but, though of school age, receiving no education	51	39	42	32	15	11	108	82

6. There is a fourth class, not enumerated in the returns, of lawless youths bordering on adolescence, who respect no authority but that of the police, a class just retaining sufficient knowledge of a forgotten education to chalk vulgar inscriptions on the walls, but who are otherwise quite illiterate. They are just at an age when, if boys have not respectability, character, or education to recommend them, there is the greatest difficulty in obtaining employment; they often prefer besides, the casual job, which just keeps them above starvation, to settled occupation; and complaint is rife here that while there is an ever-increasing charge for the maintenance of the poor, nothing is done to mitigate the evil which the ignorance and idleness of these loungers entail upon industrious ratepayers, in the shape of an augmented charge for police required to overawe them. Another serious evil is the mischievous influence these lads exercise over younger ones, to which may be traced the habit of drinking and smoking now so common here among boys of very early age. It is said that watermen's helpers, who are boys of the class described, when they are in receipt of good wages in the summer, affect high style and have their "champagne fights." On their numerous regatta days, subscriptions for which are levied on the gentry and tradespeople, expenditure in drink is excessive.

Lawless street and water-side boys.

7. A master waterman, who is thoroughly conversant with waterside habits and people, told me that, among the families with which he is acquainted, there are many lads whom the parents would gladly have at school, but who can neither persuade nor compel them to go. Similar evidence is given by a gentleman whose works are situated by the river, and who takes a deep interest in all social, especially educational improvements. He says that, whenever he has heard poverty alleged as an excuse for absence from school, he has made himself responsible for the weekly payment of such as consented to attend. He adds, "the first week these free scholars are pretty regular, the second they begin to fall off, and the third we lose them entirely." The listless, lounging habits of these boys become so engrained that it is difficult to reclaim them when brought under discipline. At the North Surrey District School the boys from Richmond and

Kingston are notoriously the least traetable, and the evil eonsequences of their early training have sometimes been unjustly instanced as damaging to its reputation.

Ability of the parent to pay the school fee.

8. Inability to pay the school fee ean seldom be pleaded with strict regard to truth in palliation of non-attendanee. It is asserted by a good authority that in Richmond, for example, searcely a housc is left unvisited by ladies usually appointed by the clergy for this purpose, and where real pressing want exists private benevolence supplies the means of edueation. Generally, too, the amount of the fee is earcfully graduated aecording to the number and eircumstances of the family, although therc are still some eases where the doubtful practice is maintained of making the fees solely dependent on the position in elass, the effeet being to deprive poor seholars, unable to pay the advanced rates, of the advantage of training in the higher standards. Sueh an arrangement keeps up the respeetability of the school at the expense of more general diffusion of education, a circumstance much to be regretted; but it is said to be unavoidable as the operation of the code compels both managers and teachers to regard the eommereial value of their scholars as a matter of first importance.

Drinking and education. A comparison between the sums expended on them.

9. A eonsideration of the drinking habits of thc people is so intimately connected with that of alleged inability to meet the costs of education, that it cannot, in full justiee to the purpose of this report, be omitted here. The great majority of applications for out-door rclief in thc three principal parishes of the distriet are due either to temporary sickness or infirmity. Those under the former head were, last year, in Mortlake, 57·7 pcr cent. of the whole; in Richmond, 38·7 per cent. of thc whole; in Twickenham, 30·1 per ccnt. of the whole. These are eases which, in the opinion of thc relieving officer, are almost exclusively attributable to improvidence, an opinion corroborated by thc statements of the poli e, who rate the relative eonsumption of drink in the three villages to be somcwhat as indicated by the above figures, and further confirmed by the comparison presented below.

COMPARISON BETWEEN THE SUMS EXPENDED ON

BEER AND ON **EDUCATION.**

	Beer: In the whole District.	Beer: Mortlake.	Beer: Richmond.	Beer: Twickenham.	Education: In the whole District.	Education: Mortlake.	Education: Richmond.	Education: Twickenham.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Per the whole population...	67,500 0 0	10,050 0 0	27,300 0 0	24,600 0 0	3,269 12 9¼	492 4 4	1,744 5 7¼	985 11 11
Per family... ..	10 14 2	11 19 3¼	10 13 4	10 5 0	0 10 3¾	0 11 8	0 12 3⅓	0 7 2¼
Per head	2 2 10	2 7 10½	2 3 8	2 1 0	0 2 0¾	0 2 4	0 2 5⅓	0 1 5¼
Population ...	31,510	4,200	12,500	12,000	31,510	4,200	12,500	12,000

10. In estimating the value of the eonsumption of beer, £450 is assumed as a fair annual average for public-houses, and £300 for beer-houses, an under-statement of the probable reeeipts of the respective houses, which, it is important to remark, derive their support from eustom far less exclusively of the wage-class than in Brentford, and from sources the counterpart of which in the latter district can scarcely be said to exist, as, for example, the elass of gentlemen's servants, who ean plead the excuse that they have no families to maintain.

11. Public-houses and beer-houses are 13 and 14 in Mortlake; in Richmond, 38 and 34; in Twickenham, 32 and 34; and in the whole distriet there are 92 of the former and 87 of the latter, or one house to an average of 176 persons, the usual weekly allowance for beer per family being 4s. 2¼d., and for edueation 2¼d., which a rate will raise almost to 3d.

12. As the endowed charities cannot be aeeredited to existing zeal or liberality, the above table makes a deduetion of their whole amount in ealculating the expenditure on the side of edueation.

13. With regard to any provision for pauper children, there appears to be a general understanding that their parents, while in receipt of relief, are responsible to the Guardians for their education. In some cases it is made an indispensable condition that those who receive assistance from the rates shall send their children to some school, full liberty of choice being permitted. Only in a very few instances, however, is it certain that scholars' fees are a distinct charge upon the rates. In the Union to which Twickenham belongs, the evidence is conflicting as to whether the Speaker's Act is directly or indirectly enforced. One of the relieving officers states:—" The Guardians of the Brentford Union do not pay schooling for any of the out-door poor children." Another says emphatically, that in the part of the Union where he administers relief, it is an invariable practice to make the fees a separate charge, but he can give no satisfactory information relative to the number of poor scholars thus provided for. The same want of system is observable in the lack of supervision over attendance ; no regular returns are obtained from the teachers, as a check upon absence or misconduct.

Pauper children. Their education much neglected.

14. In the Richmond Union, which, if Barnes be substituted for Twickenham, becomes coextensive with the district we are examining, of 66 pauper children between the age of 3 and 14, 16 receive their education at the cost of their parents and relatives ; 17 have it paid for out of the rates ; 24 are indebted for it to private benevolence ; and 10 get no schooling at all. It is not known how many such children are educated at Twickenham ; the number for the whole of that Union is stated at 120 to 130, but it seems to be purely one of conjecture.

15. Twenty-seven per cent., or more than one-fourth of the registered scholars in this district are irregular. The excuses alleged for absence are commonly, except when applicable to infants, of the most frivolous description. Ostensibly, boys are detained by errands and petty commissions ; girls by domestic occupations, especially nursing ; infants by stress of weather, distance, or sickness ; and the schoolmaster, to prevent these pretences, for such they frequently are, from ruining the financial position of the school, is compelled to add to his other duties those of a recruiting sergeant. But one very fruitful cause of absence is created by managers themselves, chiefly those of Church of England schools, who uphold the custom—for what purpose is not clearly discernible—of allowing a half-holiday on two days of the week, instead of giving the whole of Saturday, when children's services are mostly required. The consequence is, that on the remaining half-days, the classes are very thinly attended, and a suspension of the ordinary routine necessarily follows, occasioning the loss of a day to the whole school. The relative degree of irregularity in the several classes of schools is exhibited below :—

Irregular attendance. Twenty-seven per cent. of scholars irregular.

.TABLE SHOWING THE AMOUNT OF IRREGULARITY IN THE SEVERAL CLASSES OF SCHOOLS.

	The whole District.	Boys.	Girls.	Infants.	Mixed.
Average on the Roll..................	108·5	119	96	123	92
Average Attendance..................	79·2	91·6	69	88·6	64·7
Proportion of irregular Scholars	27 per cent.	23 per cent.	28 per cent.	28 per cent.	29·6 per cent.

16. It is usual to consider this evil in connection simply with the intellectual progress of individual scholars, its influence on the advancement of the school generally, and its pernicious moral effects being much overlooked. In either direction it is hardly possible to exaggerate its potency, though rather difficult to illustrate by practical examples how detrimental it is.

The bad moral consequences of irregularity

17. As the evidence of a high degree of irregularity must have great weight in determining conclusions as to the expediency of enforcing attendance, it was thought advisable to gain some positive knowledge of the extent to which, in this district, it hinders progress, and weakens the

chances of future employment. With this view, permission was obtained to examine the registers of Earl Russell's school. From these, it appeared that of 100 scholars (68 boys and 32 girls) who had formerly passed the highest standard, and including every one whose present position could be ascertained, 33 are apprentices (5 builders, 5 plumbers, 5 bakers, 1 engineer, 1 brewer, 1 tailor, 1 watchmaker, 1 brushmaker, 13 dressmakers), 12 are pages, 9 teachers, 7 gardeners, 6 clerks, 5 under-coachmen, 3 pupils in higher schools, 2 cowkeepers, 2 potato dealers, 2 butlers, 2 sailors, 2 carpenters, 2 gas inspectors, 1 gamekeeper, 8 housemaids, 2 ladies' maids, 1 barmaid, 1 nurse. Since amongst those who were so irregular as not to rise beyond the lowest standards, not one can be remembered to have entered any office or situation of responsibility, the foregoing list furnishes proof that where scholars are not indebted to any adventitious circumstances, or distinguished for more than ordinary talent, they probably owe their success to the disciplined habits which they acquired by regularity of attendance. The two butlers mentioned were the sons of very poor parents—in one case exceptionally poor—and both were of mediocre ability, yet both are now at the head of large establishments, and occupying enviable positions. The engineer's apprentice was equally poor, and received the gratuity of £200, with which his indentures were purchased, more in consideration of his steady perseverance than his attainments. There are other cases of this kind quite as conspicuous, and the only boy on the list whose character has turned out indifferently is the gamekeeper, whose promotion in class was the result rather of growth than of capacity, and who belonged to a family of systematic truants.

18. Too much prominence can hardly be given to this feature of school economy, for the fact has been repeatedly forced upon the attention in this district, that mere occasional schooling operates far more prejudicially against a child's chances of success in life than entire absence, where absence is due to regular occupation. A large employer told me that many of his men are utterly ignorant of book-learning, yet are most trustworthy and efficient servants. He contrasted their condition and character with those of some villagers who had lately sent him a scholarly letter, threatening that unless he returned them £5 by the following morning they would destroy a certain fence, and make a footpath across his private grounds. No notice being taken of the letter, they executed their threat literally. "These educated rascals," my informant added, "were at the time of the occurrence lying on my blankets, and partially fed from my own kitchen." This gentleman, who is a justice of the peace, a liberal patron of education, and an annual subscriber of several hundred pounds to the local charities, begins, it is said, to have more conservative views about the extension of education among the poor, as being of questionable benefit to them. It must be admitted there is too heavy a contingent of culprits in our prisons who can read and write, and it would be deplorable if there were nothing better to be expected; but the very district, or at least the district school, to which the orphan and destitute are sent, presents conclusive and most consolatory proof that teaching and training power, properly applied, produce better moral as well as intellectual results than this. Where 60 per cent. formerly went to the bad, now, under regular discipline, this is the case with only two or three per cent.

The influence of irregularity tested. Comparison between the results in Earl Russell's school, and those of the district school.

19. To test as closely as possible the significance of regularity in its bearing on results, the school just named, and that at Petersham, belonging to the Noble President of the British and Foreign School Society, Earl Russell, were selected for a comparison. The two schools are of a widely contrasted character. In one, the favourable conditions are what may be called, for the sake of distinction, material; in the other, mechanical. Petersham is taken as it was when under my own management, because its reputation was then, owing to a concurrence of propitious circumstances, at its highest, and not excelled perhaps in the neighbourhood. This is said without the least reference to the share I myself had in its success, the credit of which belongs rather to the active interest in the welfare of the school evinced by its noble patrons; to their lavish pecuniary support, to perfect appliances, and to what could not fail to be remarked in the occupation categories—the superior social status of the scholars. At the North Surrey School the generally low type of physiognomy, immobility of feature, unmeaning, heavy stare, and stunted growth of the boys, prove them to belong to the most unfortunate and degraded classes of the district from which they are drawn. Many of them have from infancy been bandied about from one union house to another, until their antecedents, it is said, have produced such marked characteristics on them, that they are at once distinguishable from others less pauperised. Not a few enter the school with their intellect dwarfed by bodily privations. Yet, despite these

drawbacks, a close examination convinced me that though there were none here equal in scholarship to the foremost in the Petersham school, their general excellence would not have been paralleled in the latter establishment. The instruction is much better diffused and more thorough than would have been possible in a school like Petersham, had it been under less auspicious management, and filled with boys of the same mental calibre. Such satisfactory results, out of materials and under conditions so unpromising, suggest advantages of a superior order. They are to be attributed partly to classification, which, however, though developed to an extent quite unattainable with the small numbers at Petersham, is here stripped of much of its effectiveness by the exigencies of age and size, as they give rise to the necessity of associating untaught boys with those of advanced training and abilities, to avoid making them appear ridiculous, by the side of others much inferior in years, but their equals in attainments. The schoolmaster himself ascribed his success mainly to the absence of all disturbing elements introduced by fluctuations in attendance. His testimony to the power of regularity is the more valuable as it was given quite spontaneously. To an inquiry as to the causes explaining the ease with which a high state of discipline is maintained, the reply was, "They are the orderly habits acquired in the several departments of industry connected with the school." It is believed that considerably over 90 per cent. of the boys trained here turn out well, a surprisingly high moral standard, regard being had to the number of years many of the boys have been unrestrained by any control until they entered this school.

20. A curious illustration of the inconvenience one form of irregularity imposes on conscientious teachers was met with in an infant school at Twickenham. It was considerably past the hour of dismissal, but the scholars were still marching round and round the room in a state of evident impatience. One little unfortunate girl, whose wayward paces happened to be detected, was ordered to lie on her back in the middle of the floor, and round her prostrate body the unmeaning march continued, reminding one of the celebration of some funereal rite. The code contains a regulation that schooling must go on two hours after attendance has been marked in the register; and, as many do not come in till much after the appointed time, thus delaying registration, the procession is established to complete the legal time. In the case of infants, who are already confined beyond their natural powers of attention and endurance, some relaxation of the stringency of this rule appears to be desirable, particularly as the burden is felt only by those teachers who keep the most loyal faith with the government.

The half-time principle adopted in Earl Russell's school as a preventive of irregularity.

21. It was in a great measure owing to the inconvenience and loss the school suffered from this source that, at Petersham, some years ago the half-time principle was introduced. I have since ascertained that the suggestion originated with a member of your Council, Mr. Chadwick, who, being on a visit to Pembroke Lodge, was invited to see the school, and give his own impression of its working. That gentleman pronounced it to be bad in principle, on account of the virtual exclusion of the best methods of teaching on such a scale; those in use, though they had always been complimentarily reported on by the inspectors, failed to reduce the time of instruction much below the ordinary maximum, which experience of good classification had proved unnecessarily high. Moreover, the best methods of applying the half-time system were here impracticable, and the accomplishments of singing and drawing necessarily confined to a few. The surprise manifested by Earl Russell showed that the machinery having been so often reported on as of the first-class, it had not occurred to his Lordship that his school could be other than first-class also. My testimony, based on experience, as to the contrast between the powers of large and small numbers in influencing the time of instruction, shown to be beneficially as 2 to 1 was taken by Mr. Chadwick, and together with other evidence relative to the number of hours daily which exhaust the profitable attention of scholars, transmitted to the Newcastle Commission. At the instance of the same gentleman, Earl Russell in engaging a sergeant for drill in his own family, gave directions that he should be employed at the school,* and recommended a reduction in the hours of teaching.

22. There was an understanding with the parents that the short-time plan should not be adopted absolutely and irrevocably, but should be tried as an experiment for twelve months.

* The officer engaged, who, besides having been for many years sergeant-major of his regiment, had had great experience in schools, gave it as his opinion that a saving was effected of one pair of shoes annually by this kind of training.

A census of opinion was then taken, and there being as many as two-fifths in favour of a return to full time, at the desire of Lady Russell the new plan was abandoned. No whisper was heard, certainly not from the Inspector, that the change had lessened the amount of instruction; and almost the sole reason assigned for the preference given to the original arrangement was that it allowed of stated times for meals being more easily adjusted to the convenience of the whole family—the short-time hours having been from 10 o'clock to 2·30, including thirty minutes for the mid-day meal. There is room for suspicion, however, that many of the dissentients considered that short hours ought to have been accompanied by a corresponding reduction of the fees, and really recorded their disapproval on this ground. A very pertinent objection was that the means of employing the spare time of the scholars were not easily procurable on this small scale, and the irregular habits which the remedy was intended to correct appeared in another form. The district has witnessed no other attempt at employing the half-time system; nor are the indications sufficiently strong that, if recommended, it would be adopted with success, except under such limitations as those suggested in my former report.

One-sixth of the registered scholars of the district above eleven years, who have not reached a fair standard.

23. Next to the degree of absence and irregularity, the point of greatest importance brought out by the table exhibiting the character and amount of attendance, is the fact that one-sixth of the registered scholars are above the age of eleven, and are, nevertheless, not educated up to the standard found attainable by good methods and organisation, based upon infant teaching, at a much earlier age. Cases were found of boys who had been in the same school for ten years, and seven years appeared not at all an uncommon period of instruction; but even these long periods do not suffice to equip the scholars with a sound knowledge of the mere rudiments. Table II. of the Appendix will show this in a striking light. The mixed and infant schools are not inserted, as they would mislead, and for obvious reasons the names of the schools are altogether omitted. From this table it will be seen that of 1,594 scholars who, with very few exceptions, ought all, under a scheme providing for constant attendance, to have passed the State examination, only 952, or 60 per cent., could be presented; the rest were either not eligible, or were eliminated because they had not even a remote chance of success; while of the 952, representing 2,856 passes, the actual number of passes was but 2,503, or only 87 per cent. Considering the boys and girls apart, 59·9 per cent. of boys were presented, and of this proportion only 85 per cent. passed; the proportion of girls presented was 59·9 per cent., and of these the passes were 92 per cent. Or again, taking the total actual passes, and comparing them with the passes represented by the full registered number of scholars, they are equivalent to but 52 per cent., or scarcely more than one-half. Combining the deduction from these figures with the results of the calculation, given in a previous paragraph, it may be generally stated that nearly one-third of the children of the wage classes of this district are wholly ignorant; rather more than a third are indifferently educated; and about an equal number reach the Government standard. The number of children in the elementary schools described as of the middle class is 73; and advanced instruction is represented by 444, who have got beyond the compound rules; 129 who are learning drawing; and a limited number, not ascertained, being taught Geography. This is all that is being accomplished by our national system, the very life principle of which is payment by results. Nor is this little taught satisfactorily; for, as one master states, "it is notorious that the instruction has become more mechanical, and that mental training is almost, or quite, neglected." Either, therefore, the State has fixed too high a standard, or blame is attachable somewhere—to the schoolmaster, to the clergyman (who is in most instances the responsible manager), or to the inspector; to the system as a whole, or to some of its features.

Inferior training of teachers in the normal colleges.

24. In this district, intelligent teachers are themselves the first to acknowledge that for the most part members of their profession are not efficiently trained for their work. They say that at the Normal College they have learned to acquire knowledge but not to communicate it; and it is of greater importance to them to have a command of simple language and power of illustration than to the Minister, to whom they are much inferior in the use of speech. Of logic, mental philosophy, and psychological facts, instructive in child training; of those branches of science, such as natural history and chemistry, so peculiarly adapted to form the habits of investigation and analysis which distinguish educators from mere instructors, they know next to nothing. The syllabus of the Training College appoints a repetition of the lessons which were learned during apprenticeship; and Dr. Cornwell's Geography, or similar text-books, which it is a waste of time for the student to handle, as they simply burden the memory, form the staple of his mental pabulum.

25. Teachers of long standing insist that the reputation and power of commanding respect of their whole body depend upon the maintenance of a high standard at College; deteriorate that and the *prestige* which the Certificate carried with it will be lost. Already the evil of a market overstocked with men deficient in high qualifications is felt. There were lately in this district upwards of seventy applications for a vacancy, the emoluments of which do not exceed £120; and for that created by the promotion of the successful candidate there were ninety. On the other hand, teachers of superior ability eagerly compete for offices outside their profession. At a recent competitive examination at Manchester, of the seventy-five who sat a large proportion were teachers, one of whom gained the post. A successful master, with a high-class certificate, who has held the same situation in one of the schools for nearly ten years, who now receives no more than £90, a salary considerably lower than he obtained under the old code, is trying for a commercial appointment. Another, the author of a little "History of England," which has had a circulation of 100,000, gets £75 for his services as teacher and choir-master. He is trying to get a connection among private schools as a lecturer in physical science. Real cause for uneasiness exists that, as these more intelligent teachers become absorbed in other employments, the tone of education will greatly suffer. It is said "that under existing arrangements persons totally unfit for teachers are enabled to creep in, since all that is required to obtain a certificate of some kind is to cram the memory with a number of facts and to write and spell decently." But mere intellectual or literary ability is almost the least of a good schoolmaster's qualifications; and the selection of teachers ought not to depend so exclusively as at present on that one recommendation. Brilliant talent affects the children in elementary schools but little; unimpeachable manners and neat personal appearance do, to an extent which makes it possible for any person acquainted with this class of schools to describe with tolerable accuracy, the teacher's general style and appearance, from merely seeing his scholars.

The need of a higher standard.

26. The Head Master of the National School, who has taught in Lancashire, rates the power of learning there in the ratio of five to four as compared with the intellectual aptitudes of the children at Richmond. The difference is not so great as that observed by similar experience at Brentford and other places; it still proves, however, the necessity of earlier and more efficient teaching to compensate for natural defects. Yet, as will be seen in the following table, the cheapest form of teaching power is employed, especially in the substitution of monitors for pupil teachers. The assistants are seldom certificated, and those in the infant schools have often not been apprenticed, but are senior monitors only. (*Vide* Table III. Appendix.)

27. The clergymen in this district are, as a body, men of the highest standing in their profession, most anxious and laborious for the education of their flocks, but, as shown by their school reports, satisfied with the teaching as it is, and having very imperfect knowledge of teaching power, or teaching as it may and ought to be. Few manifested any perception that children ought to learn more than the three R.'s before their thirteenth or fourteenth year. Nothing but regrets were expressed that the parents of the wage classes would take away their children half taught, or before the end of the eleventh year, and there was no consciousness evinced that they might receive full elementary instruction by that year; the necessity for their doing so appeared not to be recognised. If entrusted with compulsory powers, these managers, unacquainted as they are with the principles of school discipline and economy, would generally apply them for the retention of children in their classes up to their thirteenth or fourteenth year under the present system.

The clergy as managers.

28. To the zeal of the clergy the district probably owes one-fourth of the means annually provided for education. But it is questionable whether the application of those means has always been in favour of substantial progress. Large funds have been absorbed in the erection of structural facilities which might have been dispensed with, and there remains the spectacle of ignorant localities greatly neglected side by side with others where waste is palpable. In two contiguous parishes, one of which has abundant educational supplies, far, indeed, in excess of its requirements, the other finding it difficult to maintain its schools at all—there is an extravagant separation of school space. Yet the incumbent of the poorer parish, who, it should seem, ought to have the strongest motive to take a contrary course, scouts the proposal of a combination with something like disdain.

29. At the opposite extremity of the district a school largely indebted to the beneficence of the Queen and Royal Family, and the only one in the parish, among its printed regulations

retains one of the following exclusive character :—"All the children must be instructed in the Church Catechism and the principles of the Established Church. The children, with the master and mistress, shall attend divine service in the parish church, every Sunday morning and afternoon, no excuse for absence being allowed." So that Dissenters have no option but to send their children to a distant parish.

30. These disabilities of Nonconformists co-exist with strong dissent in the Church of England itself. Some years ago, a number of Sunday School teachers remonstrated with their clergyman, who, notwithstanding their scruples, persisted in a determination to introduce class-books inculcating extreme doctrines relative to baptismal regeneration. A disruption took place, which was followed by the establishment of a separate school both for Sunday and week-day teaching. I have been told that the older school held out inducements of an apparently innocent character, but such as were really not above suspicion, to regain the scholars it had lost; that counter bribes were resorted to on the other side; and the contagion has since so spread, that boys are known to change their school three times in a year, for the sake of the treats and excursions.

31. Of want of knowledge of educational organization, and conseqent extravagance in the multiplication of schools, a conspicuous example may be found in Richmond. In a poor part of the parish, very elaborate school accommodation for 315 children was provided, and placed under the control of two gentlemen, influential and popular, and members of the Church of England. Their catholicity of sentiment in the matter of education has been shown by the appointment, in turn, of students from each class of training college. But the purely unsectarian character of the school shocked some good people, who erected another expensive school, only twenty yards off, under the ægis of the Church. The united accommodation of these two schools supposes an attendance of 476; the actual attendance is 145, and the number on the combined registers only 196. Still, there is one zealous clergyman not yet convinced; he deeply deplores his inability at present to supply the wants of his poor parishioners who live on this spot, and for whose use a stranger would certainly think the schools were specially intended.

32 A school in the adjoining parish is in one sense the antipodes of this super-abundance. Situated near a dense, unlettered population, among which scarcely one-half of the children receive any instruction whatever, there is no school in the district with a stronger *raison d'être* than this. Yet its opportunity for usefulness is almost lost through the want of apparatus and fittings. Every child while writing must stand; the greater part are without books of any kind to read in; and the provision for the infants is so bad that they appear to have nothing they can do but sit with folded arms. At this school there are 150 on the roll, only 20 per cent of whom passed in reading and writing, and 10 per cent. in arithmetic.

The clergy as teachers of religion in schools.

33. The chief advantages proposed as derivable from the existing separate small school organisation is that of maintaining religious teaching. Now it is a duty to state that the present religious teaching is the subject of complaint, as being inefficient and bad. At the recent Conference on Education the disastrous consequences of separating religion from secular instruction were vividly pourtrayed. Much stress was deservedly laid on the importance of not leaving this subject to be taught or neglected at the discretion of imperfectly informed teachers. It was argued the clergy were the proper custodians of this branch of education, and any interference with present arrangements would involve the loss of all the benefits their supervision secures. Special attention was therefore directed to an inquiry into the amount and quality of religious knowledge due in this district to the superior information, zeal and tutorial power of the clergy, and the beneficial influences this teaching has upon the after-career of the scholars from the development of right principles. The results of the inquiry are so far important that they might claim another and a special inquiry. In one of the three large parishes the clergy abstain almost altogether from visiting the schools in their ministerial capacity, religion being left to the teachers, who would be glad to be relieved from the responsibility. There is a similar abstinence in most of the other parishes. But, where the clergy really undertake this task they do so spasmodically, and the teachers are unanimous in pronouncing their instruction worthless. Ministers would stand aghast at the opinions expressed by their subordinates of the mode as well as of the value of their lessons. Their teaching is said to be mechanical, their exegesis elevated far above the comprehension of the children, they do not

engage attention by aptitude in awakening sympathy, and their catechumens are consequently more often mystified than instructed or enlightened. As an illustration of the justice of these charges an instance may be mentioned, as stated to me, of a lad in a primary school, who, having been allowed to take the sacrament, was overheard by the head master to say, in reply to some inquiries by the other boys in his class relative to the wine, that if he had known he should have had so little of it he would not have given himself the trouble he did in preparation.

34. A curate taking an earnest personal interest in an evening school frankly says he has never entered the day schools for the purpose of giving instruction. Another minister, who also leaves religion to the schoolmaster, says his experience leads to the impression that the only Bible knowledge with which children are generally familiar, consists of the anecdotes in the life of Joseph. The simplicity and attractiveness of that narrative have too often recommended it for indiscriminate reading, and this fact has led gentlemen of high position in this district, as sincerely anxious as the clergy or any others can be that religion should not be neglected in our schools, to ask whether there is no impropriety in allowing certain passages in the life of the patriarch to be read in mixed schools, with boys and girls at the age of puberty; and if it is not putting a teacher in a most awkward and painful position to compel him to be witness to a curiosity and remarks which he is helpless to repress. In this connection, too, a reference may be made to a practice which assuredly would appear out of place were we not so accustomed to it, of requiring children to be present and to respond during special services for women in the church. Nor is the catechism itself entirely free from passages upon which a teacher must not venture to comment. These questions do not appear to be unworthy the attention of our high ecclesiastical authorities, particularly, as it is said and believed by some, that some things daily repeated very carelessly in schools were not intended for children's ears at all.

35. There is one school in the district which has obtained the reputation of devoting more than ordinary attention to religious knowledge, and inquiries were instituted in every part of the parish, and among all classes of employers, with the view of ascertaining what character boys with these advantages maintained in their situations. Amongst tradespeople the complaint was common, that no confidence could be placed in them until their fifteenth or sixteenth year, when the discipline they had gradually learned in previous situations began to tell upon their conduct. A well-known physician said that the boys he engaged from this school to carry medicines turned out very bad, and that in Richmond generally that was their repute. The newsagent at one of the railway stations states that the majority of the boys he has had from the same school have gone wrong; one stole a sovereign from him. A lady, who was accustomed to select a boy from the school for her page, lost so many articles by one after another, that she has determined not again to have a page. From these facts, the conclusion is that the formulas of doctrine which constitute the staple of religious teaching in the primary schools, whatever their value, or the constancy of their repetition, do not, in point of fact, give any appreciable advantage of character to boys instructed in them over those who have been taught to observe the plainer rules of practical Christianity

The Conscience Clause

36. Of the operation of the conscience clause, it may be said generally, that there is an honest desire on the part of the clergy and school managers to avoid giving parents cause for complaint on religious grounds. However, many instances have been met with, and they might be multiplied, not only of indifference to the evident wishes of the child's natural protectors, but of open hostility to them, such as prove it to be almost hopeless to expect that, while the present denominational system continues, and religion is taught as it is, the rights of conscience will be entirely respected. Even little children of six years are the objects of persecution. But in your delegate's experience in this district, bigotry and intolerance culminated in the conduct of a priest, who bitterly reproached a poor woman, compelled by poverty to remove her child to a free but unsectarian school, with having abandoned her faith and her church. The irate "father" would listen to no explanation, but left the woman and her husband in a state of great consternation, by declaring that, as she had forfeited all claim to his ministrations, they would thenceforward cease.

Defects in the mode of inspection.

37. Imperfections in the training of teachers, and the shortcomings of the managers, are not rectified by the present system of inspection. Inspectors give results only of an inferior primary instruction. Their reports do not state in what length of time it is completed, or at what cost; nor do they give any comparative results such as here stated. The tendency of the reports of denominational inspectors is to

make things pleasant to the contributors. Going over schools of such extreme differences in size, it is scarcely possible to suppose that the wide difference of results should not be noted, yet they are not reported. The inspector of a small, single-chambered school, with only one teacher, might at least be supposed to observe and state the loss of teaching power, and the means of repairing it by other arrangements. But this is not done. He must see that the difference of result is often as one to three, but he does not acquaint the clergy or managers with the fact; much less does he inform the teachers of the means by which, in other districts or schools, superior results have been obtained. And as the clergy or teachers themselves have had little opportunity of making comparisons, and are found, indeed, to be unaware of the varieties in the capabilities of different school organisations, they are not disposed to give ready credit to a statement of them by persons whose opinions are supposed of less weight than those of an inspector. Undenominational inspection will both correct much that is faulty and tend to fill up this hiatus in the local knowledge of educational requirements, but a further advantage would be gained, were inspectors appointed Inspectors of Education instead of Inspectors of Schools. The best fruit of the first reform would be the criterion single inspection would furnish in a comparision of the relative positions of schools. It must be that every one will have each his own standard, so that 95 per cent. of passes in one school will be equivalent, under the present system, to perhaps no more than 85 per cent. in another; or a false standard of efficiency may be the result of an inspector's bias in favour of the class of schools he examines. The other change to a wider latitude of inspection could be made an effectual check to the abuses in educational charities, the means of enforcing the right application of all educational supplies, of exposing dilatoriness or incompetence in local management; and if the Inspector's report, in place of being a mere skeleton statement for purposes of the grant, were made a complete *exposé* of the educational conditions of a district, and widely circulated among those it concerned, it would do more than almost any other means that could be devised to perfect a national scheme. It would give publicity where concealment now covers gross anomalies or abuses; it would suggest comparisons, propose methods, and devise plans, always giving to teachers and managers an *aim*, the lack of which is the cause of much of the present inertness and inefficiency.

38. The general inferiority of elementary education, notwithstanding the great length of time nominally given to it, and the causes to which that inferiority is in various degrees attributable, having been considered, it is important to show at what cost the present low standard is reached, and whether, from the sources of income now found available, the outlay required by more advanced instruction could be provided.

Sources of income.

39. The total annual expenditure, calculated on the basis of last year's balance sheets, of primary schools in the district is £3,932 12s. $2\frac{1}{4}$d.; the income £4,379 0s. $8\frac{3}{4}$d., or £446 1s. $6\frac{1}{2}$d. in excess of the outgoings. However this difference is variable, and appears alternately as a surplus or deficiency. There are, therefore, no accumulated funds derived from the ordinary sources of income, which are classified under five heads, with their respective amounts, in the table below:—

INCOME OF THE SCHOOLS IN THE DISTRICT.

Subscriptions and Donations.	School Pence.	Government Grant.	Endowed Charities.	Miscellaneous	Total.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1,168 16 2	1,012 18 3	758 14 4	662 6 5	776 5 $6\frac{3}{4}$	4,379 0 $8\frac{3}{4}$

40. Voluntary power may be assumed to be exhausted, the contributions now raised being collected with great difficulty. A schoolmaster, commissioned to make the necessary calls in one of the parishes, resigned the office because of the indignities to which he was obliged to submit from the servants, who were impatient at his calling *so many times*. In his last published statement the Vicar reminded his parishioners of their reluctant and insufficient help thus:—" It is very difficult to collect funds to pay the quarterly salaries. I do not think the managers and their treasurer should be allowed to be in continual anxiety on this point; and I am surprised that a work of such importance, carried on to the satisfaction of her Majesty's Inspector, and well reported on by him, should be allowed to drag on with so much difficulty. The subscription list does not show much effort on the part of a parish like this, and there are many

parishioners of affluence who contribute nothing to the schools either by list or by offertory." This plain language was perhaps deserved at Twickenham, where the amount per head expended on education is lower than in any surrounding parish, although the difficulty here complained of is met with everywhere.

41. Weekly payments by the scholars are at the high average of eight shillings per head per annum for the number in constant attendance. They are seldom applied, as it has been suggested by your Council they should be, to the augmentation of the teachers' incomes ; but in one instance where this has been done the wisdom of such an arrangement appears to be justified by the results. In this case a moderate fixed salary is supplemented by the whole amount of the scholars' fees. It is in the interest of the mistress, therefore, to increase her numbers as largely as she can, by the maintenance of a high standard of proficiency. This governess is uncertificated, but both her school and her income are, with one exception, by far the largest in the district. Her success is indeed, in one sense, greater than could be wished, as, owing to the high reputation she maintains, the transference of her scholars to the upper school is delayed long after the infant stages are passed.

42. An impression prevails here that the endowed charities, though largely available for educational purposes, are not applied in that direction to the extent they might and ought to be. And that substantial ground does exist for dissatisfaction as to the manner in which such funds are sometimes administered, there is strong reason to believe. At ——— there is an annual income of £100, derivable from house-rents, which ten years ago it was determined should be given to the support of education, but which has ever since been held in abeyance. The executors of the late vicar of the parish, who was the sole trustee of the fund, are ignorant of the amount of the accumulated capital, and as no other trustees have been legally appointed, the lessees of the tenements have refused payment of their rents. Meantime a proposition emanating from the Vestry has been considered, in pursuance of which the clerk was instructed twelve months ago to communicate with the Charity Commissioners with a view of obtaining their sanction to a scheme for diverting these funds from the object to which they were originally applied to the relief of the voluntary supporters of the church. The dilatoriness of the vestry clerk still leaves this charity in the condition in which it always has been—a fund to be frittered away no one knows how. An apprentice fund in the same parish, of the annual value of £50, is not a whit more satisfactorily administered. In twelve years three boys have been assisted out of it to the extent of a moiety of their premiums, or about £15 each ; and of the rest, except £200 which the vicar's executors can account for, nothing is known. In the larger parishes, much the same set of circumstances have occurred, and repeated themselves, because no one has the courage or public spirit to incur the odium that has attached to other reformers who have attempted to disturb the even current of parish abuses. These abuses are in minor charities glaringly apparent. Some of the recipients, quite unfit objects of charity, have so far lost their self-respect as to set up a kind of hereditary claim to the doles which their families have perhaps been in the habit of receiving for generations. In other cases, as was stated to me by a distributor, they are so independent that the charity must be carried to them ; they will not go to receive it. Some are altogether above the benevolence which is forced upon their children at school, producing undisguised vexation. One lady of the district, who annually gave bonnets to a class of girls, found they would never wear them except in her presence. Several of these girls were the children of people in good business. Generally, it may be said, that giving clothing to schools in this district is misdirected charity. Such schools suffer in efficiency, in tone, and elevation of character. The reason is that the dress is a badge which discredits the wearer, and deprives him of the advantage of associating with any but those of his own stamp and class, as persons of respectability object to send their children where this form of charity exists. The fact partly accounts for the superior social standing of the British schools, and probably also in some degree for so many leaving national schools morally unimproved, the degrading influences of their homes not being counteracted by better associations at school.

43. When schools are partially, but very insufficiently, endowed, the deductions from the State grant made in consideration of the endowment create great discontent. Instances have occurred of the deductions being tantamount to a total withdrawal of the grant. Small schools particularly suffer in this respect, and their endowment funds are often as much a curse as a benefit to them.

44. The subjoined table of expenditure exhibits a comparative classification of the costs per head in the different kinds of schools.

Cost per head in the various classes of schools.

COST PER HEAD IN THE DIFFERENT CLASSES OF SCHOOLS.

In Boys' Schools.	In Girls' Schools.	In Infant Schools.	In Mixed Schools.	General Average.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1 12 8	1 12 3	1 0 5	1 19 5	1 11 2

45. We are now in a position to estimate pretty accurately the total cost of a child's education from the time he enters the infant school at three years up to the age of his pubescence, when he quits school for the active duties of life. In the infant stage, which includes the four years between three and eight, he will have cost £4 1s. 8d.; and during the next stage, entending from the commencement of the eighth year to the close of the fonrteenth year, £11 8s. 8d. more, or for the whole period of 11 years £15 10s. 4d. But if our model scholar be a girl, she will have cost 35 pence less, or £15 7s. 5d. Whether boy or girl, if trained exclusively in a mixed school of the present type, his or her total will amount to the respectable sum of £21 11s. 11d. Unless, therefore, it can be shown that the quality of the education in the mixed school is superior to that on the separate plan, for every boy trained entirely in such school there is an absolute waste of £6 1s. 7d. A boy whose educational costs are £15 10s. 4d. is a debtor to the State for £3 6s.; to his own weekly payments for £4 4s.; and to all other aids for £8 0s. 4d. Suppose him not to have enjoyed the advantages of the infant school, but to have commenced learning at the end of his seventh year, and to have been educated in a small or mixed school, his cost would be £13 15s. 11d. Boys were met with, however, in this district who had gone through the infant school stage and had been scholars for ten years. It is presumable they would remain the eleventh, and the utmost they could hope to carry away in addition to the ordinary mediocre accomplishments in the three "R's" would be a very slight knowledge of the outlines of geography and equally imperfect facility in linear drawing.

46. So large a disproportion as there is seen to be between the cost of a mixed school and that of an infant school would seem to suggest something special to explain it, but the explanation is simple. Mixed schools are, by the very exigencies which originated them, *small* schools. Had there been a sufficiency of children to justify the erection of separate establishments, children of all ages and both sexes would not have been combined in one room. And, besides that, small schools are essentially less economical, whether for mixed or for separate instruetion; in mixed schools the cost is enhanced by the necessity of employing an additional teacher to superintend the industrial training of the girls. Where, too, the infants are a considerable minority, this second teacher is skilled, and her salary is a correspondingly large item in the costs. But this is no argument against the adoption of mixed schools of boys and girls, not of the infant stage, when the numbers are of a magnitude to make the multiplied results commensurate with the teacher's salary, which continues the same whether the number taught be fifty or a hundred

The greater cost of mixed schools.

47. The school teaching being at the least three years below the proved practical standards, and secondary instruction, with physical training, being generally excluded by it, the question arises for consideration, how may those standards, combined with physical training, be attained.

A consideration of the means for attaining higher standards.

48. How would those secure this object who propose that each school should remain as it is under separate management. The reply of the most determined separatists is, "All diffieulties may be ordinarily overcome by a good teacher under a judieious manager." But this report has shown, that in eases where there was no dispute that the desiderated conditions had been attained, they failed utterly to reach what is here asserted to be the aim to be accomplished. The Petersham school may be taken as a pertinent illustration. Here, except for the inherent, inseparable defects of the school, the conditions of success seemed to be complete; and yet, notwithstanding an extraordinary outlay of £2 12s. 6d. per head, nearly twice as high as the average in the district, it has been seen that in a larger school, boys

apparently the most unintelligent, and of the most unpromising character, more generally attain high standards in a shorter time, and at a greatly reduced cost.—(*Vide* Table IV. Appendix.)

49. Again, at Kew, the manager and schoolmaster are unexceptionable. Such restrictions are placed on irregularity that they virtually amount to a compulsory law. The number of scholars, one-fourth of whom are over the eleventh year, is just that which the advocates of small schools recommend as possessing the highest capabilities, viz., 49; and the income is princely in its amount as well as in its source. The average rate per head in State-aided schools throughout the country is £1 6s. 8d.; in this district, the same average in all schools whether inspected or uninspected, is £1 11s. 2d. But at Kew it is £2 10s. 7½d. With all these exceptional advantages, what are the results? Only 71 per cent. of the scholars on the roll pass the Government examination; there is no physical training; and the period of instruction is the long time, as at Petersham. To obviate in the Kew school the one great hindrance to success in the intellectual part of the training, viz., that of imperfect classification, there must be such a multiplication—speaking within certain limits—of the teaching staff, as would reduce the scheme of simultaneous teaching to that of individual teaching, thereby involving an extravagance of expenditure simply impossible. A corresponding increase of expense, proportionate to the weak conditions of each school, would be incurred throughout the district.

50. Instead of this, a more practicable scheme would be the conversion of schools in the outlying villages into nursery-infant schools, and by an arrangement similar to that described in the former report, constituting the most commodious and best adapted schools in Richmond, Twickenham, and Mortlake, the receiving schools for all children between the age of eight and eleven, of the respective parishes. For all those over that age, whether of the outlying or central parts of the district, a secondary school would be established in Richmond, which would again become a feeder to some extent to a superior school for technical education, the need of which is greatly felt.

51. The number of scholars for whom provision would have to be made on this plan, and supposing every child in the district to have the means of education, is as tabulated below:—

TABLE OF THE NUMBER OF SCHOLARS FOR WHOM ACCOMMODATION OUGHT TO BE PROVIDED.

	Nursery Schools For children between 5 and 8 years.	Primary Schools, For children between 8 and 11 years.	Secondary Schools, For children between 11 and 14 years.
No. at present on the Rolls	1,834	1,103	537
No. at present receiving no Education....	937	582	257
Totals..........	2,771	1,685	794

52. From the table it appears that to accommodate every child in the district additional space would be required to meet the wants of the 1,800 children now wholly destitute of the means of instruction. Existing schools would amply suffice for all under eleven, as many now admitted to them would be drawn off to Richmond, where the increased space would be concentrated.

The demand for a superior school for technical education.

53. Not only is there room here for the success of the superior school which has been adverted to, but the demands for it are imperative. The desire is general among the commercial and trading classes for a technical rather than a classical school. Of the latter kind several already exist, offering superior facilities to persons of social position and means, but refusing admission to the sons of tradesmen, whatever their affluence. One of these, a private adventure school, has the repute of being surpassed by few of its class in England. Attempts have been made to provide the means of sound classical scholarship for people of more moderate wealth, but never successfully. Perhaps the most promising was that of a gentleman from Oxford. Among the applications made to him was one from a tradesman, who supposed his son

would have to learn "Lat'n," but added anxiously, "*Don't give it him too strong.*" The classicist soon discovered that he and his school were superfluities, and went. Still, some of the wealthy tradesmen do send their sons to expensive classical schools. This is commonly done with a view of giving their children a superior instruction, but often with little knowledge of its nature or suitability. Like the farmer-steward who remonstrated with the clergyman for having given them no "Lat'n," and on its being suggested it would not have been understood if he had, replied, "No matter, as we've paid for the best, we likes to have the best;" so these tradesmen, as they have paid for the best, consider they have the best in a classical education for their sons, whose destination is, nevertheless, for trade or commerce. The results are generally unfortunate—a grievous waste of time at the expense of more solid acquisitions. There is, however, a great change of opinion going on in this respect. A majority of the tradesmen and people of the middle class are desirous of elementary art and science instruction, with special reference to their children's profit-making pursuits in life. Thus, among the building class, here very numerous, there are many most anxious for their sons to receive such technical aids as they have been obliged hitherto to purchase from the architect at a heavy disproportionate cost. Some years ago, when this want was first seriously felt, a proprietary school was projected for the purpose of supplying it, but the design was not carried out. It is now common for the sons of this class to go to Kensington and the Metropolitan Schools of Art, and others are only deterred by the expenses of the daily up and down journey. Nor is the desire for this kind of instruction confined to those engaged in structural or mechanical arts. Wherever the suggestion of a local superior school has been thrown out, it has met with an approval conclusive of the appreciation its advantages would secure. Considerable time was devoted in the course of the present inquiry to ascertaining to what extent art instruction was carried in the superior schools, and how far it would be beneficial to that class of pupils to establish a central art school with the best appliances. Drawing and water-colour painting are taught in all the best conducted adventure schools, but the number of pupils whose attainments are of a practical value is small. In truth, drawing being one of the extra subjects for which the fees are often enormously out of proportion to the probable or even possible results, scarcely one-third, perhaps, get instruction of this kind at all. In young ladies' schools it is more general. The lady-superior of one of these informed me that to engage an artist resident in the locality would be fatal to the reputation of her establishment. London masters, however inferior in talent, must be employed, to keep up appearances. Teachers in the primary schools would rejoice at any good opportunity that could be offered them for improving their knowledge in an art, the utility of which they begin to appreciate now that, through the excellent arrangements of the Science and Art Department, a monetary value attaches to the results of their teaching. In the Wesleyan College, at Richmond, the principals expressed a desire to see their students better acquainted with the principles of art, regretting that the demand for their services, owing to their being destined for foreign stations, is so great as to preclude the possibility of much being done in this branch at present. Prolonged residence at the college is in contemplation, one effect of which would be to liberate some hours weekly for art cultivation.

The necessary financial arrangements for a complete scheme of education for the whole district.

54. There remains to show by what financial arrangements a scheme intended to secure the education of every child in the district, and to offer him the advantages of secondary or technical training, can be kept in operation. Volunteer effort, already, as has been seen, responds with great reluctance to the demands made upon it, and no hope can be entertained until more united and organised action on the part of the managers of the schools has been realised, that this source of support will become so elastic as it ought. It is, therefore, unavoidable to have recourse to a rate, which, with the continuance of the present subscriptions, State grant, and weekly payments, augmented in their gross amounts in due proportion to the supposed increase in the number of scholars (1,800), will supply ample means, if no higher than 3d. in the £. Nowhere does anyone argue that the school-pence should be remitted; the tendency is rather the other way; and, as new energy, better methods, and improved classification are brought to bear, the revenue from the national exchequer will with certainty expand.

55. The rateable value of property in the whole district is £308,205 10s. 6d.; an addition of 3d. in the £ to the poor-rate would therefore produce £1,602 11s. 5d. The amount derived from subscriptions, donations, offertories, sermons, and the like, is £1,945 1s. 8¾d, which, by judicious arrangement, could no doubt be increased, though not largely, but for the imposition of a rate which may cause a stagnation in voluntary zeal. The total receipts from the Consolidated Fund are £758 14s. 4d. But if every school were placed under inspection, even though the proportion

of passes were no higher than at present, the future grant would amount to £1,500. School-pence now yield £1,012 18s. 3d., or eight shillings per head of those in average attendance. Supposing every child in the district to be at school, the increase of revenue from this source must be very large. However, as the new scholars would probably belong to the poorest class, and woud therefore be unable to pay according to the present scale, a general charge of six shillings, instead of eight shillings per head, is adopted in calculating the annual value of the weekly returns of the future, which would be £1,575. The charities, which now stand at £662 6s. 5d., could be made at this moment to return £750. Hence the revenue would be derived thus:—

	£	s.	d.
From Rates	1,602	11	5
„ Subscriptions, &c.	1,945	1	8¾
„ Grant	1,500	0	0
„ Pence	1,575	0	0
„ Charities	750	0	0
Total	7,372	13	1¾

Against this revenue there would be a charge of £6,766 10s. 9¼d., made up thus:—

	£	s.	d.
For 2,771 in nursery schools, at £1 0s. 5¾d per head*	2,837	7	9¼
For 1,865 in primary schools, at £1 12s. 6d per head*	2,738	2	6
For 794 in secondary schools, at £1 5s. 0d. per head	992	10	0
	6,568	0	3¼

The number of children in the district being 5,250, the cost per head would be £1 5s. 0¼d. The rate per head on the existing denominational plan is £1 11s. 2d., and the difference of nearly 6s. 2d. merely represents the saving effected by improvements in general organisation. However, internal arrangements, or general classification, would be correspondingly improved, and further economies would follow as a certain result.

56. On a comparison of the estimated income with the estimated expenditure, the former will be found in excess by £804 12s. 10½d. This surplus would be applied to meet the expenses of the governing Board, and provide the salary of a Visitor.

Constitution of the School Board.

57. Of the many suggestions which have been offered in reference to the constitution of the Local School Board, the one appearing most suitable and acceeptable is that which points to an elected representative body, one-third of its members being chosen by the ratepayers, another third by the present managers, and the remaining third by the State, on the recommendation of the Inspector, the Government to have a final revisory power, and to insist, in all cases, on high qualifications. This mode of dealing with the question possesses the advantage not only of giving representation to the several sources of revenue, but it furnishes to the controlling Board just those elements of the population it was the principal object of the advocates of *ex-officio* members to secure. It may be supposed, for the sake of illustration, that ratepayers would elect men of business, and in their case a high money qualification should be required as a guarantee against parsimony in the shape of an unadvisable reduction of the rate, and as a protection to parents who, to relieve ratepayers, might be forced to pay an undue increase of fees. Managers would probably give a preference to literary men and educationists, such as the clergy, or to those fairly representing the voluntary supporters. Lastly, the grant would have its representatives in men nominated by the education department, of high social, influential, and magisterial position. Generally, it may be stated, without regard to any distinct mode of constituting the Board, that school teachers desire to have for secular teaching, the control and support of the best educated persons in the community. In this view, and for secular teaching alone, they would prefer, and would be sorry to lose, the support of the clergy. The clergy, they are of opinion, would receive and appreciate the evidence of wider experience than their own, and both apply it and aid its application most willingly. If any elected body is appointed, they are of one accord that the

* That is according to the existing rates. It is believed, however, that in the primary schools the cost would, by re-arrangement and better management, be reduced to nearly as low a rate as now prevails in infant schools.

experience of the difference between common and special juries should be regarded and applied to the advancement of education, by requiring corresponding qualifications of the elected. Without such qualifications, the leading models of elementary instruction of the district would certainly go to pieces, were it not for the able and zealous attention of the Government Inspector, and the re-animating vigour the stimulus of inspection supplies.

Causes of delay incident to this and similar inquiries.

58. It is proper the Council should understand that the delay in the preparation of this report, which I deeply regret should have occurred, is due to serious illness in my family, and to other causes which, considered in connection with the proposed plan of inquiry by the Government, have suggested the first of the general conclusions I have the honour to append. My own examination was much hampered by want of authority to insist on prompt returns, and by the informal manner in which it was necessarily conducted. These drawbacks occasioned a good deal of correspondence between teachers and the clergy, often unproductive of result, and in some cases my schedules could not be considered until a committee of the managers had been convened for the purpose. My information was therefore frequently obtained by indirect means, which necessitated repeated journies where one should have sufficed. It seems strange that schoolmasters, upon whom the success of their several schools mainly depends, are often kept quite in ignorance of the monetary and other statistics on which the comparisons in this report are founded, and it would be a valuable reform were the Government, instead of being satisfied with a useless repetition of unmeaning entries in the "Log Book," to require that accurate and thorough statistical information should be kept of the condition of every school. But, even under present disadvantages, my estimate is that, with the attention which might be expected to be given to an authoritative inquiry demanding immediate preparation of returns, and with attendance to give information, such an inquiry might be made, and the report upon it, with conclusions for practical action, prepared and printed for local circulation and information within about a month. There can be no question of the greater delay that would be incurred by sending out schedules first, as from your office, without seeing the people who are to fill them up, to give them instructions how the returns must be prepared, and to urge them to speedier action. Returns to be obtained by correspondence, entailing the necessity of having to whip up the dilatory, the reluctant, or the remiss, must, as I have already found, occasion a grievous loss of time, while it would be very doubtful whether, the returns often having to be made by persons little conversant with such details, they would be entirely reliable, or to the purpose.

Conclusions.

59. The conclusions suggested by a consideration of the educational conditions of the district are either of a general character, or are such as apply specially to the parishes examined. I should be well satisfied to see the field of inquiry re-examined and these conclusions checked by any one practically conversant with advaneed school-keeping or educational organisation. It is probable that they would be varied, though not materially, except in the way of more violent or radical change. With the advantage of more complete returns, and the power of examining witnesses authoritatively, I might myself have recommended rearrangements, or plans slightly different from those here proposed. In regard to the conclusions limited to the district, it may be stated:—

That of the whole number of scholars, nearly one-third are absolutely uninstructed; scarcely one-half are in average attendance; one-fifth alternate attendance at school with fluctuating labour, injuriously to themselves and to the school; one-sixth are of the maximum school age without having reached the maximum of proficiency; and above one-half are children under eight years, and therefore in training in infant or mixed schools, the classification, methods, and teaching power of which are very imperfect and inferior. That at least some measure of indirect compulsion should be employed to constrain the 1,800 who are entirely without education, and more stringent regulations put in force against the irregularity, shown to be, in its effects, almost worse than total absence. That the Speaker's Act should be made obligatory, its permissive operation having introduced inconsistency and confusion into the local government, and misled the public into the belief that orphans and destitute children are generally provided with the means of education. That a semblance of effect is given to the intention of the Act, but to what extent it really applies is unknown to the authorities themselves,

That the amount of religious instruction is insufficient; that the mode of imparting it, by teachers not specially qualified, is objectionable; and that often when the task is assumed by the clergy, the results are not confirmatory of the opinion that their teaching is greatly superior to that of an ordinarily well-informed schoolmaster. That, as a matter of fact, parents never send their children to a school because the clergyman is assiduous in his attention to the progress in divinity, but always, when left to an unbiassed choice, give their preference to the most efficient secular teacher.

That the inferior monitorial system is being gradually substituted for the pupil-teacher plan; that generally the cheaper forms of teaching power are employed; and that the salaries offer but little inducement for experienced teachers to remain in their profession. That where the parents are industrious and frugal, they are neither incapable nor unwilling to pay the school fee, or they are exceptionally so; and instead of remitting these weekly payments, it would be juster policy to appropriate them in augmentation of the teacher's income, and thereby promote thoroughness in results.

That to bring the children here up to the standard attained in the district school, viz., that all shall be taught to read well, to write a clear hand, to master the ordinary rules of arithmetic, elementary drawing, drill, and industrial training, before the eleventh year, there must be a general extension of the system, an augmentation of the teaching power of the primary schools, and improved classification of scholars, better adaptation of the school pence, increased accommodation, a redistribution of the existing space, and greater facilities for physical exercise. That to keep the educational establishment well supplied, well-organised, and efficient volunteer aids must be supplemented by rates or taxes.

That, under these improved conditions, there would be a gain on the primary school stage, or to the children of the wage-classes, of three years in time, and in total cost of £6,000. That the secondary school stage would be an entire gain, the total cost per head being £1 5s. That, over and above the secondary school, there would be room for a superior school, and there is need of it, for the high art and science of professional culture, which might comprehend a wider radius. That, under a district school authority with adequate powers, assuming the three miles radius—that of Faversham and other places—near the extremities of the radii nursery and infant schools would be the chief schools, that is, in the parishes of Ham, Kew, and Petersham. That the primary schools, which would be well reached from the extremities of the district, especially on the half-time principle, would, under a proper organisation, be established in the more densely-peopled centres, and the secondary schools concentrated on Richmond.

General conclusions:—

That experience shows that, to obtain statistical data by correspondence, from persons unused to their preparation, will entail only delays and confusion; that they can only be collected quickly, reliably, and economically, by direct, competent, and independent application; whilst to obtain any expression of views would be in vain, as correct views do not commonly exist.

That, in the organisation of a national scheme, it is important that inspection should not be confined to the four walls of denominational schools, but should be extended to their outside relations—to the condition of all the children in the district, and to their position in reference to industrial service. That the substitution of single, undenominational inspection for multiplicate and sectional would not be merely a financial gain, but a means of bringing to bear, in aid of the schoolmaster, the widest experience of all schools and methods of teaching, in place of a narrowed experience of schools, cramped in their operation by unwholesome rivalries and jealousy. That a comprehensive system of inspection should provide for a special examination of art, science, and physical training, as well as for an inquiry into the application of charitable bequests, endowments, and all other means willed

or designed for educational purposes, and generally that the functions of inspectors should not be those merely of inspectors of schools, but of education.

That, to secure the best attainable results in primary and infant schools, the standard in the normal colleges must be raised, and the system of training improved. That intellectual, and especially mere memorial, capacity should be less exclusively the measure of a teacher's fitness for his profession.

That any Local Board of Control should be an elective body, representing the three main sources of income, one-third to be elected by ratepayers of high property qualifications, one-third by the voluntary contributors, and one-third by the State, on the recommendation of the inspector, care being had that there should be no invidious distinction between nominees and elected members.

That under this improved organisation, and by the proper exercise of compulsory powers, the growing hereditary mendicancy, pauperism, and delinquency would be extirpated, and the healthy moral tone and condition of the lowest classes advanced to that of such schools as the District School at Anerley. That children of the wage-class would receive a complete primary elementary instruction, and those among them of better attainments, together with the whole of the middle-class, would have the benefit of an advanced secondary education, including elementary art and science, of which they are now destitute, and, by the addition of bodily training, the general productive force and capacity, physical as well as mental, would be largely augmented.

I have the honour to remain,
My Lords and Gentlemen,
Your most obedient servant,
T. Paynter Allen.

APPENDIX.

TABLE I.

NAME OF SCHOOL.	No. on Roll.	Average Attendance.	No. for which accommodation is provided.	No. over 11 years.	No. over 8 years.	No. over 5 years.	No. over 3 years.	No. under 3 years.
RICHMOND.								
St. Mary's ....Boys	208	165	358	80	128	..	..	..
,, ...Girls	122	102	175	30	56	36	..	..
,, ...Infants	245	218	175	..	24	116	85	20
St. John's ....Boys	119	90	161	28	58	33	..	..
,, ...Girls	80	55	120	14	55	11	..	..
,, ...C. Infants ..	130	90	140	..	..	60	60	10
,, ...V. Infants ..	126	86	118	..	12	60	44	10
British..............Boys	102	75	214	30	50	22	..	..
,, ...Girls	125	96	180	20	43	40	21	1
Paradise-road ....Mixed	85	65	168	16	20	21	28	..
Mission ....Mixed	77	55	315	9	23	27	18	..
Catholic ....Mixed	94	61	90	15	41	38	..	..
TWICKENHAM.								
Archdeacon of Cambridge ....Boys	143	120	150	48	60	35	..	..
,, ,, Girls	90	70	150	17	57	16	..	..
,, ,, Infants	145	100	150	..	13	70	51	11
Parochial ....Boys	118	82	120	20	74	24	..	..
,, ...Girls	96	65	120	20	36	40	..	..
,, ...Infants	107	65	120	..	..	58	49	..
British..............Mixed	150	106	178	18	40	42	50	..
Montpelier-road .....Mixed	106	56	97	8	28	40	30	..
MORTLAKE.								
Parochial ....Boys	157	118	280	47	74	36	..	..
,, ...Girls	154	94	190	49	70	35	..	..
,, ...Infants	168	104	120	..	..	83	76	9
Catholic ....Mixed	74	60	74	23	24	27	..	..
,, ...Infants	72	50	70	..	..	39	26	7
KEW.								
Queen's ....Boys	49	44	57	11	13	19	6	..
,, ...Girls	46	34	40	6	12	14	14	..
HAM.								
Parochial ....Boys	56	39	80	10	25	21	..	..
,, ...Girls	56	36	70	8	44	4	..	..
,, ...Infants	85	60	70	..	..	..	65	20
PETERSHAM.								
British ....Mixed	60	50	52	10	23	27	..	..
Parochial...........Infants	29	25	36	..	..	..	24	5
Totals	3,474	2,536	3,438	537	1,103	1,094	647	93

TABLE II.

TABLE SHEWING THE RESULTS OF EXAMINATION BY THE GOVERNMENT INSPECTOR.

Boys.					Girls.				
No. on Roll.	Presented for Examination.	Passed in Reading.	Passed in Writing.	Passed in Arithmetic.	No. on Roll.	Presented for Examination.	Passed in Reading.	Passed in Writing.	Passed in Arithmetic.
118	60	55	55	59	96	60	60	58	47
102	61	51	57	51	44	24	20	21	11
49	37	36	35	33	154	77	68	71	59
157	93	76	67	62	80	43	40	40	39
56	29	29	28	29	122	84	84	80	79
119	73	66	66	65	56	32	30	32	32
143	77	72	72	68	90	62	62	62	61
208	140	112	107	106	..	..	..	..	..
952	570	497	487	473	642	382	364	364	328

TABLE III.

THE STAFF OF TEACHERS FOR THE WHOLE DISTRICT, AND STATEMENT OF THEIR AVERAGE SALARIES.

Males.			Females.		
No.	Class of Teacher.	Average Salary. £ s. d.	No.	Classs of Teacher.	Average Salary. £ s. d.
10	Masters	88 10 0	22	Mistresses	33 10 0
4	Assistants	52 10 0	6	Assistants	25 0 0
6	Pupil Teachers	12 10 0	15	Pupil Teachers	10 0 0
9	Monitors	4 15 0	19	Monitress	3 0 0

TABLE IV.

A COMPARISON OF THE COSTS OF EDUCATION AT THE NORTH SURREY DISTRICT SCHOOL AND AT EARL RUSSELL'S SCHOOL, PETERSHAM.

NORTH SURREY SCHOOL.
Average Attendance, 810.

	£	s.	d.
Schoolmaster	100	0	0
Assistant	50	0	0
Three pupil teachers	7	16	0
Schoolmistress	60	0	0
Assistant	40	0	0
Four pupil teachers	10	8	0
Infant schoolmistress	44	0	0
Assistant	15	0	0
Sewing mistress	25	0	0
Assistant	15	0	0
Drill-master	27	10	0
Estimated cost of rations	416	0	0
General expenses	97	14	0
Total cost	£908	8	0
Cost per head	1	2	5

PETERSHAM SCHOOL.
Average Attendance, 65.

	£	s.	d.
Schoolmaster and sewing mistress	135	0	0
Pupil teacher	15	0	0
Fuel and lights	7	10	0
Apparatus	5	0	0
Repairs	5	0	0
Cleaning and miscellaneous	3	2	6
Total cost	£170	12	6
Cost per head	2	12	6

It was observed in the text, that, notwithstanding the Petersham School was affected by many rare conditions of success, it failed, through an unavoidably defective organisation, to reduce the time required for the

attainment of an ordinary standard of qualifications, such as that proposed by the Government, much below the maximum, viz., seven years. On the other hand, the North Surrey School is a conspicuous example of the fact, confirmed by general experience, that in large schools, organised on scientific principles, the same acquirements may be gained in from three to four years. The total cost, therefore, of a child's education in the latter school will be at the utmost £4 10s., while in the former it will advance to £18 10s. That is to say, a pauper in a district school, in which the rate of expenditure is above the minimum proved practicable, will be well taught the rudiments of instruction in *half the time* and *at a fourth of the cost* required to bring a tradesman's son in the Petersham School up to a nominally equal but really inferior degree of mental culture.

LONDON: W. TROUNCE, 9, CURSITOR-STREET, CHANCERY-LANE, E.C.

AN INQUIRY INTO THE
EXISTING STATE OF EDUCATION
IN
BATTERSEA.

MY LORDS AND GENTLEMEN,

1. Almost the whole treatment of the elementary education question has been determined rather by the knowledge derived from within the schools than by their outside conditions, which have scarcely been regarded with that attention their importance seems to demand. From my own observations, though limited in extent, it appears to me obvious that an acquaintance with opinion in the workshops, the position of the parents in respect to labour, and the prevailing characteristics of their homes, must throw new light upon the whole question, and materially assist in the resolution of those difficulties which have principally engaged the attention of the Legislature. I am happy to see that the information collected for the Society by a colleague, if I may so call him, who has conducted an investigation into the outside relations of the school, particularly with the view of obtaining evidence upon the religious aspect of education, has been received with marked approval on both sides of the House of Commons, the results of my own inquiries on that cardinal topic being entirely and remarkably in corroboration of his general conclusions. Hitherto I had omitted to make religion a prominent subject of inquiry in my house-to-house visits, as, from the instructions I received from your Council, the Society appeared to be desirous of avoiding any religious question, out of regard to the neutral ground they occupy; but they are probably since surprised at the magnitude to which discussion on this question has attained, to the exclusion of others of scarcely inferior importance.

The nature and extent of the population.

2. To few districts can the issue of that discussion, and the final settlement of all vexed questions which impede the progress of the Education Bill, be of greater moment than to Battersea. It is a pre-eminently poor parish. Amongst the inhabitants themselves a consciousness of the pervading freedom from genteel associations has been whimsically expressed in the epithet applied to a house somewhat more pretentious than the rest, known as "Todd's Folly." The "fields," over which the "Folly" commands a prospect of rather equivocal beauty—once the favourite resort of such students of botanical science as Gerarde and Ray; the Sunday and holiday attraction of pigeon fanciers and lovers of sport; the solitude where dukes and marquises avenged outraged honour—are fast disappearing under hammer and trowel. The little village of Petersee, which, within the memory of living parishioners, had grown to scarcely 5,000 inhabitants, which crouched by the water-side just within reach of the chimes of its metropolitan at Westminster, has suddenly expanded to the dimensions of a large provincial town, with an area of three and a quarter square miles. An old inhabitant was so impressed with its vast increase, that, only after actual demonstration, would he be convinced of the impossibility of counting 10,000 unoccupied houses in an hour. The enforced displacement of population, occasioned by improvements in Pimlico, Westminster, and Kensington; the extensive engineering operations in connection with the Metropolitan and other railways; the establishment of great junctions and centres of communication at Victoria and Clapham; the construction of three new bridges across the Thames, one of which is said to be the widest in Europe, all contributed their quota of population, almost exclusively of the wage class. Already a great disproportion between the dependent and self-supporting classes had been created by the influx of Irish poor employed in the market gardens, and the inequality was steadily widened. This excess of the poor and unskilled became a reproductive evil, as it affected the value of property, caused a reduction in the rents, and a corresponding increase in population and pauperism. The subdivisions of a house were multiplied, till every room was a separate tenancy. Sixteen is no uncommon number to a house, and 97 have been counted in four successive houses of the ordinary four-roomed size. In one of the

most densely-peopled streets, at nearly every door of which I called, scarcely a child, as it was remarked to me, had escaped the measles. There is great neglect of cleanliness; and from the two causes, want of cleanliness and overcrowding, it is to be feared more malignant forms of disease would spread with equal impunity.

3. From returns based upon a census just completed under the direction of the local Board of Works, it is ascertained that the growth of the population has not been arrested by diminished labour, and that, since the last Parliamentary census, the increase has been really prodigious; numerically, the parish, at the present rate of growth, will have quadrupled itself within the decade. The highest official estimate places the inhabitants at 80,000; the lowest at between 50,000 and 60,000. In this report it is assumed—I think on sufficient grounds—that the correct number is 70,000.

4. The inquiry into the character, increase, and extent of the population was thought to be germane to the leading purpose, as it proves how inadequate the resources of the clergy were likely to be in raising and maintaining a system of schools commensurate with the needs of the parish. There is an area of upwards of 2,000 acres, inhabited almost entirely by the labour and pauper classes, and upon the narrow fringe of wealth which forms its border rests the burden, not only of building churches and schools, but of organising a score of minor agencies for administering relief and assistance which in districts less destitute would not be required. When a single minister with his curate has the care of fourteen thousand souls; when, of the three most substantial members belonging to the congregation of a second, one is a vendor of newspapers, and another a baker; when the urgently needed church of a third has to be raised by the help of a penny lottery for children—it is as wonderful that there should still be found men who can publicly deprecate any interference with the gradual and natural growth of a plan of education dependent on denominational development, under such adverse conditions, as that the clergy, with their excessive pastoral and other duties, should have accomplished so much.

The voluntary schools.

5. The National and British Schools (the foundation of which is due to the initiation of the clergy and ministers), and such as are supported by the several denominations and by contributions, are 24 in number, under the management of eleven committees, acting independently. Three of these schools are located in small four-roomed houses, as ill-adapted as can be, and with most imperfect appliances, two of them being without prospect of removal to more suitable premises; and one is temporarily housed in a substantial building affording the amount of accommodation necessary, but inconvenient for classifying the scholars. The teachers and buildings do not fulfil the conditions of the grant, and the schools are therefore not aided by the State. They have a united roll of about 400 scholars.

6. With the exception of the British Schools—established at the beginning of the present century, but since enlarged and remodelled, for the separate instruction of the sexes—and the Parochial Schools, founded soon after the institution of the National Society, the remaining twenty schools are all of very recent date, and constructed on the most approved principles of modern school architecture. The total number for which these twenty-four schools supply accommodation is 4,160; the muster-roll is 4,168, and the average daily attendance 3,141. Thus the school space, which is fairly distributed, corresponds very closely to the number of children who are nominally scholars.

7. Apparently, therefore, the supply of schools has kept pace with the demand for education; but, in fact, as will be presently seen, it is not so. A large insufficiency is not only demonstrable by figures, but in every quarter of the parish it is the complaint of parents that there is no school, not already overcrowded, to which their children can be sent. In face of the herculean, and perhaps impossible task of meeting this deficiency, there would be some injustice in accusing any party of want of zeal; still it must be said that, in proportion to their numbers, the Nonconformists are the least represented by schools. Among the large Catholic community indigence and destitution are so general that they have scarcely any resource but the precarious help of non-residents. With this aid, a convent has just been raised, in which arrangements will soon be completed for the education of 200 girls, a large part of the duty of the "sisters" being to give elementary instruction. In one case, where there is not the same lack of means—where, indeed, new schools were in contemplation—progress has been stayed by the uncertainty which hangs over the issues of the Government Bill.

8. By extraordinary effort, the denominations have organised schools for, speaking roughly,

4,000 children. They acknowledge, with the liveliest regret, that much remains to be done, and that they cannot do it unassisted. Still, those who are presumably best acquainted with the proportions of instructed and uninstructed children—the clergy, school-teachers, parish officers—are lamentably uninformed of the true numerical relation of the two classes. The chairman at a public meeting, convened since the commencement of this inquiry, than whom none takes a more active interest in the state of education in this parish, gave out that the number of children receiving their training in the streets was 600; whereas a search, literally into every court and corner of the district, proves it to be thousands. It was felt that some who attended the meeting must have gone away with the impression that, after all, there was no need of the revolutionary changes they had heard advocated by Mr. Beales and other gentlemen of the League.

Dames' schools and private seminaries.

9. Between the 4,000 in the voluntary schools, and the 12,600 which, on the assumption that 18 per cent. of the population are from 5 to 12 years of age, should be scholars, the difference was too great to be easily accounted for. According to the best authority, only 600 were in the streets. Where were the remaining 8,000? To answer this question satisfactorily, it was necessary to visit every establishment, calling itself a school, in the district. This was done; and the result shows that, if Battersea were judged by the number of its seminaries, without regard to their efficiency, it would deserve to take high rank as an educated parish.

10. Of these seminaries, or private adventure schools, there were found 101 in active operation; 4 had just been instituted, but were without pupils; and 7 had recently closed, with so little noise or ceremony, and with so little inconvenience to the neighbourhood, that the fact was often not known ten doors away. The precise number of these schools could only be ascertained by inquiries repeated at almost every other door, and it is possible that one or two remain undiscovered, but that is the outside. Their number varies almost daily. Many of them trace their beginning to insufficient accommodation in the larger and better-appointed schools, and owing to the same cause they multiply, it is said, with great facility. A mistress, whose experience offered the strongest corroborative testimony of the truth of her statement, said:—"No one need have any trouble in setting up a school in any street in Battersea." She had herself tried the experiment four times, with a degree of success she seemed to regard with satisfaction. The projector requires neither capital, experience, professional ability, nor special aptitude of any sort; the simple expedient of placing a card in the window on Saturday, unaccompanied by any recommendations or exchange of references, will ordinarily raise the nucleus of the future school by Monday. Often there are two, perhaps three, in the same row of houses; in one instance, three were included within the range of ten doors. The first had 51 scholars, but the second at least must have been a stranger to fame—its rival, fifteen paces off, knew nothing of it. The major part of these mushroom schools are domiciled on the basement floor or in the garret, many of them without appliances of the commonest description. Only now and then, where the mistress has been a pupil teacher, or, in the absence of special training, has at least the qualification of having been educated, is there any approach to method, classification, or systematised teaching. The pupils are heterogeneously, both as to age and attainments, seated on forms in front of their mentor, commonly with a book, occasionally, if more advanced, with a slate in their hands, awaiting their turn to be called up to repeat some lesson. The mistresses are sometimes lodgers, with but a single chamber, in the house where school goes on, and bed and benches jostle each other. Some are widows, left without any provision; some are without the physical strength for this or any other occupation; some have adopted the profession of teaching from notions of respectability, and to ward off more plebeian forms of industry; while others alternate shop-keeping, mangling, &c., with their instructions, to eke out a subsistence. One woman, with a very young infant in her arms, looked seriously ill, and acknowledged that her 35 scholars were altogether too much for her. A poor widow, who had placed her card in the window an hour or so before I called, said, "What can I do, Sir? I can't go into the workhouse." Another schoolmistress, long past the age of seventy, who sat basking herself, arms and legs akimbo, on the threshold, seemed quite incapable of answering any questions, and finally left it to the neighbours surrounding her to describe the character of her school. To sensitive ears, their description would have sounded unpleasant. At a school where the room was so small that, with sixteen scholars present, the door was opened with difficulty, the mistress wished to send her own boys to a better school; she complained that they were quite past her own management, and there, sure enough, they lay, respectively 8, 10, and 12 years, across the gutter in the street, knowing little more than the kerb on which they sprawled. It was thought that the acquisitions of knowledge in these so-called schools would be more profitably left to the imagination than ascertained by inquiry.

11. Excluding the seven "establishments" which had just closed, there were among the remaining 105 perhaps a dozen which really deserved the name of schools, conducted by ladies and gentlemen, practical teachers, and thoroughly qualified for instructing the children of the middle classes. At least twice that number, however, claim to be "select," though, to all appearance, much would be gained if the parents would bestow their choice on a good national school. In one of these select schools, the mistress, who produced her roll of scholars, numbering 51, in the half-dozen sentences in which she endeavoured to explain the necessity that existed for keeping her scholars "select," four times violated the law of agreement between the plural nominative and its verb. "There's often three to a family"; "They's very irregular," and the like.

12. Indeed, the general testimony was, that irregularity was an evil afflicting these schools quite as much as the national schools. So slender, in many cases, is the child's chance of attendance, that should the father succumb to the temptation of an additional pint of beer (not an unlikely contingency) it would be entirely lost. Ordinarily, a new set of scholars appeared to be admitted once in every six weeks or two months; the changes occurring too frequently for the mistress, should her scholars exceed ten or twelve, to become familiar with their names. The use of registers was almost unknown, and for this reason it was often difficult to learn accurately either the total number, or which sex had the numerical preponderance. But the average attendance in the private or independent schools throughout the district, as ascertained, was 1,833, 1,064 of whom were girls, and 769 boys. The lowest charge was 2d. per week, or two brothers for 3½d.; in a few schools it was 9d.; but 1s. was a pre-eminently "select" fee, the most usual being from 3d. to 6d. As the average number of scholars to each establishment is only seventeen, the weekly receipts cannot amount to more than from five to six shillings, or less than one-half the ordinary earnings of a washerwoman. Perhaps it is not surprising that cases were met with of the one profession having been abandoned for the other, and that others occurred in which the two were carried on in conjunction.

13. To an inquiry as to the cause of the preference given to these inferior private schools, the replies were commonly that tender children could not associate with the rough boys of the larger schools; that a superior education was to be obtained; that there was an absence of accommodation in better schools; and, above all, that the teachers were men or women — it being a frequent objection to the voluntary schools that the scholars were entrusted to the care of "bits of boys and parcels of girls," as they denominate our much-prized pupil-teachers. Your Council had recently an opportunity of witnessing how, as serjeants, lieutenants, and captains, these "bits of boys" could acquit themselves to the satisfaction of veteran generals.

14. To mitigate the evil, which at present seems to suffer no abatement, of educating children irregularly in unsystematised groups, in which all the disturbing elements of various capacity, different attainments, and inequality of age are conglomerated; in which, if organisation were possible, poverty would exclude the appliances essential to its being effective; which are under the conduct of teachers physically and morally unqualified and incompetent—the single remedy to be applied is the improvement and extension of the government schools. Really efficient, well-conducted schools of that class would soon make competition on the part of the petty seminaries impossible. To another department of social reform belongs the problem of determining by what means provision can be made for those who are thrown, it may be by some hard misfortune, upon that last resource of respectable helplessness—the instruction of the young.

15. Of middle-class education in Battersea there is next to none, and higher instruction is absolutely unrepresented—no demand for it exists. Professional men, who are bound by their calling to the spot, are, with the exceptions previously referred to, almost the only residental gentry, and they either educate their sons at home or send them beyond the district. A few boys belonging to the upper stratum of the trading class go to St. Mark's College, Chelsea. This and similar facts are beginning to be recognised, and it has been recommended, for the consideration of the trustees of the charity, that what is called the "National Free School," a foundation with an annual income of £400, should be re-organised for receiving scholars of the middle-class.

16. Secondary art and science education appears to be confined to the evening "Science Classes," which are much indebted for any little success they may have achieved to Mr. Buckmaster. That gentleman informs me that he is almost everywhere thwarted by the neglect to enforce the

provisions of the Workshops Act. Apprentices are obstinately kept at their work till a late hour by masters, with whom he has remonstrated, who will only respect the strictest execution of the law. The fact is one of many which might be cited, in support of a suggestion lately offered by a member of your Council, that the relation of master and apprentice in this country should be fully inquired into, with a view to all the statutory measures by which the condition of apprentices is affected being revised.

17. Outside Inquiry.—In the Streets.—It was perhaps not to be expected that, in the homes of the poorest families (nearly 500 of which were visited for a special inquiry relative to free education), any clear conception of the meaning of the present controversy would be evinced, and, in truth, with a few exceptions, none of the men had formed any opinions at all upon the main points of discussion. Unsectarian teaching and the teaching of religious formularies were to them all one. The terms themselves were not understood, and replies to questions were sometimes about as relevant and satisfactory as that of a woman whom I asked if she thought her minister was a "popular" man. "No," she said, after looking a little dubious for a moment, "I think he is more of a Scotchman." But in the workshops, though the mass of the operatives had reflected but little upon the great measure intended principally for the amelioration of their condition, the overlookers in the several departments were men who, in many instances, had read works on philosophy and political economy; who could discuss questions relating to capital and labour, to competition, and kindred subjects; who descanted on clerical influence, and who were discriminating in their choice of a newspaper. They were generally in favour of the more sweeping changes, except as to secularism, and, to ensure the education of every child, would willingly submit to a fair share of the necessary burdens. Among the small shopkeepers, who, for the most part, send their children to the State-aided schools, the leaning was rather to the retention of the denominational plan, though not one in twenty would put any obstruction in the way of a uniform system, by insisting on distinctive dogmas being taught. Further inquiries, extended to the highest class of tradesmen, to professional men, parish officials, and others, believed to be well acquainted with the views of influential townsmen, had reference principally to the incidence and probable effect of the Rate for the support of the new schools. In the streets, the same ground was repeatedly gone over, that the statistics of ignorance might be complete and reliable. It will be convenient to present these first.

18. There were said to be 4,168 scholars registered at the voluntary schools, and 1,833 at the private schools. Adding to these totals 200, a most liberal allowance, for those children whose homes are in the parish, but who are educated in the adjoining parishes; and 700, the number belonging to three large industrial schools, which although situated in the parish, are really exotic institutions, not being fed at all from Battersea, the result is 6,901, representing the whole number of children attending school out of a population of 70,000. Twenty-four per cent. of the inhabitants are children between the ages of 3 and 14 years; and eighteen per cent. are between 5 and 12 years, the limits of age prescribed by the Government Bill. Within these limits, there are in Battersea 12,600, 6,901 only being in school. Of the latter number, however, 500 were found by direct inquiry to be above 12 years, and 590 under 5 years. Between 5 and 12 years, therefore, instead of 12,600, there were but 5,811, or roughly, 6,000, being educated in the 132 schools by 250 teachers; the missing school population amounting to 6,600. It may be fair to deduct the odd number, to allow for those who are being instructed in the nursery, or by private tutors, or who are taking occasional lessons in music, &c., but there still remains a host of 6,000 in the ranks of ignorance. The corresponding figures for the whole of London, on the assumption that the number of inhabitants is 3¼ millions, are, 6,128 schools, 11,607 teachers, and 278,571 of uninstructed children, against 306,428 who are getting some kind of education, but, in the case of more than one-half of them, a very indifferent one. In truth, only one-half in the inspected schools, by far the best, reach the government standard. Were Battersea a town of Saxony or Prussia, where the limits of age appointed by law are 6 and 14 years, its school contingent would be 13,700 of certain, instead of 6,600 uncertain or irregular scholars. As a Dutch town, it would send 17,000 to the schools, and insist on every one of them reaching a standard of attainments, say, for example, in arithmetic, which at this moment is approached by only 1,000 scholars in Battersea as it is.

19. All the absentees are not wholly untaught, but their attendance at school has been so short and intermittent, that their acquirements would not stand the test to which the most ordinary occupations would frequently subject them. Among the hundreds whom I questioned in the streets, few would hazard a guess at the name of the largest town in the world; only one boy

could say the multiplication table thoroughly; while a lad of fourteen, otherwise sharp enough, who "had been to all manner of schools," could not tell "Four fours?" but to the question "Three fours?" replied, with some confidence, "Seven." For a few days or weeks when the profits of labour have been more than usually elastic; when the parent has suddenly discovered her unschooled family to be unmanageable; when there has been a prospect of the school offering more tangible benefits than reading or writing, then these neglected waifs have been sent to the national school, or to the temple of learning next door. A new school was opened, and blankets, it was said, were to be given away; very soon 100 scholars had removed from the school a few hundred yards away. "My school is free," said a manager, "but all my charities, all my persuasion, are powerless against the seductive halfpenny got by turning somersaults before the pleasure vans on the way to Hampton Court." In a house where there were 12 children, all of whom had been at school the previous week, not one had attended the week I called. Speaking to a group of three women at their door, I found that of 30 children in the two houses where they lived, only 4 got any week-day schooling. Among 145 children playing in groups, there were not more than 62 who belonged to a school. Of 247 spoken with one afternoon, 94 never attended any place of instruction. Between 10 and 12 o'clock one morning, when all the schools were open, 1,303 were counted in the streets, all of school age. One evening, just before eight o'clock, 90 children were playing in a single street, and of these 67 were growing up in complete ignorance. In 200 families visited in succession, there were 285 children never at school. In a street of about 40 houses, where free school accommodation for 50 scholars has been provided, I found in 20 of the houses upwards of 60 children without education, notwithstanding my returns were incomplete, This was considered an exceptionally bad locality. The active benevolence of a lady has done much to improve the condition of those resident in it; but they are still regarded as a sort of pariah, and are proverbial for personal violence and brutality. Whatever truth there may or may not be in these accusations, it is undeniably true that the calendar of our penal establishments is little more than a repertory replete with cases of shocking brutality accompanying ignorance.

20. On an open space, known as the "Gipsy Fields," an encampment consisting of about fifty families is usually squatted for the night. Among them there is a sprinkling of unmistakable gipsies, but they are more often the common rough hawker or pedlar. Rightly or wrongly, they are reputed to exercise a bad influence in the neighbourhood, and it was thought that some inquiry among them would not be out of place. The evening meal was preparing, and I had an opportunity of witnessing the contrast between their substantial fare and the meagre table of the house-dwellers I had just left. There was an abundance of both meat and butter—not a single individual seemed to be limited to bread and vegetables. The usual industries—peg and skewer cutting, the manufacture of nets and mats, &c.—accompanied the cooking. Some of the men were engaged in trials of strength, with the customary amount of betting and drinking, while others were combative, a woman who was bandaged round the waist—her husband, as she said, having broken two of her ribs in the morning—being prominent among the number. One boy of eighteen was reading—repeating over and over from beginning to end—the alphabet in Roman capitals. When the letters were pointed to promiscuously, he stumbled, and could not tell which was "O" without traversing the whole course from "A." He was receiving his lesson from a younger brother, and these two youths possessed all the scholarship that could be found in the encampment. Many of the adults thought that a little knowledge of reading and writing would be useful to them, one of them giving a practical illustration of its advantage: "Often, when they were down in the country, they were obliged to stop for two or three hours at the cross-roads, until some one came by to read the 'post.'" They want education for their children, they say, but they will not have it at the price of parting with them. "If the clergy or some other gentlemen would go and teach them, they would be very glad to have them learn."

21. From observations and inquiry in the streets, almost endless facts might be mentioned to prove the increase of immorality through the neglect of education. The precocity of infantile vice is alarming, and if no other object than its repression were to be gained by enforcing attendance at school, there are few thinking men in Battersea but would hail a compulsory measure with satisfaction. When I stated to a clergyman that parents had complained to me of having been obliged to send their children into the country, as they could not avoid hearing the dreadful language of the streets, his reply was, "The language is awful; almost the first words a child learns to utter are words of blasphemy." Instances were mentioned to me, in the course of this inquiry, of respectable families quitting their houses, at a considerable sacrifice of rent, because of the annoyance they suffered from want of protection to their children against this contagious habit of the street. Even in the

better part of Battersea, "a hundred children would, in a few minutes, be collected round any drunken woman that might chance to clamour at the Union gates." The porter there—who served in China, and who has been in Siberia, Egypt, and the Mediterranean—judging from what he has seen since he has held his present office, is of opinion, that "there is no part of the world where the children are so neglected as in Battersea." His evidence as to the fascination surrounding a brawling woman in the streets was fully corroborated by my own observations. Round two women, bandying foul epithets from one to the other on their own doorsteps, there were gathered 70 children in less than two minutes. In the same neighbourhood, I had heard a child of five years exclaim in language which would have surprised me if it had come from the lips of a hardened criminal. "Can you swear?" said a decent looking little fellow to his playmate. "Yes." "What can you say?" From a fear that his accomplishments would not appear striking, they were pronounced too indistinctly to be overheard. These children, early initiated and trained in the ways of the street, need but a few such "popular educators" as the illustrations in the "Police Intelligence" (great favourites here) to complete their aptitude for a career of professional law-breaking. The magnitude of the street evil was even used as an argument, by one workman, against the enforcement of education. Education *had* done nothing towards the suppression of street ruffianism, *ergo*, it *could* not. His was a solitary objection. No other instance of antagonism to the principle of compulsion was met with among the superior class of workmen to which he belonged. Not only among the artisans, but in every class, the same general opinion was expressed, that no remedy less drastic than arming educators with compulsory powers would be of any avail.

22. Outside Inquiry.—At the Homes.—Not infrequently, when I was examining children in the streets, parents came to me, inquiring if it was my intention to establish a free school. They wished to have their children educated, they said, but could not afford it. A visit to the homes was undertaken, to learn how far poverty did influence attendance at school. In Brentford, where the proportion of the destitute class was similar to that at Battersea, the average wage of 200 heads of families, educating their children at a free school, was ascertained to be 12s. weekly during the six winter months. The average number in a family was 6·1, or, including those who had left home and were self-dependent, 6·67. On a comparison of original weekly accounts with the statements of the people, it was found that the average bread bill was 6s. 9d., and the average rent (sometimes collected on the Sunday for safety) 3s. 2d. Deducting these two items from the weekly earnings, 2s. 1d. remained for the purchase of the barest necessaries. The consumption of bread in one large family was so great, that, happening to enter the house just as the weekly allowance had been purchased and placed upon a counter, I mistook it for a baker's shop. To prove at what sacrifices bread alone was obtained, the mother produced a packet of unredeemed pledge-tickets, the only vestige of a wardrobe once replete with the cherished apparel of dear children. In another house, more than 60 of these tickets were the melancholy possession of a woman, who related how a hard struggle had not saved her from starvation. The articles pledged showed that her home must once have been very respectable. Out of the 200 families, there was scarcely one to whom the pledging of furniture had not become a familiar practice. There were only 55 men and 9 women, of 1,200 individuals belonging to these families, who had fairly regular or permanent employment; and, on a full consideration of all the circumstances of frequent and prolonged sickness, scanty wages, and precarious occupation, it did not appear that more than 30 of these families could have afforded the school fee during those exceptionally severe months. Often, however, the income of a family appeared fully adequate to the demands of education, until more imperious necessities were understood. "I have had eighteen children," said a woman, "only seven are living, and I seem constantly either to have a birth or a death in the family. My husband has 25s. a week, but out of this I have to pay 7s. 7d. for bandages to my leg."

23. Altogether, in these families there were 416 boys and 426 girls; and of the 98 who had left home, 35 were boys and 63 girls. Most of them were married; not an instance could be found of that event being delayed beyond the 22nd year, nor of one of the 98 reaching any higher distinction than that of a soldier or domestic servant. Of children attending the free school, 213 were boys and 177 girls; the remaining 354 being distributed—24 at other schools paying a fee, 213 at home without occupation, and 117 in occasional employment. The contingent at the ragged, or free school, was made up of 169 who had been in an infant school, 35 previously in a superior elementary school, and 186 who had not before had any education whatever.

24. Pursuing a similar inquiry at Battersea, the parish was mapped out into convenient

districts, and the poorest parts of each carefully investigated. Particulars were obtained of 250 families (the heads of which are occupied in 70 different branches of industry) relative to the average earnings, the degree of regularity in employment, the number in family, and the amount of education.* The statistics of 200 of these families are tabulated below in fifties, according to the order in which they were visited :—

	No. in family.	Children between 3 and 14 years.	Children not at school.	Total average earnings.
				£ s. d.
1st 50..................	321	153	71	52 13 6
2nd ,, ...	310	146	71	44 17 0
3rd ,, ...	317	140	79	48 17 0
4th ,, ...	280	107	64	52 14 0
200..................	1,228	546	285	199 1 6

25. It will be seen in the table how remarkably the corresponding items in each fifty approximate, and how strongly the totals of children corroborate the previous estimate that nearly one-half between 5 and 12 years of age are receiving no instruction; since the 285 in the table should represent about one-fourth, or 25 per cent. of the whole, and 18 per cent., the proportion between 5 and 12 years would therefore be 205, or more than one-half of 381, the total number between those limits ; 546 being the total between 3 and 14 years.

26. The income of each family averages almost twenty shillings. To a Continental labourer in the districts lately reported on by her Majesty's *attachés* this would, perhaps, appear a handsome wage ; but the difference in the size of the families (in Battersea, as in Brentford, the average is 6.1), the higher charge for rent, and for provisions, being considered, the purchasing powers of wages in England and on the Continent are not widely dissimilar. Twenty shillings, however, is the average for fairly regular but not permanent employment ; and as 61 families out of the 200 were earning nothing for about a third of the winter, the real average for the 200 families, during six months, was sixteen shillings. Those whose incomes were especially precarious were almost all engaged in building operations—carpenters, sawyers, bricklayers, and servers. Shoemakers were everywhere suffering, being unable to compete with the machine. In the building trade, a sudden collapse, through rash speculation, reduced many hundreds to short-time work, and threw out others altogether. The 2,000 or more labourers who crossed over the bridge to Chelsea daily have fallen away to 200. Thirteen hundred houses had still to be completed in Battersea, and five hundred others were projected; but rather than submit to a reduction of wages, required by the altered conditions of labour, men abandoned work entirely, and went to the rates for support. On the testimony of a medical officer, I can state that men in the Union have been overheard remarking that "they could get from twenty to thirty shillings at any time if they liked, but they would be d——d if they would work for less than six shillings a day." Is it for the convenience of these superb gentlemen that the Guardians have consented to an outlay of £60,000 (perhaps more) on annexes to the Union, to be decorated with ornamental marble ?

27. Cases of this description are not unknown to the relieving officer; and the abuses of relief, when obtained, are known to have been common. But there has been undoubted suffering. In one week of February, 2,049 cases were relieved, of which about 1,500 were directly traceable to want of work. To weed out all cases of deception, and to afford additional aid to the deserving, a society was instituted in December, upon principles analogous to those of the Mendicity Society, with most happy results. No relief was given until after thorough investigation. Inquiry proved how often the susceptibilities of ladies had been deceived by the simulations of sturdy beggars. " Of 710 applications, fully 100 were rejected on the ground of false statements and misrepresentations, and quite as many which were palpably fraudulent." Four hundred cases were relieved, and " the remainder were mostly parish cases, receiving relief from the Guardians, or cases in which relief ought not to have been sought or given, the applicants being in work, and in receipt of good average wages, some even being regular subscribers to a club." Poverty in Battersea is of recent growth, and has not yet attracted the

* My notes concerning 50 of these families, and the details of 200 conversations with labourers and artizans, are unfortunately lost.

sympathy which, as Mr. Bartley's inquiries seem to show, has made Bethnal-green the Paradise of impostors. Still, there is need to be charitable with caution. A gentleman, whose avocation brings him a good deal in contact with the poor, relates the story of a woman who boasted of the ease with which, by false representations, she could gain the ear of charity, and return laden with spoil. At the close of the day, she had collected 28 soup-tickets (equal to seven gallons), 2 lying-in tickets, and 2 "letters" for the hospital. She sold her soup-tickets, realising about 5s. A belief exists that, in one district, the begging profession have established a division of labour, and that, on one pretext or another, almost every house in the wealthier quarter is begged, the plunder being divided at the close of the day's rounds. The technical term for such a raid is "slag."

28. Intemperance is charged with being the cause of more than half the evils that afflict the people. The clergy, who are vainly striving to stem the current of improvidence and vice, complain of the licensing system, and of the inertness and apathy of Parliament in amending the law. There is a very general cry among the teachers in the small seminaries that the fees are irregularly paid, or the scholars withdrawn without payment, on account of the "drink." Provision dealers say that where the poor should spend 3s. or 4s. at their shops they spend but 1s., because they will drink to excess. A baker, with a business of 35 years' standing in the parish, says that, owing to the beer-house competition, he does less now than when he started. (The bakers' shops are 1 to every 194 adult males; the beer and public-houses, 1 to every 74.) He curses the guardians of the poor as the authors of equal mischief. The relieving officers know that the money they give is often not carried beyond the first corner-house. A tradesman had been witness to two labourers flinging three sovereigns to the landlord at a public bar, with the request that he would answer their orders and pay *himself* as they drank. In making my inquiries among groups of children in the street, I was asked for "half-a-pint," by boys under 14 years, who seemed to think that was the proper way for me to acknowledge their courtesy. Till lately, it was the custom of a famous firm to give gratuities to men whom fluctuations in trade compelled them to discharge. A recipient of £150, capable of earning 50s. at his craft, is now receiving parish relief, having squandered his bounty in gambling and drinking; his son has just been released from prison. My informant, who has excellent opportunities of judging, says that all such gifts are wasted, and that they frequently shake the stability of the receiver's character.

29. The condition of the homes of many of the poor is deplorable; they have no appearance of comfort, the furniture is miserably scanty, and the walls are thick-faced with filth. Where there is contagious disease the dirty papers must become a species of pesti-duct, and it may well be asked whether compulsory vaccination is more needful in such cases than compulsory white-washing. Great improvement in the comfortable appearance of their homes could be made by the poorest, but it would be incompatible with the flourishing condition of 159 beer and public-houses, to which the preference is almost always given.

30. The conclusion from all the facts observed in relation to labour and the condition of the homes, is that much distress, if not actual destitution, exists—it especially prevailed during the last winter—and that there is a wide-spread inability to pay even the minimum school fee for every child; but much of the distress is due to an exceptional state of the labour-market, and is aggravated by the excessive improvidence of the people themselves. Yet, it is open to grave doubt whether free or ragged schools would be the most economical or satisfactory solution of the difficulty which this distress raises in regard to education. This is not the same question as that of making education entirely free. To establish some free schools in particularly needy localities, would be to complicate the proposed dual system, and to increase the difficulty of economising by efficient organisation. Distress and insufficiency of labour are often exceptional, and a system of free schools would, in consequence, be wanting in the essential elasticity to make it economical. At one time the schools would be full to overflowing, or altogether incommensurate with the demand for space; at another, when trade and labour improved, they would be nearly empty. The fee school and free school, standing side by side, would each be alternately rendered inefficient by plethory or depletion. In Battersea, this would certainly be the case. It is beginning to be felt, too, that the epithet "ragged," as applied to schools, though very useful at first in attracting sympathy, is exceedingly unfortunate. Even the poor object to it, as being invidious and degrading; and at this moment the ground cannot be purchased for the erection of such a school in Battersea, the name carrying with it associations which, it is said, have actually depreciated the value of property, in one district, by 25 per cent. My inquiry leads me to conclude that, if the poor were really charged according to their means, there need be no free scholars

at all. The principle at present in force is quite the reverse of this. Two parents, with exactly the same income, have respectively 7 and 2 children; the first, whose general expenses are greater, whose rent is higher, whose medical bill is heavier, could nowhere in Battersea get his children educated for less than a shilling a week; but the second, who has the advantage in every respect, can send his family to school for a third of that sum.

31. Assuming that all children between 5 and 12 years of age, in Battersea, are brought under instruction, and that free accommodation were provided in the same proportion to population as in Brentford at present, making due allowance for the different purchasing powers of the average wages in the two parishes, at least 3,000 free scholars must be expected, even after the cases of imposition had been reduced to a minimum.

Outside inquiry—in the workshops, &c., — especially as to Religious Teaching.*

32. Whether from a spirit of tolerance, or because they have a common enemy to encounter, the ministers of various denominations are prepared to sink minor differences, and to act entirely in concert on the question of religious teaching. A Bill even less regardful of existing usages in schools than that of the Government, so long as it did not exclude religion altogether, would have been accepted by them in preference to delay. The clergy would look with some misgiving on any attempt to modify the catechism to suit all shades of opinion, not so much from an unwillingness to remove some portions especially offensive to Dissent, as from a fear that agreement in the Church itself would be impossible. The time-table conscience clause they appeared generally to approve. Among the artisans, the opinion that schools should be universally undenominational was strongly expressed, scarcely one in a hundred holding the opposite view. On the other hand, the shop-keeping class were inclined to be a little more conservative, but though a few were in favour of distinctive teaching, not half-a-dozen were found who insisted on the use of formularies as essential. Even with the minority, formularies did not seem to be associated with the idea of separate creeds; the notion rather was, that a catechism of some kind was a necessary part of a Christian education. And this, as far as it could be gathered, was the view held by the poor who were visited at their homes. To very many the catechism was a mere name, accompanied with a very vague impression that it was attached to something proper for a child to learn. Such being the facts, it is not surprising that teachers "never hear anything about conscientious objections." Nor does any objection appear to be raised on the ground of neglect. "I do not see how any child could be taught to obey its parents, unless he were taught the catechism," said one man; and another was of the belief that "the Catechism was to be preferred to the Bible itself;" but they do not urge these views upon the attention of the master.

33. Generally, apart from any consideration of denominational differences, there is an unmistakable desire to have religion taught in schools. Its exclusion would be condemned severely, by those even who themselves, by their own acknowledgment, habitually disregard religious observances. Not systematic theology, but "simple stories which the children never forget," would seem to realise the general notion of what religion should be in schools. And perhaps to those who can appreciate the force as well as simplicity and beauty of the lessons of the Teacher who "spake in parables," this unlearned view of the teacher's mission will recommend itself. A little leaven of error would be thought preferable to the "scriptures unexplained," and the Catholic religion to no religion. Fifty out of a hundred children in the Catholic school belong to Protestant parents. Only five—it should be said all men of intelligence—of the many hundreds spoken with were in favour of purely secular schools, but the large majority decided that the schoolmaster was the best person to give the instructions in religion, and that the same discretion should be allowed him in this as in other subjects. Practically, this is the position he occupies at present, and no apprehension need, I think, be felt that, if thus recognised in law, his proceedings would tend to create a new sacerdotal class. He is at least in no respect inferior to the class of teachers who conduct the seminaries, and in their case no word is heard as to what they shall or shall not teach. However, they fully respect the known wishes of the child's natural protectors. In one of the private schools the mistress had a class reading the Douay version simultaneously with another being instructed in the Protestant version. When a new system of schools has been appointed, it will be more than ever possible to permit to the schoolmaster this exercise of his discretion, as ample facilities will exist for a non-content parent to remove his child to a school where the teacher's views are in stricter accord with those held by himself.

* The replies of the artizans as to compulsory education and religious teaching, taken *verbatim*, were all lost.

34. In establishing supplementary schools in Battersea, the fact should not be overlooked that migration among the poor is constant. Even when occupations are fixed and permanent, new lodgings are frequently being sought and corresponding changes produced in the schools. But, as has been seen, wide disturbances of population often follow upon improvements, upon the construction of new works, by the dismantling of old ones, or the insolvency of large firms. The break-up of an establishment employing nearly a thousand hands was lately said to be imminent; had the disruption occurred, the majority of the men would have left Battersea, taking all the children dependent on them to other schools. It has been already mentioned, that, of 2,000 labourers who every day crossed over from Battersea to Chelsea, all except 200 are dispersed. The master of the St. George's district says, that during the last four years, with his average of 180, he has had upwards of 300 pass through his school annually. He has endeavoured to learn what becomes of all these children, but can get no satisfactory information of their subsequent whereabouts. Such cumulative evidence of the changes which often affect large masses of the population, and so too the schools in a proportionate degree, points to the necessity of placing the whole education of the metropolis under the control of one board instead of many, and especially of reconsidering, in every large district like Battersea, the advisability of adopting uniform manuals and other books in the schools. The objection originally raised against uniformity, as proposed by Mr. Matthew Arnold, was that the masters should not be fettered in their choice of instruments, of which they were the best judges —an objection which might be easily met without being overridden. In Battersea, the utility of the suggested reform cannot be open to question.

Organisation adapted to special local conditions.

35. A very important and urgent problem for Battersea is that which relates to the reconciliation of the claims of the school with the exigencies of female labour. The institution of nursery schools, something similar to those of Tuscany, would be a great boon. In Florence, and other large towns of that province, young children, in charge of their elder brothers or sisters, who carry with them a small basket containing what provisions can be spared from the scanty cupboard of their parents, leave home for school at eight in the morning, when the mother goes to her work, and remain all day till she returns, their own bit of bread, or simple fare, if insufficient, being eked out with soup and other cheap but nutritious diet, supplied at the school. These institutions, which are conducted by females specially fitted for such a task, are said to work admirably, with little expense. Many of the women in Battersea are at times the principal bread-winners in the family, being chiefly employed in laundry work; and schools of the kind mentioned would release them, while affording protection to their infants against the deformity, imbecility, and premature mortality, now the common results of bad nursing and neglect.

36. It was not very flattering to one's national pride to find that, with a solitary exception, perhaps, the three German workmen—the only foreigners whom I met with in my inquiry—were better read than any of their English compeers. Each of these men had read a good deal of general literature, and they proved by their conversation, that they had taken a deep interest from the beginning in the question of elementary education. One of them read the *Times*, the *Daily Telegraph*, and the *Daily News;* he preferred the latter. Besides his own language, he spoke English, French, and Italian fluently; when I called he was studying Spanish, in which it appeared, from his exercises, he had made considerable progress. He complained, that in England teachers are not well trained, and gave, with much vivacity, a description of the training through which the teachers of his native province must pass, and afterwards of the mode in which such a teacher would conduct an infant class in reading in the remote village school where he got his own education. Labourers, and the wage class generally, have hardly any means in Battersea of improving their knowledge, even if they are desirous to do so. They cannot afford a daily newspaper perhaps; there are no institutes, no reading-rooms easily accessible, none of the ordinary means of self-culture to be met with in the majority of large towns; and, if it were possible to obtain from the ratepayer an additional penny for the purpose, no better application of it could be recommended than the purchase of a kindred library to that which is so much appreciated in Campfield, in Hulme, in Ancoats, and other parts of Manchester.

37. So far as it could be learned by inquiry, the prevalent impression appeared to be that the overwhelming need of new schools was so generally recognised by the ratepayers, that they would acquiesce, without more than the usual reluctance, in a penny rate for the service of education, notwithstanding the oppressive weight of the

Educational rating.

burden they have already to bear. But to provide accommodation for 6,000 children, with the addition of another 1,000, who will most certainly be drawn from the worst of the seminaries, £30,000 will be required for buildings, and a rate of $2\frac{1}{4}$d. (exclusively of the interest on the cost) for their future maintenance.

38. With attendance strictly enforced, the average out of a registered number of 7,000—making allowance for sickness and other unavoidable causes of detention at home—may be taken at 6,500. The annual cost of instructing this number, on a well-organised plan, would be £1 per head. But the dual system of denominational and rate-aided schools will prevent either class adopting the efficient arrangements attainable by a combined administration and unity of plan. We must therefore increase the capitation cost by probably 2s., which would make a total annual sum of £7,150. This amount would be raised from three sources, viz., 6s. per head, or a total of £1,950 from fees;* 10s.† per head, or £3,250 from the government grant; and 6s. per head, or £1,950 from the rate, which, at $2\frac{1}{4}$d. in the pound would produce, on a rateable value of £221,443, £2,076 0s. $6\frac{3}{4}$d., yielding a surplus of £120 0s. $6\frac{3}{4}$d. for "Board" expenses. To pay off principal and interest of the building debt in about 30 years, the rate must be raised from $2\frac{1}{4}$d.to $2\frac{3}{4}$d.

39. The case of the voluntary schools would stand thus :—The present average attendance is 3,141, and the total annual cost, £3,464 18s. 3d., or about £1 2s. $0\frac{3}{4}$d. per head, which is made up of 8s. 1d. from the fees, 7s. 8d. from the grant, 4s. $3\frac{1}{2}$d. nearly from contributions, and 2s. $0\frac{1}{4}$d. from funded charities and supplementary offerings or donations. It may be said, perhaps, that a total not exceeding 5s. 6d. is due to subscribers, whom the government propose to relieve by an augmentation of the grant, to the extent of 50 per cent. Enforced attendance would swell the income from fees to 9s. 6d., and the ordinary grant to 9s., which, with the augmentation, would become 13s. 6d. From these two sources alone, therefore, there would be obtained a surplus of $5\frac{1}{4}$d. per head over the present average cost, and the necessity for voluntary aid would no longer exist, but for the purpose of increased efficiency. To enlarge the staff of teachers, with the view of gaining that object, the surplus must be absorbed, and with it nearly 2s. more per head. The requisite outlay per head would, on this calculation, be nearly 24s. 6d., that is, the total annual expenditure for all the schools would be £3,847 4s. 6d., of which about £314 would be paid by subscribers.

40. General Conclusions.—The general conclusions deduced from the facts observed in the Brentford and Richmond districts are, for the most part, applicable here. In Battersea, it is true, greater economy of means is manifest; but it is effected at the expense of efficiency in the teaching power, instead of by improvements in organisation. This misapprehension of the true principles of economy, combined with special causes affecting the standard of attainments, has produced the result which alone could have been expected—a reduction in the per-centage of scholars capable of passing the examination under the Revised Code. Only 45 per cent. fulfil the conditions of the maximum grant!

41. If these results could be shown to be little, if at all, below the average throughout the metropolitan districts—and there is much reason to fear they could—the importance of a full appreciation of the principle of a division of educational labour under skilled teachers, as demonstrated by the instructional papers emanating from your Council, becomes more than ever apparent, especially as it concerns those who, in accordance with the provisions of the Bill now in progress that the whole of the metropolis be controlled by one Board, shall be elected to that responsible office. In Battersea everything will depend on its representative having mastered the principles of educational training and administration. If he be elected in the manner common at local elections, of not insisting on the requisite special knowledge, the result to be apprehended is inefficiency and waste. Here, perhaps, a gentleman taking a prominent part at public and Vestry meetings, with undoubted zeal for education, who has resided for years in the district, and been conspicuous as a local manager, would be considered in every respect eligible ; yet it was precisely such a gentleman who was so seriously in error as to rate the number of children in the streets at hundreds instead of thousands, as correctly ascertained under your directions. With a Board so elected, the very first step would be a conflict with the

* Fees would not reach the same amount in the rate aided schools as in the voluntary schools, the former owing their existence partly to the inability of parents to pay the fee.

† A rather higher grant is supposed obtainable in the rate-aided schools, on the ground of their probable organisation on a larger scale than that of the voluntary schools.

want of information in a representative who might not be easily set right. How unfit, without aid and instruction, many persons who would have a voice in the election are to choose a well-qualified administrator, is evident from their being so often misled by ignorance and the merest quackery in their choice of teachers and schools, as revealed by an examination of the private seminaries. Hence the conditions of this district—and the observation applies with scarcely less force to the others previously investigated—seem to point to the extreme importance of steps being taken for the guidance and information of the electors as to the competency and fit qualification of those whom it is desirable, for the attainment of the object in view, to elect. Such a task, in the absence of any departmental initiative in this direction, might well be undertaken by the Society of Arts or similar societies, who have given an impartial attention to the whole subject, and who have already done much to compensate for the unavoidable deficiencies of information from official sources. The uninformed electors have not only to be guarded against the danger of inaction, but also against the great danger of misdirected action, as of waste in the construction of expensive and useless buildings, shown in these examinations to frequently accompany neglect and want. Unless this warning be held out, an augmentation of the existing local burthens, without equivalent benefit, is seriously to be feared, and, indeed, a repetition of the grounds of complaint against the present administration of the poor-rate and that for local works.

42. If these evils were guarded against, a competent School Board might be made the means of largely improving and shortening the time of primary education, and of thus providing for that Art and Science instruction which your Society have so greatly at heart.

43. But a very numerous Board, on a parochial principle of representation, will almost necessarily engender conflict and disorder. It is to be hoped, therefore, that the districts will be so large as to facilitate the election of men known as educationists, occupying a public position, and of influential character. While, too, each district has its special conditions—as, for example, the very migratory character of the population in Battersea—which, it would appear, could be best known to persons resident in the place, it is probable that a Board composed of men known generally rather than locally would be more free from intestine differences, and, from its elements of wider experience, be capable even of judging more wisely of local exigencies than another constituted of members elected on the opposite principle.

44. What may be accomplished by a Board thoroughly conversant with advanced educational ganisation, is seen in the Appendices to the Report, where it is shown that the expenditure in the three districts examined may be reduced from £22,000 to £14,000 annually; and if the whole cost of education were calculated, the saving to be obtained by improvements easy of adoption, instead of a third, would be at least one-half. Perhaps it is not too much to say that on the right understanding of questions like these depends, as much as upon anything, the whole value of the reform contemplated by the present Bill. That Board will be a model for the country at large; and if, in the absence of any securities for the members of it possessing the highest qualifications, its defects should be re-copied and multiplied in every district, enormous waste will everywhere follow.

45. It is much to be regretted that, in the formation of the Board, some share of Government intervention is not provided for, as it would have served to create that concurrent action of the police and Poor-law departments which will be found necessary for clearing the streets of the juvenile mendicants and Arabs, guilty of the delinquencies within the province of Adderley's Industrial Schools Act. In Battersea, this question of clearing the streets is one of first and vital importance. Regarding the utility of a well-appointed Board in the light of the experience gained in the examinations your Council have conducted—and whatever their shortcomings, in so far as I have had a share in them, I have a perfect confidence that the more they are considered the more the truth of the conclusions based upon them will be advanced—I should say that an economy of more than a third can be everywhere effected, and that the attainment of this economy, or the continuance of the waste, will be dependent on the acquaintance of the respective Boards with the best principles of school administration.

I have the honour to remain,

My Lords and Gentlemen,

Your most obedient servant,

T. Paynter Allen.

APPENDIX I.

SYNOPTICAL TABLE OF THE STATISTICS OF EDUCATION IN BATTERSEA.

AREA OF PARISH, 2,108 Acres.
ESTIMATED POPULATION, 70,000.

NUMBER OF HOUSES, 9,188
NUMBER OCCUPIED, 7,306.

Estimated No. of children between 5 and 12 years		12,600
No. in 20 voluntary and inspected schools	3,765	
In 4 schools of the same class not inspected	403	
In 105 private seminaries	1,833	
In 3 parish or special charity schools	700	
In schools not included in the parish, or taught privately	800	7,501
Total number of those who, though perhaps not absolutely untaught, may at any time be found unregistered as scholars		*6,000
No. for whom accommodation is provided in the voluntary schools		4,160
No. on the roll		4,168
No. in average daily attendance		3,141

Of the 1806 in schools under inspection, and confined to boys or girls above the infant stages—all of whom should have been eligible for examination—only 45 *per cent.* passed in the three subjects.

Actual passes	816

Voluntary Schools.

	£	s.	d.
Cost per head	£1	2	0¾
Of this sum, the amount obtained—			
From government grant	£0	7	0
„ voluntary contributions	0	4	4
„ school pence	0	8	1
	£0	19	5

How the deficiency is made up does not appear.

No. relieved in one week in February	2,049
No. of proved misrepresentations out of 710 applications for extra relief	300

Teaching staff in the voluntary schools:—

Masters	7	
Assistants	4	
Pupil teachers	11	
Monitors	7	29
Mistresses	17	
Assistants	13	
Pupil teachers	32	
Monitors	18	80

Total estimated number of teachers in all the schools	250
or,	
For London	11,607

Ages of scholars in voluntary schools:—

Over 11 years	596
„ 8 „	1,435
„ 5 „	1,547
„ 3 „	517
Under 3 „	73
Total—above 8 years	2,031
„ under „	2,137

Rate-aided Schools.

No. of scholars to be provided for in the proposed rate-aided schools, 6,000 + 1,000, a moiety of those now educated in private seminaries	7,000
Probable average attendance if enforced	6,500
Estimated cost of the new schools	£30,000
Estimated annual cost of their maintenance, at 22s. per head	7,150
Yearly rate required after the cost of the buildings has been defrayed, making allowance for grant and fees	2¼d. in the £.

No. of public and beer houses	159
or, 1 to every 74 adult males.	
No. of bakers' shops	60
or, 1 to 194.	

* Why this number does not correspond with the difference between the two preceding totals is explained in paragraph 18.

APPENDIX II.

COST OF THE DUAL SYSTEM IN ALL THE THREE DISTRICTS EXAMINED—BRENTFORD, RICHMOND, BATTERSEA.

TOTAL RATEABLE VALUE, £512,967 0s. 6d.

POPULATION, 114,510.

No. of scholars on the registers	9,743
No. in average attendance	7,233
No. of children between 5 and 12 years not at school	7,956
No. of children between 3 and 14 years not at school	13,200

No. of schools	69	Inspected schools	53, with a roll of	8,062 scholars.
		Uninspected "	16, "	1,681 "

With a 50 per cent. augmentation of the grant, 14 of the 53 inspected schools would be able to dispense with contributions, unless greater efficiency were contemplated.

Average receipts from pence	7s. 5d. per head		Total annual cost per head, £1 6s. $3\frac{1}{4}$d.
" " grant	7s. 6d. "		
" " contributions	6s. 11d. "		
" " miscellaneous	4s. $5\frac{1}{4}$d. "		

VOLUNTARY SCHOOLS.

7,233 Scholars in Average Attendance.

In these schools 2s. per head must bo added to the average for increase of efficiency.

Average cost per head .. .. .. £1 8s. $3\frac{1}{4}$d.

On the data explained in the concluding pages of the report—

The pence would be	8s. 10d. per head	£1 8s. $3\frac{1}{4}$d.
" grant "	13s. 3d. "	
Ordinary contributions	1s. 9d. "	
Miscellaneous	4s. $5\frac{1}{4}$d. "	

Total cost .. .. £10,244 5s. 11d. yearly.

RATE-AIDED SCHOOLS.

7,344 Scholars in probable Average Attendance.

Average cost per head .. .. .. £1 2s. 0d.

Pence	6s. per head	£1 2s. 0d.
Grant	10s. "	
Rate	6s. "	

Total cost .. .. £8,078 8s. 0d.

A rate of $1\frac{1}{4}$d. in the pound would yield a surplus of £468 10s. $0\frac{3}{4}$d.

Total cost of the two sets of schools	£18,322 13 11
If combined, the cost would be	14,577 0 0
Possible annual amount to be saved by good organisation	£3,745 13 11

R-1

APPENDIX III.

AN ILLUSTRATION, DRAWN FROM THE DISTRICTS EXAMINED, OF THE INCREASE IN THE AMOUNT OF THE RATE DUE TO DEFECTIVE ORGANISATION.

As an illustration of the extent to which the amount of the rate for education will depend upon the scale on which numbers are aggregated under the same management, and in explanation of the high rates required in the cases cited by Sir M. Lopes and Colonel Barttelot in the House of Commons, let it be assumed that all the future schools of the Brentford, Richmond, and Battersea Districts, required for the accommodation of the present average attendance, 7,233, and the average to be provided for, 7,344, are organised on the same scales as those of the existing voluntary schools. There are 69 of these schools:—

11	containing a total of	474,	and an average of	43
28	„	2,092,	„	74
18	„	2,240,	„	124
12	„	2,427,	„	202

And, by a Table of the Costs of various School Organisations, published in the Society's *Journal*, of December 17th, 1869—

The cost per head	in a school of	40	would be	£2	11	3
„	„	70	„	1	15	6
„	„	120	„	1	10	10
„	„	200	„	1	3	0

From which it would appear that the respective costs of the above groups of schools would be £1,214 12s. 6d., £3,713 6s., £3,453 7s. 6d., £2,791 1s., making a total of £11,172 7s. for the present average of 7,233; and at the same rates, the average to be provided for, 7,344, would cost annually £11,343 16s. 1d. Therefore—

To provide these districts with an education	on the existing plan would require	£22,516	3	1
„ „	on the proposed dual plan (Appendix II.)	18,322	13	11
„ „	on a combined and well-organised plan (Appendix II.)	14,577	0	0

The illustration will explain how Sir M. Lopes's school of	50	requires a rate of	$7\frac{1}{4}$d.
„ „ „	100	„	6d.
And Col. Barttelot's three schools, with an aggregate of 216 under the same management		„	$5\frac{3}{4}$d.

It will be seen that the rate is *high*, as the numbers operated upon are *small*, and that it is lowered by every advance to larger scales, or improvement in general organisation.

LONDON: W. TROUNCE, PRINTER, CURSITOR-STREET, E.C.

R.